Utter Pradesh
Rajarshi Tandon Open University

DHEN-04

Nutrition for the Community

Block

1

BASIC CONCEPTS IN NUTRITION—I

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Sept 1994 (Reprint)

ISBN-81-7263-285-1

Further information on the Indira Gandhi National Open University courses may be obtained from the University's office at Maidan Garhi, New Delhi-110 068.

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by Dr.A.K.Singh, Registrar, U.P.R.T.Open University, Allahabad (July, 2012)
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COURSE INTRODUCTION

All of us would remember having lively discussions on the nature of food, food preparations and combinations. Several questions puzzle us. What foods should we eat? What happens to food once it enters the body? How much should we eat to keep healthy? What would happen if we eat too much or too little? These and several other aspects are, in fact, very much a part of the study of nutrition. This course comprising six blocks and a manual introduces you to the discipline. It also tells you how you can use the knowledge you gain in helping yourself, your family and your community.

We begin with the basic concepts of nutrition in Blocks 1 and 2. The aspects discussed include food and its functions, the nutrients in food, as well as the concepts of nutrition and health.

Building on this foundation, we will learn about how to select the right kinds of foods in the right amounts for ourselves, our family and other members of our community in the last unit of Block 2 and also in Block 3.

We all know that food costs money. How can we make the best use of the money available to purchase the right kind of foods? What can we do to stretch our food supplies? Block 4 throws light on aspects such as food expenditure and food budgeting. It also talks about preserving foods while they are in season as well as using certain processes to get the maximum nutritional benefit. The vital issue of food safety and related laws, standards and regulations are also discussed.

Block 5 gives you the answer to the question: what happens when we eat too much or too little? The block talks about several nutritional problems—their nature, causes, treatment and prevention. These problems sap the vitality of our people, reduce their capacity to do work and even cause death. This is why the government has launched various programmes to combat the major nutritional problems in the country. You will learn about these programmes in Block 6. A study of these blocks would equip you to reach out to your community and create an awareness about nutritional problems and their possible solutions. You could actually become an agent of change, modifying attitudes and practices and promoting optimal use of existing nutrition and health services.

A word about the manual. the manual supplements the theory contained in Block 1 to 6. It deals with weights and common household measures, the composition of different foods, regional meal patterns, methods of cooking and planning meals and diets for different individuals.

BLOCK INTRODUCTION

Block 1 introduces you to some basic concepts in the study of nutrition. It consists of three units.

Unit 1 unlocks the whole world of food and its relationship to nutrition and health. You will study how our body handles food and how food is intimately linked with society and culture, money and purchasing power and even with our emotions. Further, the unit explores the relationship of food with health. It emphasizes the role of good food in helping us to enjoy complete well-being.

We are all familiar with the fact that food nourishes us. What is it that is present in food that helps in this function? The answer is contained in one word—*nutrients*. Nutrients are nothing but substances present in food which are essential for our existence. The mysteries of nutrients in food will unfold before you in Units 2 and 3 of this block as well as in the next block. You will find that there are certain nutrients which are required in larger quantities by the body. These are naturally called *macronutrients*. Units 2 and 3 deal with the macronutrients—their role, food sources and how the body handles them. On the other hand, some of the nutrients are needed in very small amounts. These, as you will learn in Block 2, are called *micronutrients*.

UNIT 1 FOOD, NUTRITION AND HEALTH

Structure

1.1 INTRODUCTION

The word *food* brings to our mind countless images. Food is associated with worship and divinity; with celebration and mourning; with family gatherings and with community feasting. It is closely interwoven with every feature of our existence. This is not surprising because food plays a crucial role in our lives. It sustains us, it nourishes us. It is the "life-giver".

This unit tells you about food and some of its components. It will give you some idea about why food is essential for our survival. You will also be introduced to the terms *nutrition* and *health*.

Nutrition is the term used for the scientific study of food and how it is utilized by the body. Eating the proper kinds of food in the right amounts is essential to keep us healthy. In other words, our health is dependent on our eating pattern. This leads us to the vital question—how much and what should one eat to keep healthy? How much and what, for example, should an infant consume? Similarly, how much and what foods should be consumed by a child, an adolescent, an adult or an old person? Further, what happens when one eats too much or too little? These are the types of questions that a study of nutrition helps us answer.

Objectives

After studying this unit, you will be able to:

- define food, nutrient, nutrition and health
- list the functions of food
- describe in simple terms how food is handled by the body
- discuss the social, psychological and economic aspects of food and eating
- explain the concept of health and
- discuss the relationship between food, health and disease.

1.2 FOOD AND ITS FUNCTIONS

What is food? The term *food* refers to *anything which nourishes the body*. It would obviously include solids, semi-solids and liquids which can be consumed and which help to sustain the body and keep it healthy.

We all know that food is a basic necessity. Have you ever wondered why? Food is essential because it contains substances which perform important functions in our body. These essential substances contributed by our food are called *nutrients*. If these nutrients are not present in our food in sufficient amounts, the result is ill health and in some cases, even death. Food also contains many substances which are non-nutrients e.g. colouring and flavouring substances in food.

Food is, therefore, a complex mixture of different nutrients and non-nutrients.

FUNCTIONS OF FOOD: You are now familiar with the fact that food consists in part of various nutrients. You may be surprised to know that there are over forty essential nutrients which are supplied by the food we eat. These nutrients can be classified into five major categories (based on certain similar features): proteins, carbohydrates, fats, vitamins and minerals. Water is important as a nutrient as well as a food. You will learn more about this aspect in Unit 2, Block 1.

Each of the nutrient categories has a specific physiological role to play. Here the term "physiological role" refers to the role of food in maintaining certain specific body functions. Since food contains nutrients, it has physiological functions too, as you will learn in the subsequent paragraph. Food also has social and psychological functions in addition to physiological ones (Figure 1.1).

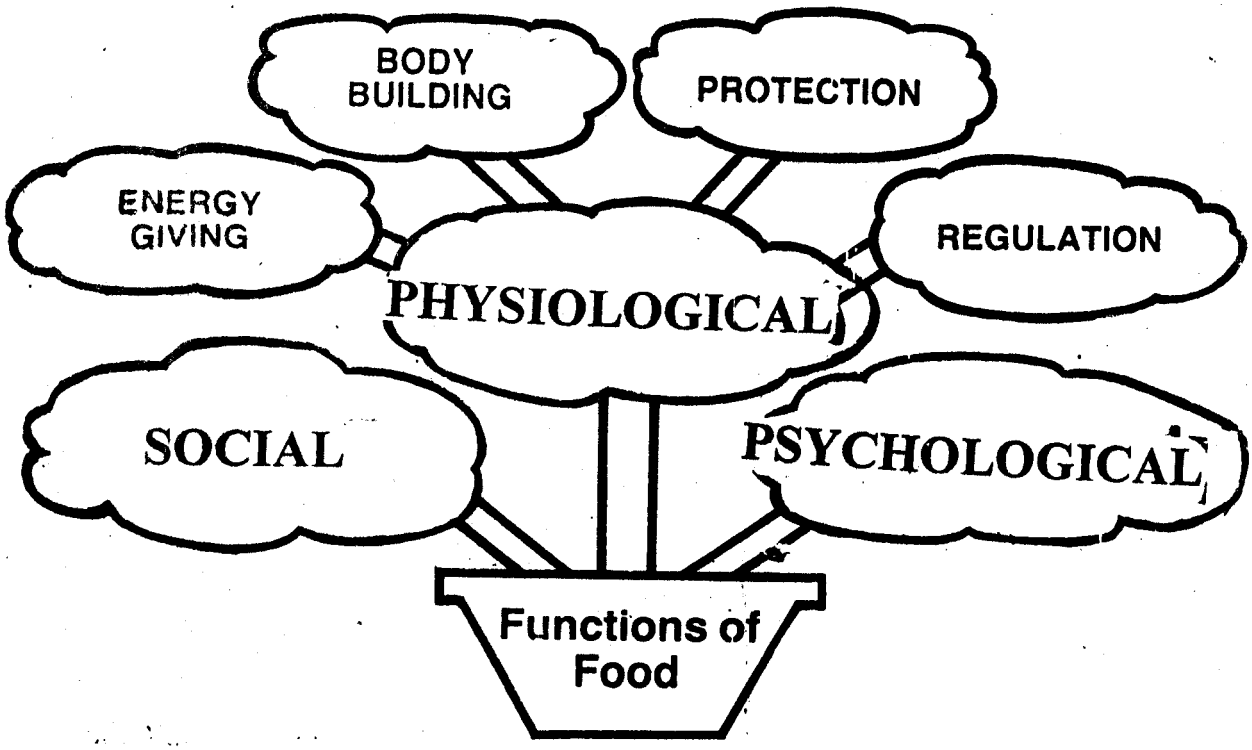

Fig. 1.1 Functions of food

Physiological Functions: The physiological functions performed by food are the *energy-giving, body-building, protective* and *regulatory functions*. We need energy every moment of our lives for performing various types of activities such as sitting, standing, walking and running and performing all our household and other tasks. You may not be aware of it but several activities take place within the body as well e.g. beating of the heart, contraction of the intestines, expansion and contraction of the lungs. Activities performed within the body also require expenditure of energy The energy-giving function of food is basically performed by two nutrient categories—carbohydrates and fats. This is why these nutrients are also referred to as the "body fuels". The situation is similar to the burning of coal or wood which are familiar fuels. When these fuels are burnt, energy is released in the form of heat and light. The fire we observe is, in fact, nothing but the conversion of the energy locked up in the fuel to heat energy and light energy. Similarly, carbohydrates and fats are burnt in the body. The energy and these substances contain is released to perform the various activities that we talked about earlier.

Food is also needed for growth and repair. What is meant by these two terms? As you know, our body is made up of millions of units called cells. When growth takes place, new cells are added to the existing ones. The existing ones also increase in size. On the other hand, cells do get worn out and die. These cells have to be replaced. This process is called repair. For both growth and repair, proteins are necessary. We can understand the role of proteins in growth and development if we just think of the tremendous increase in height and weight that occurs from infancy to adulthood. How does this take place? This is made possible by the process of growth.

The other major physiological functions performed by food are the protective and regulatory functions. Let us talk about the meaning of the term 'protective' first. Here protective refers to the role in preventing infection by ensuring proper functioning of the body systems responsible for fighting infections. Even if a person does develop an infection or any other type of illness, food and the nutrients it contains facilitate rapid recovery. A person eating a poor diet would take much longer to recover. He would get ill more easily as well.

The regulatory function mentioned earlier refers to the role of food in controlling body processes. As you are aware, several processes take place in the body such as the beating of the heart, maintenance of body temperature and contraction of muscles. Each of these processes is controlled. Our body temperature, for example, is maintained at 98.4° F or 37°C. Similarly, the rate at which the heart beats is also maintained. This is achieved by certain specific nutrients (among other substances) and is illustrative of their regulatory function. Vitamins, minerals, and proteins contribute substantially to both protective and regulatory functions. So does water.

You are also probably aware that several chemical reactions take place in the body. With the aid of these chemical reactions, simpler substances are used to build more complex ones. Similarly, complex substances are broken down into their simpler components. Figure 1.2 shows you how one or two types of simple units join to form complex substances and how complex substances break down into their simpler units. You will understand this better when you go through Units 2 and 3 of Block 1. The rate at which these reactions proceed is carefully controlled according to the need of the body. Vitamins, minerals and proteins play a major role in controlling these reactions i.e. they act as regulators.

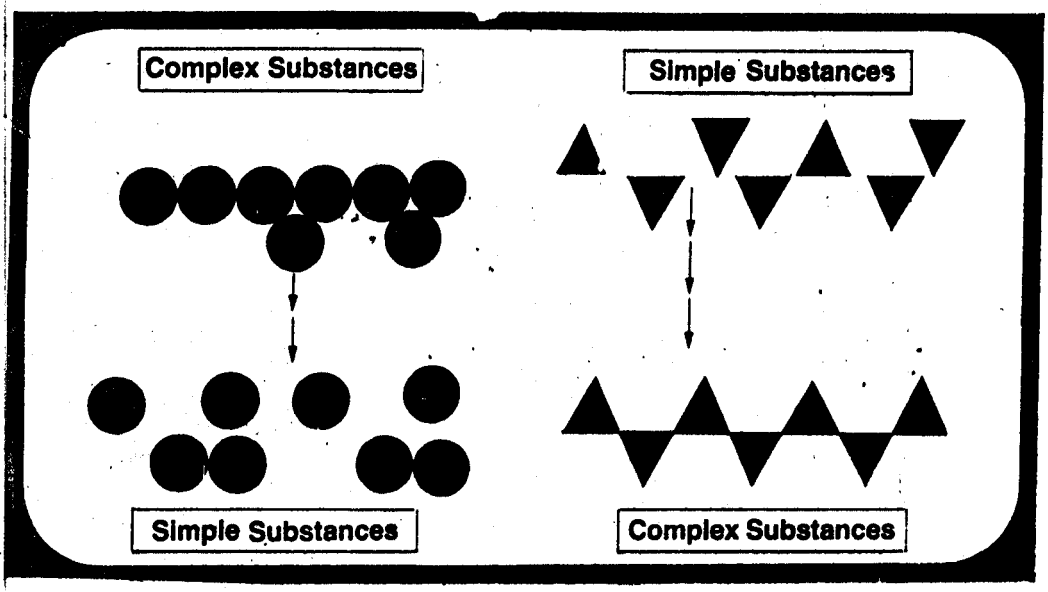

Fig. 1.2 Interconversion of simple and complex substances

Social Functions: Food and eating has significant social meaning. Sharing food with any other person implies social acceptance. When you share a meal with anyone else, you are expressing your acceptance of and friendship and respect for that person. Earlier only persons enjoying equal status in society ate together. A person would never share a meal with someone inferior to him in social terms. Of course, we observe considerable change in this respect now particularly in cities and towns. In a restaurant, for example, any person can eat irrespective of his social background if he has the money to pay for the food.

Food is an integral part of festivity anywhere in the world. You must have surely noticed that joyous occasions such as the birth of a child or a marriage are celebrated by having feasts and serving delicacies. Festivals such as Diwali, Dussehra, Pongal, Onam, Lohri, Holi, Christmas and Id are celebrated by having special and prescribed menus. In all these cases, food serves the function of bringing people together.

Food also has a specific significance and meaning in the religious context. Certain food items such as fruits, sweets and coconuts are offered to the deity in temples. Often sweets are prepared at temples and gurdwaras and distributed to devotees as a benediction or *prasad*. Further, people of a given religious community share a common eating pattern. This is because religious texts and practices strongly recommend some foods while rejecting others. Food thus becomes an integral part of the social and religious life of people.

Psychological Functions: We all have emotional needs such as the need for security, love and attention. Food is one way through which these needs are satisfied. When a mother prepares her child's favourite dish, the child recognizes the fact that she loves him enough to remember his likes and dislikes. He appreciates the attention he is given. As you are aware, when people share food it serves as a token of friendship and acceptance. A child quickly accepts foods eaten by his friends and by people he admires or wants to identify with. He may even accept food he first found distasteful if he observes his friends enjoying it. Sharing the same food as others around him and those he considers important in his social sphere gives him a degree of confidence in himself and reassures him that he will be accepted by others like him.

Food is also closely allied to our emotions. Food often serves as a reward. When a mother wishes to reward her child for doing well in a test, she may buy him a sweet or an ice cream. In this manner, that particular food item evokes pleasant feelings in the mind of the child. On the other hand, certain foods become associated with sickness such as khichri (a rice-dal porridge). This type of food is generally eaten when a person suffers from fever and may, therefore, not be associated with pleasant feelings.

Check Your Progress Exercise 1

1) List the three functions of food.

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2) Fill in the blanks.

a) The body-building function of food is related to the presence of .....

b) Energy-giving foods are rich in carbohydrate and/or .....

c) Vitamins and minerals have..... and..... functions.

3) Read the following statements carefully. Comment in two sentences on whether the statement relates to the physiological or social or psychological functions of food.

a) Pankaj is celebrating his birthday. He has called his friends to his house for a party in the evening. His mother has prepared several delicious dishes particularly those which Pankaj likes.

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b) Nandita is a three year old child. She has grown so much in these three years! Her mother says this is due to her love and care and, of course, the good food she has given Nandita.

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1.3 MEANING OF NUTRITION

Nutrition is a scientific discipline with food as the major focus of interest. Nutrition also deals with several other related aspects as the following definitions will illustrate.

The simplest *definition of nutrition* can be expressed thus: "the study of what happens to food once it enters the mouth and thereafter." However, a more detailed definition would be: "*the science of foods, the nutrients and other substances therein; their action, interaction and balance in relationship to health and disease; the processes by which the organism ingests, digests, absorbs, transports and utilizes nutrients and disposes of their end products. In addition, nutrition must be concerned with the social, economic, cultural and psychological implications of food and eating.*" We will now consider each aspect in some detail.

1.3.1 Nutrients: Action, Interaction and Balance

Food, as you know, contains nutrients as well as substances which are non-nutrients. The body needs each nutrient in specific amounts. Some are needed in relatively larger amounts (the macronutrients) and some in smaller amounts (the micronutrients). But they are all equally essential for our health. Each nutrient plays a significant role in the body. The mineral, calcium, for example, helps build strong bones and teeth. This is the *action* of calcium. Similarly, other nutrients have their own specific functions as depicted in Figure 1.3(a). To return to the earlier example, bones and teeth also contain another mineral, phosphorus. Both calcium and phosphorus must be supplied to the body in the required amounts and proportions to ensure the normal growth of bones and teeth. This means that normal growth of bones and teeth and maintenance of their normal structure and function requires an *interaction* between these two nutrients. (Figure 1.3(b)).

The concept of *balance* can also be explained by taking the example of calcium and phosphorus. If the diet contains too much phosphorus, it prevents the body from taking in enough of calcium. This creates an imbalance between calcium and phosphorus and affects the bones and teeth. This imbalance can be corrected by consuming foods that supply the two nutrients in the correct proportions.

In the larger context, the term balance means that the nutrients needed by the body should be provided in the right amount and proportions. This will, of course, ensure good-health as you see in Figure 1.3(c).

You will learn more about the action, interaction and balance of nutrients in Units 2 and 3 of Block 1, and Units 3 and 4 of Block 2.

1.3.2 Handling of Food and Nutrients by the Body

How does the body handle food? We take in food through our mouth where it is chewed and then swallowed. It then passes down into the stomach and thereafter into a long, coiled, tube-like structure called the intestine. Since our body cannot utilize food as such, it alters its nature and converts it into utilizable forms by many specific actions. This process is called digestion.

Once digestion is completed, several nutrients are available to the body in a form in which the body can use them further. The process by which nutrients move from the intestine into the blood is referred to as absorption. The blood then transports them

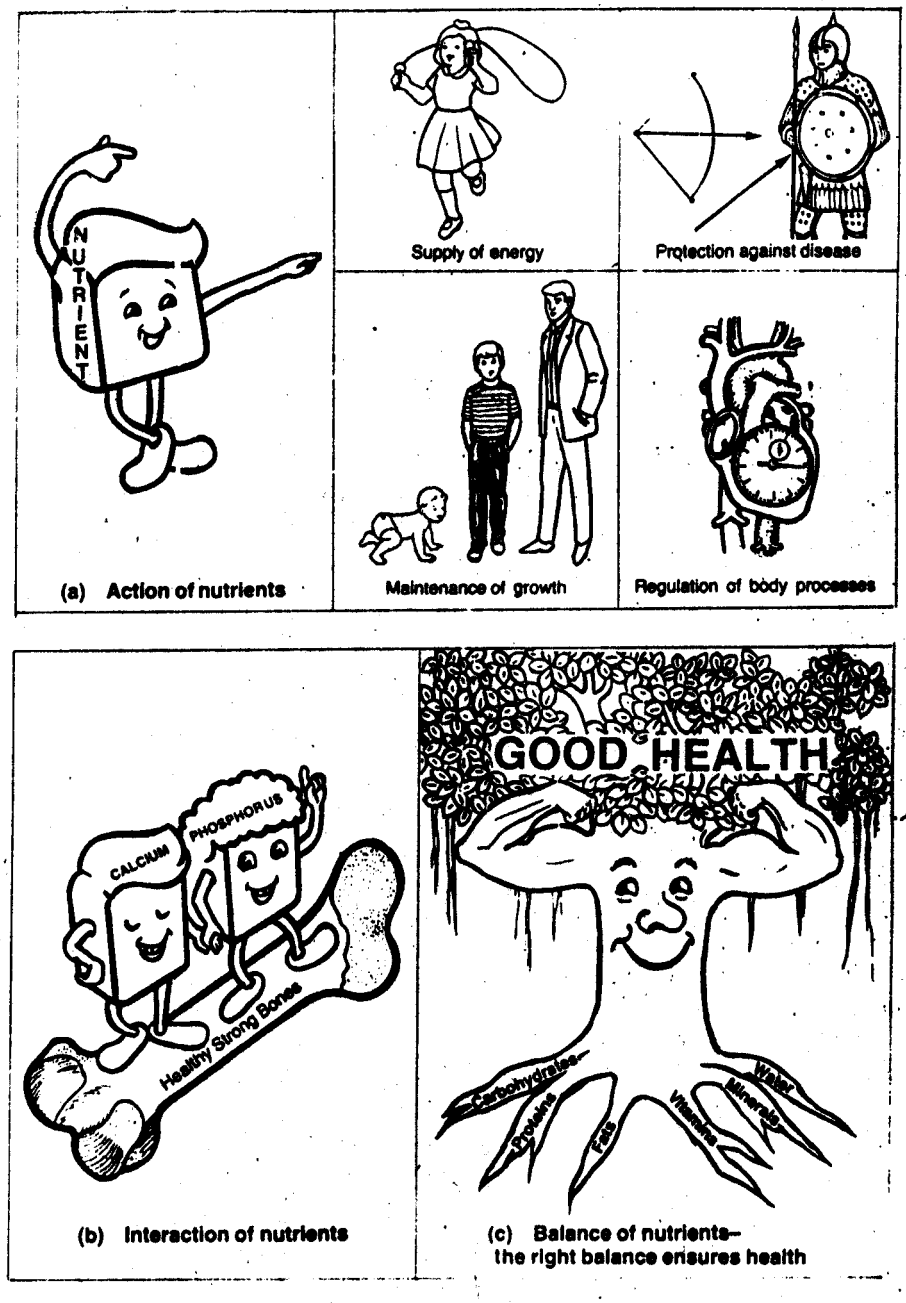

Fig. 1.3 Definition of nutrition

to all the cells of the body where they are utilized for different functions.

All the substances in the food which the body *cannot absorb* are thrown out in faeces. The processing and handling by the body of *absorbed nutrients* results in the formation of certain other substances or by-products. Some of these are harmful and need to be thrown out of the body. This is achieved by transferring them from the blood to the urine. The latter is then thrown out of the body. You will learn more about digestion and absorption in the next unit.

1.3.3 Social, Psychological and Economic Aspects of Nutrition

Social and psychological factors determine the acceptability of a particular dietary pattern and the foods included. We might suggest a nutritious diet for a person but it might not be acceptable to him because of socio-cultural reasons, for example. This is the reason why a person's social background and reactions to particular food items have to be carefully considered. Further, economic considerations determine whether foods are available and affordable. Let us now look at each of these aspects in detail.

Social and cultural aspects of eating: Food has a special meaning in the social and cultural context, as you know. Our ancient Vedic tradition emphasizes food as the

life-giver. It further attributes specific qualities to specific foods. It is said that *sattvic* foods, for example, increase intellectual capacity and creativity, energy and cheerfulness. Milk and milk products are regarded as the prominent *sattvic* foods. The *rajasic* foods (foods that stimulate passion) are stated to include fish, eggs and meat while pork and beef are put in the category of *tamsic* foods (stale, reheated, tasteless and impure foods). Contrast this view of food and eating with our modern views, we no longer believe that certain foods or categories of foods (when part of a usual diet) can influence our behaviour to any significant extent. At restaurants and hotels, customers frequently eat reheated food which in the Vedic tradition has the lowest status. Many people, even though they may be vegetarian, do not mind sharing food with non-vegetarian friends. The former, of course, would not consume meat and meat products but may still accept vegetarian foods prepared in kitchens where meat is also cooked. This is a desirable trend. *Tolerance and adaptability to varied eating habits is a healthy sign of progress.*

You must have now realized why nutrition concerns itself not only with the body's handling of nutrients and other food components, but also with food acceptance. We cannot expect members of a community to immediately accept a food just because it is rich in nutrients. We have to consider any food from their point of view. Is it a food rejected by their culture? Is it a food considered to be a "prestige" food in that community? (Here, of course, we mean foods which are accorded a high status because they are expensive or because they are consumed by people of higher status in society). Are all population groups belonging to that community allowed to consume the food item or is it forbidden in the case of pregnant women or infants? *This shows us how important it is to keep a person's socio-cultural background in mind whenever we talk of improving or modifying food-related practices.*

The psychology of eating: How does a person react to food? What psychological factors influence our eating patterns? Consider examples A to C.

Example A: Minnie is a housewife. She gives her whole family vitamin tablets because she thinks this will keep them healthy and full of energy. Her friend tells her that she needs no vitamin tablets because the same vitamins can be supplied by the ordinary foods consumed. Minnie does not agree; for her the vitamin tablet is an answer to all ills.

Example B: Raju, a five-year-old boy, loves to watch television. He sees the numerous advertisements for foods like instant noodles, soft drinks, toffees and chocolate every single day. His mother frequently gets annoyed because he wants her to purchase the foods he sees on television even though she tries to convince him that they are not good for health.

Example C: Sarla has just given birth to a baby boy. Her mother-in-law insists that she consume til laddoos, panjiri and ghee to stimulate the flow of breast milk. (Til laddoos are sweet balls made of jaggery and sesame (til) seeds, panjiri is made of whole wheat flour, sugar, nuts and fat) Sarla does as her mother-in-law advises.

Have you gone through the three examples carefully? You must have noticed the importance of people's attitudes to food in determining the type of foods they select and the quantities they eat. Many factors influence our choice of foods such as advertisements and the attitudes of other people around us. Our reactions to these influences often determine both what we eat and how much we eat. One example is the child who seeks to overcome a feeling of insecurity or inferiority by eating more. Another child may seek to overcome the same feelings by eating less. *Thus our individual reactions to food and to the people around us can have a significant psychological influence on our eating pattern.*

The economics of food: Food costs money. It must be within the reach of people and it must be equitably distributed to all sections of the population. The availability of food and its proper distribution are of great importance. You may have heard of people dying of starvation even when plenty of food was available. In India, for example, agricultural production has consistently increased. However, the problem of distributing our food surplus still remains. As a result large sections of our population do not get enough food. These are only some of the larger economic issues of interest to everyone. Our ultimate aim should be to ensure the good health of all individuals. Towards this end, we need to ask and try to find answers to

questions such as the following with the help of experts from different backgrounds:

- How do we meet the food needs of people who do not have the money to purchase adequate amounts? Should we give them food as payment for work done by them or should we help them out by giving extra food at cheaper rates or free of cost?
- How much food must we produce in order to meet the needs of people?
- How can we ensure that food reaches all sections of people? Is our network of ration shops and the public distribution of food adequate?
- What types of food should be grown? Do we need to increase production of pulses and oilseeds, for example?

These issues are difficult to resolve. It takes time and the coordinated effort of planners, farmers, suppliers and consumers of food products.

Check Your Progress Exercise 2

1) List 4 aspects of the study of nutrition.

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2) Fill in the blanks.

a) Nutrient balance can only be achieved by supplying all nutrients in the correct.....and proportions.

b) .....is the process whereby nutrients move from the intestine to the bloodstream.

c) The acceptance of particular foods by a person would depend on social, cultural,.....and economic factors.

1.4 THE CONCEPT OF HEALTH

We are all familiar with the term "health". What does his term mean? Let us consider the definition of health proposed by the World Health Organisation (WHO):

> *"Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."*

This definition tells us that health is a positive state. In other words, health is a state of complete well-being and not just the absence of disease. A person may not be suffering from any disease and yet may not enjoy complete well-being. There are so many times when we feel tired or exhausted and incapable of concentrating on our work. At such times we are not enjoying complete well-being, even though at other times we do. There are also times when we suffer from an infection or periods of ill health. This means no person enjoys full health all the time. However, we call a person healthy if he or she enjoys good health most of the time.

One dimension which is also gaining prominence is spiritual health. You would notice that this dimension is not mentioned in the definition. This is a newer dimension which is gaining recognition though it is still not precisely defined.

Let us now examine each of these different dimensions of health.

1.4.1 Physical Health

The physical dimension of health is familiar to us. When we say a person is healthy, we are generally referring to this aspect. Physical health is easy to detect and describe. A person is physically healthy if he or she looks alert, is responsive, energetic and vigorous. Table 1.1 lists some of the signs whereby a person in good physical health can be identified.

Table 1.1 : Signs of Good Health

Body part/characteristic	Signs of good health
Hair	Shiny, lustrous, healthy scalp
Neck glands	Not enlarged
Skin	Smooth, slightly moist, good colour
Eyes	Bright, clear, no fatigue circles
Lips	Good colour, moist
Tongue	Good pink colour, no lesions
Gums	Firm, good, pink colour; no swelling or bleeding
Teeth	Straight, no crowding, no discolouration
Abdomen	Flat
Legs, feet	No tenderness, weakness or swelling
Skeleton	No malformations
Weight	Normal for height, age, and body build
Posture	Erect, arms and legs straight, abdomen in, chest out
Muscles	Well developed, firm
Nervous control	Good power of concentration, not irritable or restless
Appetite	Good
Digestion and absorption	Normal
Sleep	Good, sound

Source : Adapted from Table 1.1 in *Essentials of Nutrition and Diet Therapy* by Sue R. Williams, 4th ed. (1986)

1.4.2 Mental Health

Mental health implies:

- freedom from internal conflicts
- no consistent tendency to condemn or pity oneself
- a good capacity to adjust to situations and people
- sensitivity to the emotional needs of others
- capacity to deal with other individuals with consideration and courtesy
- good control over one's own emotions without constantly giving in to strong feelings of fear, jealousy, anger or guilt.

You would have realised that mental health is a more complex concept than physical health. It is much more difficult to measure. Though we can usually recognize the extreme cases of mental ill health rather easily, it is difficult to categorize individuals who are normal in other ways but may have a problem understanding another person's viewpoint or being sensitive to the emotional needs of others. Such problems if they are sufficiently serious and persistent would definitely be indicative of poor mental health.

The interrelationship between physical and mental health can be explored with the help of specific examples. High blood pressure is one form of physical ill health. It can be caused by constant stress and poor ability to handle difficult situations (particularly if the individual already has a tendency to develop high blood pressure). This is an example of how mental ill health can cause physical ill health. The reverse can also happen! Physical ill health can also lead to mental ill health. A child who suffered from polio and cannot run or play feels inferior to other children. This may lead him to be dominated by feelings of fear or self pity. Such feelings may constantly trouble him and prevent him from interacting in a normal fashion with others.

1.4.3 Social Health

What is social health? If an individual recognizes that he/she belongs to a family and is able to identify with a wider community, the first step towards social health has been taken. An individual who recognizes his/her obligations towards other members of society and is able to relate to other people around him/her can be described as socially healthy.

It is impossible to realize the goal of social health if mental health has not been achieved. Any type of mental ill health will adversely influence interaction with others and therefore diminish one's ability to be a useful member of society. Similarly, a person who does not enjoy physical health would find it difficult to

achieve social health. Physical ill health often makes one irritable and depressed and unable to reach out to others normally.

How does one recognize social ill health? Criminals are examples of socially ill individuals. They indulge in behaviour that is not socially acceptable and can be called anti-social. Theft, murder and destructive behaviour are examples of anti-social behaviour. Society actively controls such behaviour since ignoring such acts would destroy society itself.

1.4.4 Spiritual Health

Spiritual health is the most difficult to define. We, as Indians, probably understand spirituality more because in our society religious and moral codes of behaviour are easily observable. A healthy individual obeys these moral codes most of the time. The concept of doing good and of not harming others; of believing in the basic forces of goodness and justice whether or not these are worshipped as God; of recognizing the needs of others and trying to fulfil them; of commitment, duty and obligation, these are all characteristics of a spiritually well person. Spiritual health is certainly not easy to attain!

One must also emphasize that blindly following religious practices and customs does not necessarily make a person spiritually healthy. Spiritual health is more a matter of attitudes and a way of looking at situations and people. What is important is concern for others and a genuine desire to help and be of assistance.

Check Your progress Exercise 3

1) Define hialth.

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2) List the four dimensions of health.

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3) Suraj is a ten year old boy. He shows no obvious changes in physical appearance and his doctor cannot find any sign of illness. However, he cannot perform as well as his friends at school and he tired getseasily. Would you call him healthy? Gove reasons for your answer.

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1.5 MEANING OF NUTRITIONAL STATUS

Nutritional status is the condition of health of an individual as influenced by the utilization of nutrients. How do we determine the nutritional status of a person? The definition makes it sound difficult, doesn't it? To determine nutritional status all you have to do is to put together information about:

- what kind of diet is being consumed;
- what types of illnesses, if any, the person has suffered/is suffering from including any observable signs of ill health such as discoloured skin or bleeding;
- what is the level of nutrients and other substances in the blood and urine (as determined by blood and urine tests).

You will understand the concept better with the help of an example. If a person doe not consume enough of vitamin C (one of the water-soluble vitamins), its levels in

the blood will drop and one can predict that the person is likely to get vitamin C deficiency. This finding can be confirmed if a look at the diet reveals very few foods being eaten which are rich in this vitamin.

1.6 INTERRELATIONSHIP BETWEEN NUTRITION AND HEALTH

Nutrition is closely interlinked with health. If a person eats the right kind of foods in the required amounts, he or she will keep good health provided no other factors intervene. On the other hand, a poor eating pattern or eating too little or too much will result in poor health as is depicted in Figure 1.4.

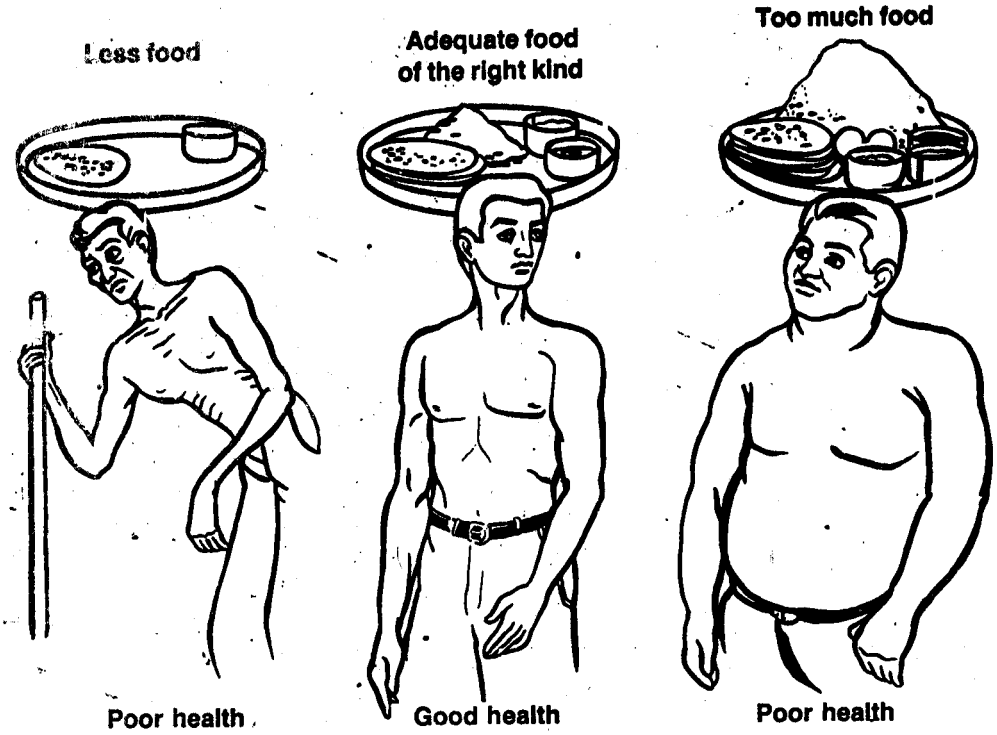

Fig. 1.4 Interrelationship between nutrition and health

It must be emphasized, however, that though good food is one of the crucial factors in ensuring health, it is not the only one. The food eaten must not only be nutritious but it must be wholesome and clean and free from harmful germs. If this is not so, the person eating the food would get ill even if the food is nutritious.

Before we go any further, you need to be familiar with the term "malnutrition". *Malnutrition is an impairment of health resulting from a deficiency, excess or imbalance of nutrients.* In other words, malnutrition refers to both undernutrition and overnutrition. Undernutrition means a deficiency or lack of one or more nutrients and overnutrition means excess of one or more nutrients. Both undernutrition and overnutrition result in ill health.

One prominent example of undernutrition in our country is vitamin A deficiency. When young children do not consume enough vitamin A-rich foods, their eyes are affected and ultimately blindness results.

A disease that we easily relate to overnutrition is extreme overweight or obesity. When a person takes in more energy than he is able to spend on his daily activities, he accumulates fat in the body and his weight increases. If the weight increases substantially, the person becomes obese.

This section has just introduced you to some aspects of the interrelationship between nutrition and health. It will be our aim in this course to tell you much more about these and other issues so that you can apply this information in your day-to-day life.

Check Your Progress Exercise 4

1) "Good health cannot be achieved without good food." Comment on this statement in 2-3 sentences.

.....

.....

.....

2) List three different aspects of the interrelationship between nutrition and health.

.....

.....

.....

1.7 LET US SUM UP

Food has been described as "anything which nourishes the body". Food, we learnt, has many specific functions. It provides energy, helps build the body, protects it against disease and regulates body processes. In addition, it helps to bring people together. It is also a means whereby emotions and feelings are expressed.

Various aspects of the study of nutrition have been enumerated in this unit. Nutrition encompasses the study of food and how it is handled by the body. It also explores the influence of social, psychological and economic factors on our eating patterns.

Health and its various dimensions have also been discussed. Health is a state of complete well-being. It has physical, mental, social and spiritual dimensions. The interrelationship between these dimensions has been highlighted.

In addition we have talked about the fact that nutrition and health are intimately linked. Good health cannot be achieved without eating the proper kinds of foods in the amounts needed.

1.8 GLOSSARY

Benediction	:	**Blessing**
Cell	:	**The smallest unit of an organism that is able to function independently**
Deficiency	:	**A condition of the body resulting from an inadequate dietary intake of one or more nutrients**
Delicacies	:	**Special dishes made for certain occasions**
Development	:	**Changes leading to greater complexity and finally leading to maturity of the individual**
Diet	:	**Food items (dishes) you eat during the course of a day**
Eating Pattern	:	**The number of meals, the types of foods served**
Growth	:	**Changes such as increase in size and number of cells**
Impairment	:	**Appearance of ill health**
Implication	:	**Meaning, significance**
Infirmity	:	**Physical or mental weakness**
Lesion	:	**Abnormality in structure and/or function**

Menu	:	List of dishes included in a particular meal
Nouri	:	To make well and strong
Obesity	:	Extreme overweight
Tissue	:	A number of similar cells in the body together form a tissue

1.9 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) physiological; social, psychological

2) (a) proteins (b) fats (c) protective, regulatory

3) Answer on the basis of what you learnt about the functions of food.

Check Your Progress Exercise 2

1) Any four of the following:

a) food and nutrients b) processes of ingestion, digestion, absorption, transp... and utilization of nutrients and disposal of end products c) social implications of eating d) economic implications of eating e) psychological implications of eating.

2) a) amounts b) absorption c) psychological

Check Your Progress Exercise 3

1) The state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

2) Physical, mental, social, spiritual

3) Suraj is not healthy. This is because he is not showing indications of optimum health and optimum functioning even though he is free from disease.

Check Your Progress Exercise 4

1) Good health cannot be achieved without good food. This statement is true. Nutrition is one of the major factors influencing the health of an individual. Since food is the source of nutrients, selecting and consuming the right types of food in the right amounts becomes important. If the diet is poor, ill health will result because of deficiency or excess of one or more nutrients.

2) Causation of diseases by deficiency or excess of nutrients; effect of nutrients in preventing disease and promoting quick recovery; good nutrition as one of the factors ensuring good health.

UNIT 2 THE MACRONUTRIENTS-I: CARBOHYDRATES AND WATER

Structure

2.1 INTRODUCTION

You know that nutrients are essential constituents of food that must be supplied to the body in suitable amounts. There are around 40 essential nutrients which (based on their chemical structure and properties) are placed in five categories. These are carbohydrates, fats, proteins, vitamins and minerals. Water has the unique status of a food as well as that of a macronutrient.

You encountered the two terms—macronutrient and micronutrient in Unit 1. Most of the weight of the food is due to carbohydrates, proteins, fats and water. These nutrients are collectively known as macronutrients. Vitamins and minerals contribute to only a small fraction of the total weight of the food. These are termed as micronutrients. Our body needs carbohydrates, fats, proteins and water in much greater amounts than vitamins and minerals. But vitamins and minerals or micronutrients are as essential for the body as macronutrients.

Units 2 and 3 of this Block and 4 and 5 of Block 2 will introduce you to the fascinating world of macronutrients and micronutrients. Entry into this world of nutrients will require a little extra effort on your part. You will be required to know the basic concepts of chemistry for understanding the nature and functions of nutrients. All the necessary basic chemical terms are explained in these units. Try to understand one term before going on to the other. Do remember that these units will lay the foundation for other units of the course. So concentrate here.

This unit will first take a look at how food is handled by the body i.e. the processes of digestion, absorption and utilization. It will then move on to a discussion on two specific macronutrient categories—carbohydrates and water. You will learn about the nature, food sources and functions of these nutrients. In addition you will be introduced to the processes whereby the body handles carbohydrates and water.

Objectives

After studying this unit, you will be able to:

- describe the processes of digestion and absorption of food
- discuss the concept of utilization of food in simple terms
- distinguish between available and non-available carbohydrates
- describe the chemical nature of carbohydrates and water
- list the food sources of carbohydrates and water
- state the role of carbohydrates and water in the body and
- describe the processes of digestion, absorption and utilization of carbohydrates in the body

2.2 DIGESTION, ABSORPTION AND UTILIZATION OF FOOD—AN OVERVIEW

You already have an idea of the processes of digestion and absorption. What is the purpose of the process of digestion? It is through this process that the complex substances in food are broken down into simpler substances which the body can take in and use. Some of these complex substances such as carbohydrates, proteins and fats undergo some change during digestion. However, water, minerals and vitamins present in the food can be absorbed directly without undergoing any digestive change. Digestion and absorption take place in the digestive tract of the body. Look at Figure 2.1. It shows you the essential parts of the digestive tract.

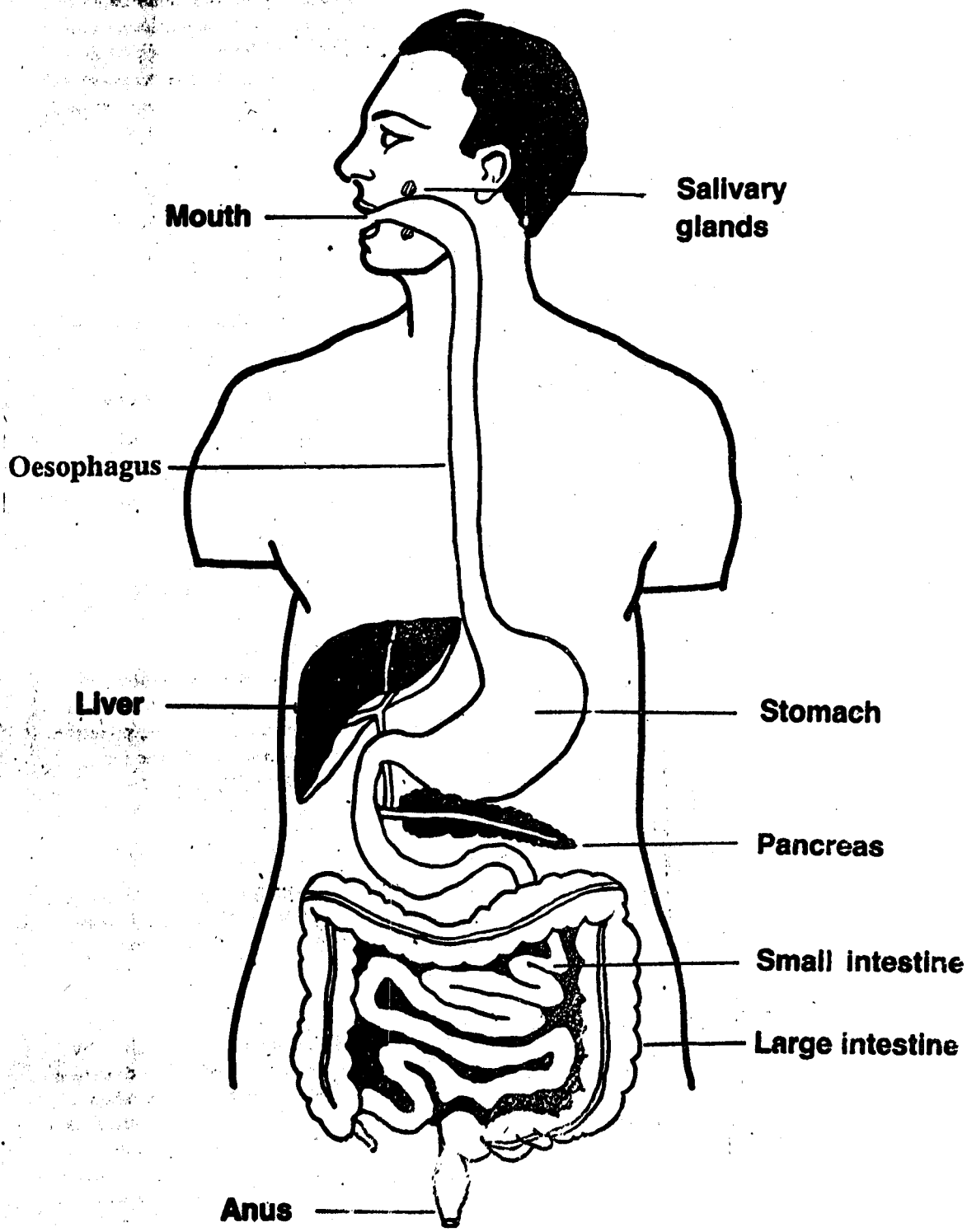

Fig. 2.1 The digestive system

Food takes the following path in the digestive tract.

Mouth → Oesophagus → Stomach → Small intestine → Large intenstine → Rectum → Anus

The liver and pancreas are not a part of the digestive tract but they secrete certain juices or secretions which do play a role in the process of digestion and absorption of food.

The whole process of digestion is accomplished in the time food remains in the digestive tract. The process of digestion starts from the ingestion or intake of food in the mouth. From here food passes to the other parts of the digestive tract. Each of these parts of the digestive tract (except the oesophagus, rectum and anus) contain some kind of digestive juice. These juices are either secreted by that particular part of the tract or poured in from the other organs or glands of the body such as liver and pancreas. These digestive juices contain chemical substances known as enzymes. Enzymes are proteins which help chemical reactions to proceed faster. They bring about changes in food substances without themselves undergoing any change.

DIGESTION OF FOOD : Let us now have a look at the overall process of digestion. Digestion takes place step-by-step at various sites in the digestive tract as you will learn from the following discussion.

- **Mouth :** As you have already noticed, the process of digestion begins in the mouth where food is chewed by the teeth and mixed with saliva. While the food is still in the mouth, it is acted upon by an enzyme, amylase, which acts only on cooked carbohydrates and partially digests them or breaks them up into smaller units.
- **Stomach :** The chewed food mixed with saliva then passes into the stomach through the tube-like structure called the oesophagus. Here it gets mixed with the digestive juice present in the stomach called gastric juice. Besides enzymes and water, gastric juice also contains small amounts of an acid called hydrochloric acid which makes it acidic in nature. Mixing of food with the gastric juice converts the food into a thin soup-like consistency. Gastric juice contains an enzyme which acts on proteins and brings about their partial digestion. Other nutrients in food remain chemically unchanged.
- **Small intestine :** The next stop in the digestive tract is the small intestine. The partially digested mass of food passes from the stomach into the small intestine. The small intestine not only contains intestinal juice (which is secreted from the small intestine itself) but also secretions from the liver and pancreas. The secretion from the liver is called bile and from the pancreas is known as pancreatic juice. Bile aids in the digestion and absorption of fats (you will learn about the role of bile in fat digestion in Unit 3). Both pancreatic and intestinal juices contain enzymes which break down fats, proteins and carbohydrates into simpler substances. These simple substances ultimately reach the bloodstream.
- **Large intestine :** The food which is not absorbed in the small intestine along with a large amount of water passes on to the large intestine. Here most of the excess water is reabsorbed and the remaining water and solid matter is eliminated from the body as faeces.

ABSORPTION OF FOOD : Where is food absorbed? You would have realised by now that absorption takes place in the small intestine. The end products of digestion or the nutrients present in the small intestine can be used by the body only when they enter the bloodstream. This process of movement of digested food or nutrients across the intestinal wall to the bloodstream is termed absorption of food. The wall of the small intestine is made up of numerous folds or finger-like projections known as villi. The presence of these villi tremendously increase the total area from which absorption can take place. Most of the nutrients are absorbed from the upper part of the small intestine through some are absorbed from the lower portion. Figure 2.2 gives a summary of the processes of digestion and absorption.

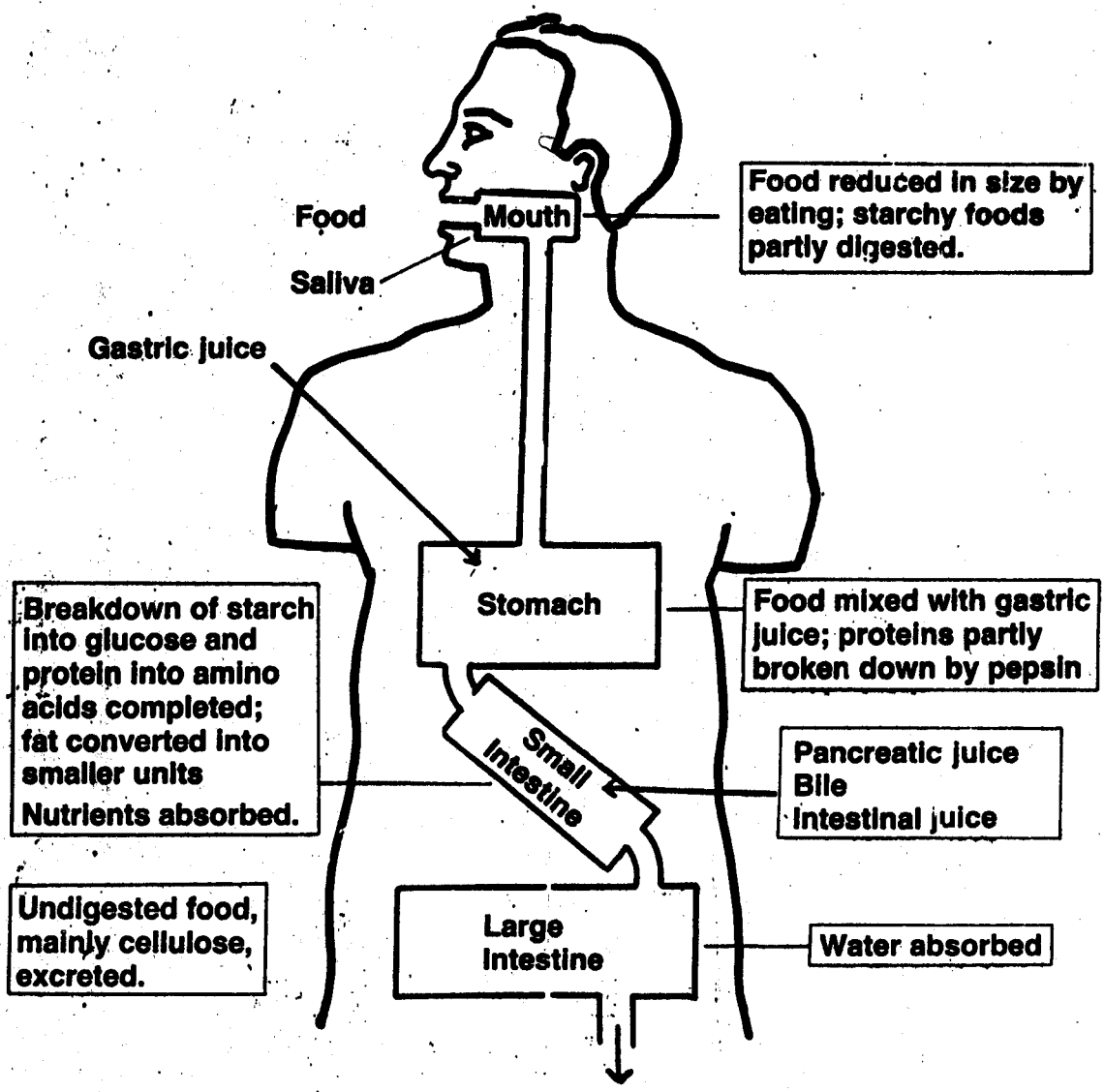

Fig. 2.2 Summary of the digestive Process

As you know, the end products of digestion move into the bloodstream after absorption. The blood circulating in the body and therefore, the nutrients it carries reaches every cell of the body. Blood can, therefore, be considered somewhat like a bus carrying passengers from one stop (i.e. the intestine) to another (i.e. the cell) (Figure 2.3). Once they reach the cell, the nutrients perform their specific functions.

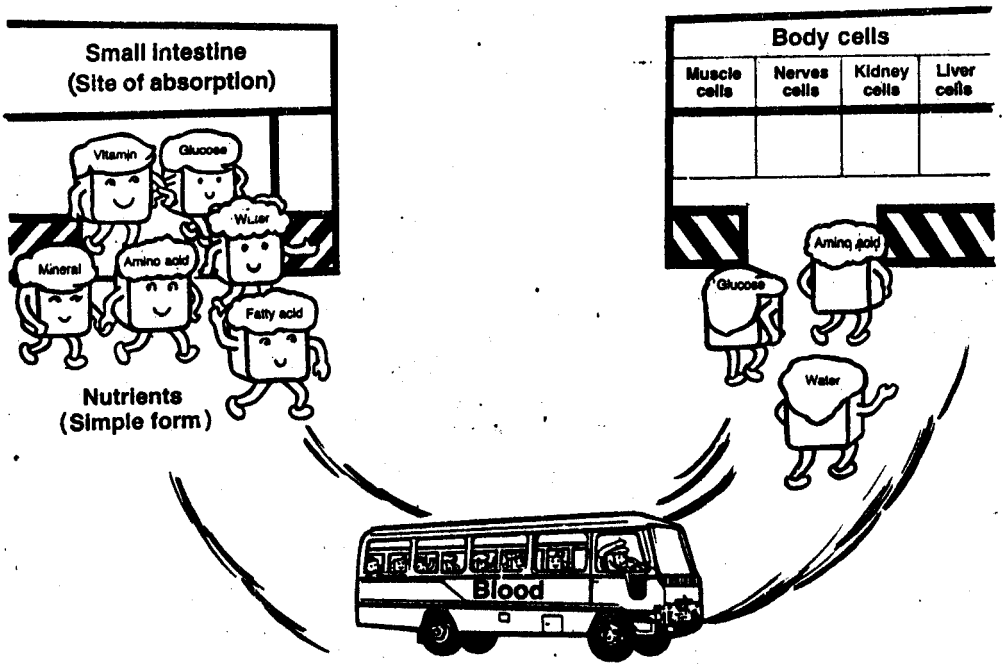

Fig. 2.3 Transport of nutrients

UTILIZATION OF FOOD : How is food utilized? In order to be utilized for specific functions the absorbed end products or the nutrients from the food we eat further undergo chemical changes. They are either further broken down to release energy or are used to form more complex substances. These substances can then be used to manufacture more complex substances or can be stored in the body. We use certain terms to refer to these processes. Let us learn these terms.

Metabolism is a general term. It is just a small word referring to all the chemical changes that take place in the cells after the end products of digestion are absorbed. You know it is of two types—breakdown of complex substances into simpler ones and manufacture of complex substances from simple ones. We have two terms referring to each of these processes. Let us learn these.

Anabolism is the term used to refer to all the chemical reactions by which simple substances are used to manufacture more complicated ones and *catabolism* includes all the chemical reactions by which complex substances are further broken down to simpler components.

In Units 2 and 3 you will learn the mechanism of digestion, absorption and utilization relating to carbohydrates, fats and proteins separately. It will provide you a better understanding of the same. Let us now discuss the nature, functions, food sources and processes of digestion, absorption and utilization relating to carbohydrates and water.

2.3 CARBOHYDRATES

The term carbohydrate refers to a large family of organic compounds essentially made of three elements i.e. carbon, hydrogen and oxygen. If you are not familiar with the terms element and organic compound read the information given in Box 2.1.

Box 2.1 : Elements and Compounds

Chemically all nutrients are made of *elements*. There are around 103 naturally occuring elements. Some of these are essential for living cells. These include/ Hydrogen (H), Carbon (C), Nitrogen (N), Oxygen (O), Phosphorus (P), Sodium (Na), and Calcium (Ca). All elements are made up of small units called atoms.

Atoms of one element combine with the atoms of another element to form a compound. Note that atoms present in a compound cannot be separated. For example, water (H_2O) is a compound made up of two atoms of hydrogen and one atom of oxygen. All compounds containing carbon (except a few like carbon dioxide) are called *organic compounds*. All other compounds which do not contain carbon are *inorganic compounds*. According to these definitions *carbodydrates, proteins, fat and vitamins are organic compounds* (i.e. they essentially have carbon as one of the elements). *Minerals are inorganic elements; water is an inorganec compound.*

Carbohydrates are widely distributed in plant foods. They are mainly present in these foods in the form of three types of compounds called sugars, starches and fibre. All these carbohydrates are made up of some basic simple units. One prominent example of a basic unit is *glucose*. Other examples are fructose and galactose (Figure 2.4).

Table sugar (cane sugar) which we commonly use in our houses is a carbohydrate made up of two basic units i.e. one unit of glucose and one unit of fructose. On the other hand, a starch molecule is very large. It is made up of several basic units of glucose linked together. These chains of glucose can be straight or branched. Examples of foods rich in starch are rice, wheat, maize and tapioca.

Fibre, like starch, is made up of a number of basic units. The term fibre includes several substances. Cellulose is one example. It is a substance made up of several glucose units. How, then, is it different from starch? It is the type of linkage between glucose units in cellulose that makes all the difference.

All these types of carbohydrates i.e. sugars, starches and fibre can also be classified as available and non-available carbohydrates. Carbohydrates like sugars and starches are digestible in the human digestive tract and hence can be made available to the body for its functioning. These carbohydrates are termed as available carbohydrates. Cellulose and certain other large carbohydrate molecules that cannot be digested in the human digestive tract are collectively referred to as fibre or non-available carbohydrates.

The discussion in Section 2.3.1 is on available carbohydrates and 2.3.2 on non-available carbohydrates. *In this unit the term carbohydrate is used for available carbohydrates and fibre for non-available carbohydrates.*

2.3.1 Available Carbohydrates

You will now learn various aspects relating to sugars and starches i.e. the available carbohydrates.

Food Sources : Which foods provide good amounts of carbohydrate? The list includes cereals and millets, roots and tubers, some fruits, sweeteners like cane sugar, jaggery and honey. You will find more details in Table 2.1. Cereals and millets are the main source of carbohydrates in Indian diets. All cereals like wheat, rice, and millets e.g. jowar, bajra and ragi contain considerable amounts of starch. So do roots and tubers like potato, tapioca, sweet potato, yam and colocasia. Fruits like mango, banana, sapota are, however, rich in carbohydrates in the sugar form. Cane sugar or cube sugar and other sweeteners like honey and jaggery are 95 per cent to 100 per cent carbohydrate (sugar form).

Pulses also contain substantial amounts of carbohydrates. However, pulses are more important in our diet as sources of protein.

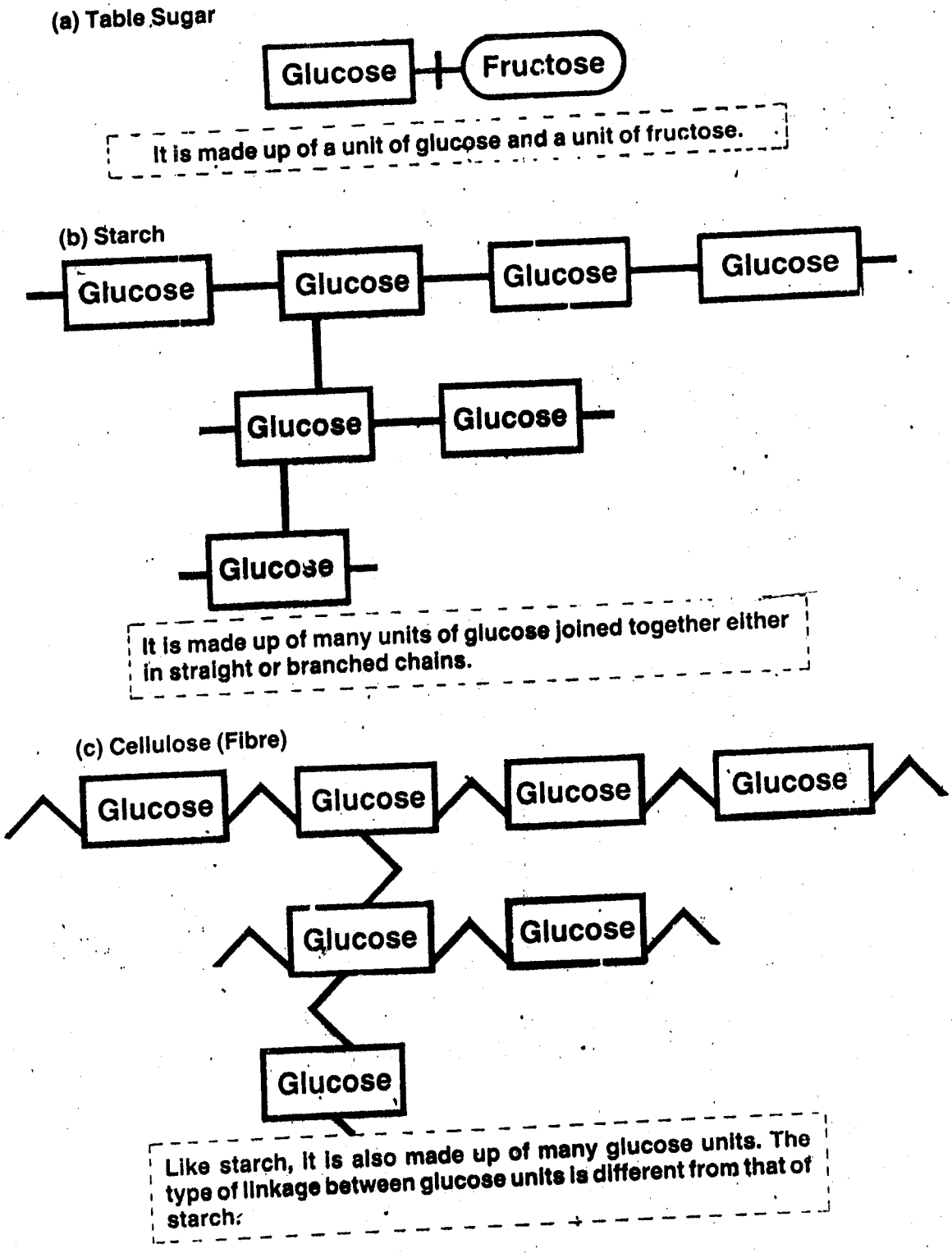

Fig. 2.4 Categories of carbohydrates

Table 2.1 : Carbohydrate—rich foods

Foodstuff	Carbohydrate content (g) (per 100 g edible portion of food)
Sugars:	
Cane sugar	99.4
Honey	79.5
Jaggery (cane)	95.0
Cereals:	
Wheat	71.2
Rice (raw, milled)	78.2
Roots and tubers:	
Potato	22.6
Sweet potato	28.2
Tapioca	38.1
Fruits:	
Banana (ripe)	27.2
Sapota	21.4
Mango (ripe)	16.9

Source: *Nutritive Value of Indian Foods* by C. Gopalan, B.V. Rama Sastri and S.C. Balasubramanian; revised and updated by B.S. Narasinga Rao, Y.G. Deosthale and K.C. Pant; National Institute of Nutrition (1989)

Functions: Some of the important functions of carbohydrates are listed below.

1) **Energy-giving function:** The chief function of carbohydrates is to furnish energy for the working of the body. One gram of carbohydrate provides approximately 4 kilocalories (Kcal). Carbohydrate foods are widely distributed in nature and are the cheapest sources of energy. They usually provide 60-70 per cent of the total calories in our diets. The kilocalorie is the unit of measurement of energy. One kilocalorie is the amount of heat required to raise the temperature of 1 kilogram of water by 1 degree centigrade (°C). Do note that in nutrition, kilocalorie and calorie mean one and the same thing.

2) **Protein-sparing action:** Though proteins can be broken down in the body to meet the energy need, this is not their chief function. You will learn more about the functions of proteins in Unit 3. An insufficient amount of carbohydrates in the diet will force the body to break down proteins for releasing energy instead of using them for the body's growth and development. Carbohydrates, if taken in sufficient amounts to meet the energy needs of the body, spare proteins for their important basic role in the body i.e. supporting growth and body-building. This particular act of sparing proteins for other functions is termed as the protein-sparing action of carbohydrates.

3) **Utilization of fats:** Some amount of carbohydrate is needed for the proper utilization of fat in the body. Presence of carbohydrates in the diet prevents the body from breaking down too much fat for energy. In case of deficiency of carbohydrates in the diet, more fat will be broken down to meet the energy requirements of the body. Why is this harmful? The reason is that excessive fat breakdown can result in accumulation of by-products of fat metabolism. This accumulation causes a problem and can affect health.

Check Your Progress Exercise 1

1) What do we mean by protein-sparing action of carbohydrates?

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2) How are starches different from table sugar?

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Digestion, absorption and utilization : Digestion of carbohydrates involves breakdown of starch and sugars like common table sugar in the diet to their simplest unit namely, glucose. Other carbohydrate substances like dietary fibre present in whole grains, vegetables and fruits cannot be digested by human beings because the stomach and intestines do not have the necessary chemical substances called enzymes to do this job.

The digestion of carbohydrates begins in the mouth itself. Saliva contains an enzyme called amylase which is capable of breaking cooked starch into smaller units. However, the time available for this enzyme to break down the starch in the mouth is too short to allow for any significant amount of conversion to take place. The longer one chews the food, the more the digestion of starch. There are no carbohydrate-digesting enzymes in the stomach. Thus the principal site of carbohydrate digestion is the small intestine. The major carbohydrate-digesting enzyme present here is an amylase secreted by the pancreas. This enzyme is capable of acting on both raw and cooked starch and converts it into smaller units. The next phase of carbohydrate digestion takes place within the cells of the small intestine where three important enzymes complete the process of digestion. These enzymes act on sugars and partially digested starch and ultimately break them up into the simple basic units i.e. glucose, fructose and galactose.

All the simple sugar units are taken to various body tissues and cells through the bloodstream and are ultimately converted to glucose. Some amount of glucose remains in the blood as blood sugar and is drawn upon by the body cells whenever needed. In the body cells glucose is mainly burnt to release energy. You know that oxygen is necessary for burning. Several substances are burnt in the body using oxygen. This process of burning of substances in the body is called oxidation. Hence the process of burning of glucose to release energy can also be termed oxidation of glucose. However, you must remember that burning or oxidation of glucose is not a single reaction. It takes place in several steps.

The extra glucose (which is not burnt to release energy) is converted to a substance called glycogen which is subsequently stored in the liver and muscles. Glycogen is made of long chains of glucose molecules. Glycogen can be broken down to release glucose whenever needed. But only a limited amount of glucose can be stored in the body as glycogen. Once the limit of glycogen storage is exceeded the remaining excess glucose is converted into fat and is stored in the body.

Check Your Progress Exercise 2

1) Why are substances like cellulose or dietary fibre indigestible in the human digestive tract?

.....

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2) Fill in the blanks.

a) The principal site of carbohydrate digestion is the.....

b) ..... and..... are the major sources of

carbohydrates in our diets.

c) Starch is an example of a carbohydrate built up of several..... units.

d) One gram of carbohydrate provides approximately .....Kcal.

e) ..... is the storage form of glucose in the body

2.3.2 Non-available Carbohydrates

If you have gone through the health columns of leading newspapers or magazines, you may have come across the term *fibre*. Fibre is nothing but non-available carbohydrate.

Is fibre a nutrient? What role does it play in our body? Let us try to answer these questions. Fibre, as you are aware, refers to a number of indigestible carbohydrates like cellulose present in plant foods. Research in this field shows that though these indigestible components of food are not available to the body, yet they play an important role in the regulation of some body processes. This is the reason why they are considered regulatory substances.

Functions : Let us now study the role of fibre in some detail.

1) **Satiety value :** You know fibre cannot be broken down chemically in the body. However, in the digestive tract some componets of fibre absorb water. They swell up and make the food residue bulky which gives a feeling of fullness or

2) **Elimination :** Fibre also helps in the easy elimination of unabsorbed food in the form of stools or faeces from the body. Fibre present in stools holds water, makes them softer and hence helps in their easy elimination. This particular function of fibre makes it useful for preventing or relieving constipation. Hence, it is a good idea to eat a diet that has generous amounts of fibre sources like cereals, pulses and vegetables.

3) **Prevention of diseases like cancer, diabetes and heart disease :** Some research studies have indicated that fibre does play a role in prevention of diseases like heart disease, diabetes, cancer of the colon i.e. the large intestine.

Food Sources : Fibre is present in the outer covering of cereals and pulses. The wheat grain, whole wheat flour and whole pulses (with outer husk) like black gram, rajmah, lobia, contain appreciable amounts of fibre. Refined cereals like maida and suji and washed dals (without outer covering or husk) do not contain much fibre.

What do we mean by the terms "whole cereal" and "refined cereal"? You will find that all grains have a common structure (Figure 2.5). They have three main parts—the outer covering or the bran, the germ or the embryo (the part which grows into a new plant) and the endosperm (which stores food for the growing embryo)..The grain with the outer covering (or its product having the outer covering in it) is termed whole grain cereal (or whole cereal product). For example, when whole wheat is milled (ground in machines) to form atta, most of the bran remains in it. Thus, atta or whole wheat flour is a whole cereal product.

Maida and suji are produced by further cleaning or refining (removal of coarse particles of bran and germ) of atta and are thus known as refined cereals.

Fibre is also present in the outer skin and seeds of most vegetables and fruits. However, some of the vegetables and fruits are particularly rich in fibre. Some examples are lotus stem, green leafy vegetables, ladies finger, peas, beans, brinjal, guava, oranges and amla. Animal foods like milk, milk products, meat, fish, poultry do not contain fibre.

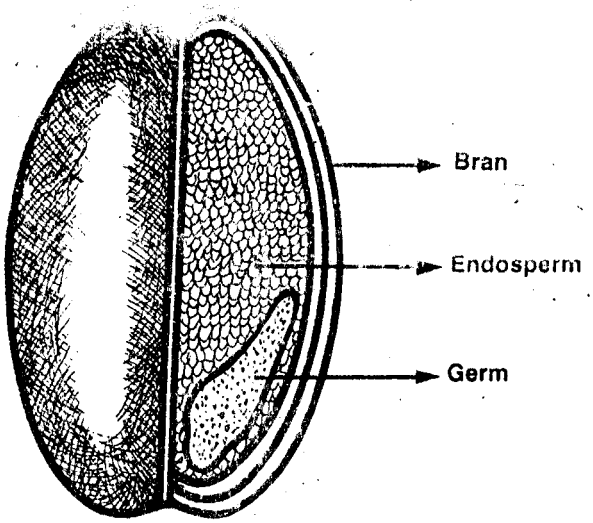

Fig. 2.5 Parts of the cereal grain

Check Your Progress Exercise 3

1) What is the role of fibre in relieving constipation?

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2) Fill in the blanks.

a) .....and.....are termed refined cereals.

b) Fibre is the term used for..... carbohydrates such as.....

c) .....and.....are some of the rich sources of fibre.

2.4 WATER

Water is essential for life. In fact, one can survive without food for weeks but not without water. Water is a macronutrient made of two elements—hydrogen and oxygen. A molecule of water contains two atoms of hydrogen and one atom of oxygen in other words the ratio is 2:1. Remember water is an inorganic compound.

You would have noticed that water has earlier been referred to as a food. This is because water in the form in which we consume it contains other nutrients like sodium and potassium which belong to the mineral category.

Functions: What role does water play in our body? Many of the functions of water are self-evident. Try to think. You will be able to list some of them. Important functions of water are given below. You can cross check your answer with these.

1) Water is the *major component of our body*. It makes up approximately 60 per cent of the total weight of an adult and almost 75 per cent in the case of the infant. It serves as the major and essential component of all cells and tissues though the amount of water present in different body tissues varies.

2) Water is the *medium of all body fluids* including blood, saliva, digestive juices, urine, faeces, sweat or perspiration.

3) Water plays an important role in the *regulation of body temperature.* Under normal circumstances your body temperature is maintained at 98.4° F or 37° C. You know that heat is produced in the body by the burning of carbohydrates, fats and proteins. Water helps to distribute this heat throughout the body. Some amount of water is lost from the body by evaporation and cools it down. This is because the water uses the body heat to evaporate. Thus, extra heat from the body is lost and body temperature is maintained.

4) Water is a *universal solvent.* This means it dissolves a variety of substances including all the products of digestion and carries them to various parts of the body via blood. Similarly, it helps in the removal of the waste products from the body. This property of water makes it essential for all the chemical reactions taking place in the body.

5) Water bathes the body cells and keeps them moist. Hence it acts as a *lubricant.* Water present in saliva and other digestive juices helps in the passage of food down the digestive tract. It is also an important lubricant for the joints.

Water does not undergo any digestive change in the body and is absorbed as such.

Sources : Our body gets water mainly by :

a) *The ingestion of water in the form of liquids :* This includes water which we drink daily as such or part of beverages like tea, coffee, fruit juices and aerated drinks.

b) *The ingestion of water in the form of solid foods :* Water is present in various foodstuffs in hidden or invisible forms. The water content of foods varies widely. Table 2.2 gives water (moisture) content of some of the foodstuffs.

It is vital that the water we drink is safe and free from germs causing water-borne diseases such as diarrhoea, dysentery, and cholera. Clean and safe drinking water is absolutely necessary.

Table 2.2 : Moisture Content of Some Foodstuffs

Foodstuffs	Moisture content (g) (per 100 g of edible portion)
Vegetables	
Spinach	92.1
Pumpkin	92.6
Peas	72.1
Fruits	
Apple	84.6
Milk	
Cow's milk	87.5
Cereals	
Wheat	12.8
Rice (raw, milled)	13.7
Pulses	
Bengal gram	9.8

Source : *Nutritive Value of Indian Foods* by C. Gopalan, B.V. Rama Sastri and S.C. Balasubramanian; revised and updated by B.S. Narsainga Rao, Y.G. Deosthale and K.C. Pant; National Institute of Nutrition (1989)

c) *Water formed in the body from the metabolism of nutrients.* Some amount of water is formed in the body during the various chemical reactions involved in the the metabolism of carbohydrates, as you have studied earlier. The reactions involved in fat and protein metabolism also contribute water to the body.

Thus, the total water available to the body is obtained through these three sources i.e. drinking water and beverages, foods and the metabolism of nutrients in the body.

During the course of utilization of water for various body processes some amount of water is also lost from the body through the kidneys, skin, lungs and digestive tract.

A significant amount of water is lost through the skin in sweat or perspiration. Water is lost from the kidneys in the form of urine. A small amount of water is also lost from the digestive tract in saliva and faeces. The air we breathe out from the lungs also contains some amount of water. Normally the body maintains a balance between intake of water i.e. ingestion and loss of water from the body i.e. excretion. This is termed water balance.

Check Your Progress Exercise 4

1) What is the meaning of the term 'water balance?

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2) Fill in the blanks.

a) Our normal body temperature is.....

b) Water is the universal.....

c) Water makes up approximately.....per cent of the total weight of an adult.

2.5 LET US SUM UP

Food provides five major categories of nutrients i.e. carbohydrates, fats, proteins, minerals, vitamins, and water. Water, as you know, can be termed as a food as well as a macronutrient. Each of the nutrients has specific functions in the body. Some of these are known as macronutrients while others are called micronutrients.

The discussion in this unit is on two categories of macronutrients i.e. carbohydrates and water.

Carbohydrates are classified into three major categories—starch, sugar and fibre. Carbohydrates are also classified as available (starch, sugar) and non-available carbohydrates (fibre). Available carbohydrates i.e. sugars and starches are digestible in the human body. The chief end product of digestion of sugar and starches is glucose. The main function of available carbohydrates is to furnish energy for the functioning of the body. The non-available carbohydrates are indigestible in the human digestive tract but have many beneficial functions in the body like increasing the satiety value of food, helping in easy elimination of faeces or waste products from the body and the prevention of diseases like heart disease, diabetes, cancer of the colon i.e. large intestine.

Water (like carbohydrates, proteins and fats) is a major component of food. A molecule of water is made of two atoms of hydrogen and one atom of oxygen. Water is absorbed as such without any digestive change. Water has many important functions in the body. It is the major component of all cells and tissues of the body. It is the medium of all body fluids, helps in transport of many substances and excretion of waste products from the body. Water helps to regulate body temperature and keep it within the normal range.

2.6 GLOSSARY

Constipation : A condition of the body characterized by the difficult, delayed passage of stools

Enzyme : Protein substances present in living cells. Enzymes help chemical reactions to proceed faster. They bring about changes in other substances without themselves undergoing any change

Edible portion : Most foods have both an edible portion (which can be eaten such as the flesh of fruits and vegetables) and a non-edible portion (which cannot be eaten like the seeds and outer skin of some of the fruits and vegetables). Some foods have a higher percentage of edible portion as compared to other foods. The nutritive value or nutrient content of the food is usually given on the basis of edible portion contained in them

Glycogen : The main storage form of carbohydrate in animals

Water balance : A balance in the body between the intake of water i.e. ingestion and loss of water i.e. excretion

2.7 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) Both proteins and carbohydrates can be broken down in the body to provide energy. The main function of carbohydrates is to furnish energy for the body; this is not the case with proteins. The presence of carbohydrates in the diet takes care of the energy needs of the body and hence spares proteins for their chief function of growth and body-building. This function of carbohydrates is termed protein-sparing action.

2) Starch is a very large molecule which is made up of many basic carbohydrate units or glucose. It is made of long chains of glucose (either straight or branched) whereas the table sugar which we commonly use at home is a much smaller molecule and made up of only two basic units—one unit of glucose and one unit of fructose.

Check Your Progress Exercise 2

1) Substances like cellulose are termed indigestible because enzymes capable of bringing about their digestion are not present in the human digestive tract.

2) a) small intestine
   b) Cereals and sugars
   c) glucose
   d) 4 Kcal
   e) Glycogen

Check Your Progress Exercise 3

1) Dietary fibre present in food cannot be digested in the body. The unabsorbed food residue chiefly containing indigestible fibre absorbs water, gives bulk to the stools and helps in their easy elimination from the body. Thus, fibre plays a role in relieving constipation.

2) a) Maida and suji
   b) blood glucose

c) Indigestible or non-available cellulose

d) whole cereals and pulses

Check Your Progress Exercise 4

1) Intake of water into the body from all three sources (i.e. water as such and in the form of beverages, water from foods, water produced in the body from the metabolism of nutrients) is termed ingestion. Some amount of water is lost from the body during the course of its utilization. This is termed excretion of water. Usually in normal conditions the body maintains a balance between ingestion of water and excretion of water. This is termed water balance.

2) a) 98.6°F or 30°C

b) solvent

c) 60-70 percent.

UNIT 3 THE MACRONUTRIENTS-II: PROTEINS AND FATS

Structure

3.1 INTRODUCTION

In Unit 2 you learnt some aspects relating to two categories of macronutrients i.e. carbohydrates and water. This unit will cover another two categories of macronutrients i.e. proteins and fats. Like carbohydrates, proteins and fats are also organic compounds. This unit discusses the nature, functions and food sources of proteins and fats. In addition, the processes of digestion, absorption and utilization of proteins and fats in the body are also discussed.

Objectives

After studying this unit, you will be able to:

- describe the chemical nature of proteins and fats
- list the food sources of proteins and fats
- state the role of proteins and fats in the body and
- describe the processes of digestion, absorption and utilization of proteins and fats in the body.

3.2 PROTEINS

You have so far studied about carbohydrates and water. Let us now concentrate on the study of yet another category of macronutrients i.e. proteins. Proteins like carbohydrates are organic compounds but are distinct from carbohydrates in certain respects. Besides carbon, hydrogen and oxygen, proteins also contain another element called nitrogen. The basic building blocks of proteins are nitrogen-containing units called *amino acids*. Amino acids are joined or linked together in chains by linkages called peptide linkages. Several hundreds or even thousands of amino acids are strung together in specific strands and coils to form proteins (Figure 3.1).

You may be amazed to know that these proteins are built up of just 22 amino acids. Food has an almost endless variety of proteins and no two proteins have similar structure. This is because the twenty or more amino acids are present in varying proportions and are arranged in varying sequences in different kinds of proteins. Of these about 8 cannot be manufactured by the body while the rest can. Those which cannot be manufactured by the body must be supplied by the diet. These amino acids are called *essential*. The amino acids which can be manufactured by the body need not, of course, be supplied by the diet. They are hence called *non-essential*. Hence the terms "essential" and "non-essential" only refer to whether it is essential or not essential to provide them in the diet. We must remember that for the synthesis of body proteins both essential and non-essential amino acids are equally important.

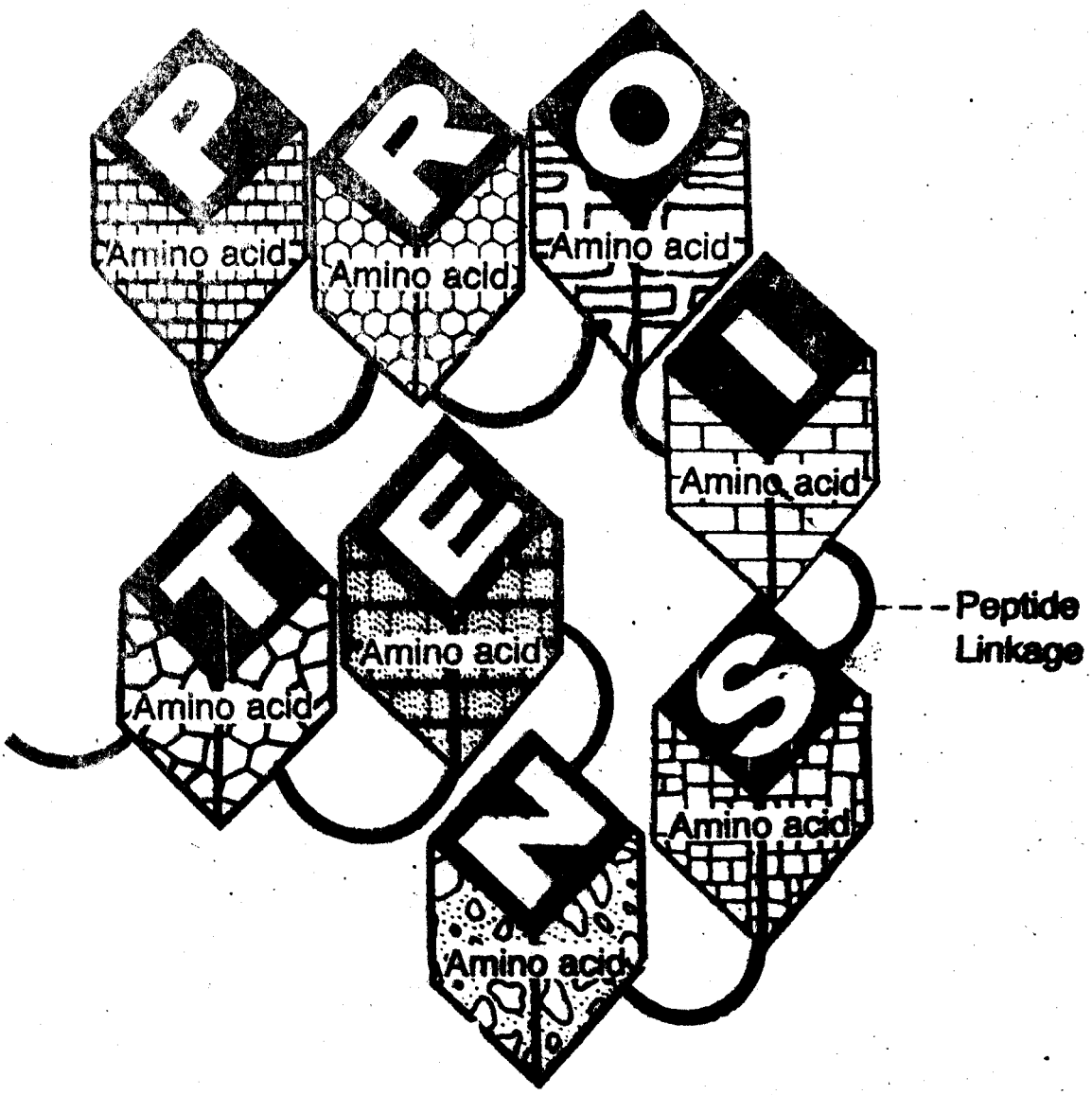

Fig. 3.1 Amino acids are the building blocks of proteins

Table 3.1 lists the essential and non-essential amino acids.

Table 3.1 : Essential and Non-essential Amino Acids

Essential amino acids	Non-essential amino acids
Isoleucine	Alanine
Leucine	Asparagine
Lysine	Aspartic acid
Methionine	Cystine
Phenylalanine	Cysteine
Threonine	Glutamic acid
Tryptophan	Glutamine
Valine	Glycine
Histidine*	Hydroxyproline
	Hydroxylysine
	Proline
	Serine
	Tyrosine

*Essential for infants only

The quality of food proteins depends on the number and the proportion of essential amino acids contained in them. Proteins are obtained from both animal and plant foods. The proteins in animal foods are of good quality because they contain all essential amino acids in the required amounts and proportions.

On the other hand, the proteins in plant food generally lack one or two essential amino acids and, therefore, are not of good quality. For example, cereals are poor in lysine and rich in methionine. On the other hand, pulses are poor in methionine and rich in lysine. When cereals are combined with pulses in the same meal then the quality of protein improves. Protein quality of plant foods can be thus improved by the combination of one or more kinds of foods of plant origin. If you look at the traditional Indian diets (whatever the region you may belong to), you will find many dishes which are prepared by using either a *cereal-pulse combination* as in dosa (rice, urad dal); dal-roti; rice-dal or *cereal-animal food combinations* as in dalia (milk, broken wheat); rice-fish. This is one of the ways of improving the quality of food proteins. *By a judicious combination of foods of animal and plant origin, you can ensure that the protein consumed will be of good quality.* You must remember that even small amounts of animal protein with vegetable protein in a meal greatly improves protein quality.

Food Sources: Here is the list of some of the rich sources of proteins. The list is vast and includes: milk, milk products (like curd, khoa, paneer), flesh foods (meat, fish, poultry), eggs, nuts and oilseeds (groundnuts, almond, cashewnut, walnut) and pulses (bengal gram, lentils, green gram, rajmah, soyabean). Among pulses, soyabean is particularly rich in protein. Protein content of some of these foods is given in Table 3.2.

Table 3.2 Protein-rich Foods

Foodstuff	Amount of Protein (g) (per 100g of edible portion of food)
Foods of Animal Origin	
Flesh Foods:	
Goat meat	21.4
Fish (Pomfret)	20.3
Egg	13.3
Milk and Milk Products:	
Milk (cow)	3.2
Khoa	20.0
Paneer (Cottage cheese)	18.3
Foods of Plant origin	
Nuts and Oilseeds	
Cashewnut	21.2
Groundnut	25.3
Pulses	
Soyabean	43.2
Rajmah	22.9
Bengal gram (whole)	17.1

Source: *Nutritive Value of Indian Foods* by C. Gopalan, B.V. Rama Sastri and S.C. Balasubramanian; revised and updated by B.S. Narasinga Rao, Y.G. Deosthale and K.C. Pant; National Institute of Nutrition (1989)

If you look at the current prices of foods of animal origin like meat, fish, poultry, you will find that most of these are very costly. The only animal foods which are relatively less expensive (though expensive as compared to plant foods) are milk and eggs. As the protein in foods of animal origin are of good quality, one should try to include small amounts of these foods in the daily diet. Milk is the only animal food used by both vegetarians and non-vegetarians. Although the protein content of 100 g milk is only 3.2 g yet it contains protein of very good quality and is rich in lysine. Hence, even a small amount of milk added to a basic Indian diet of dal-roti greatly enhances the protein quality of the whole diet. One should therefore try to include at least a small amount of milk in the daily diet. Non-vegetarians, who cannot afford meat, fish and chicken can eat eggs which are cheaper and as nutritious as meat, fish or chicken.

Let us now take a look at the foods of plant origin. According to Table 3.2, pulses, nuts and oilseeds are rich sources of proteins. But these foods are also very expensive. Pulses are the major source of protein in Indian diets. One can try to improve the quality of cereal proteins by combining them with pulses. A small amount of milk, if it can be afforded, will further improve the quality of food protein.

Check Your Progress Exercise 1

1) How can we improve the protein quality of cereals?

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2) List the sources of animal and vegetable proteins in your diet and compare their cost.

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Functions: Remember your childhood days when your parents/elders forced you to drink milk. They always said that you need milk for the proper growth of your body. Now, as an adult and a student of nutrition, you would realize that they were right. Milk is a good source of protein and proteins do play a role in growth and body-building. Let us now study the body-building and other functions of proteins in detail. Some of the functions of proteins are given below:

1) **Body-building:** Proteins supply amino acids for building new body tissues and for the replacement of worn out tissues. Thus they help in the growth and the maintenance of the body. For the constant growth of human beings from birth till adulthood, a regular supply of dietary protein is required. This does not mean that proteins are not needed when growth ceases. Even during adulthood worn out body tissues need continuous replacement. Thus, proteins are required throughout life for the growth and maintenance of the body.

2) **Proteins as regulatory and protective substances:** Proteins are also part of some chemical substances essential for the regulation of vital body processes. You are aware of the role of enzymes in the process of digestion of food. All enzymes are proteins in nature. Like enzymes, hormones are also chemical substances vital for the regulation of metabolism as well as some other body processes. Some of the hormones (like insulin) are proteins. Antibodies which protect the body from illness are also proteins.

3) **Proteins as carriers:** Some of the proteins act as carriers and help to transport certain substances from one place to another. One prominent example of a protein carrier is haemoglobin, the red coloured protein-containing substance present in the blood. Haemoglobin carries oxygen from the lungs to various body tissues and carbon dioxide from body tissues to the lungs.

4) **Energy-giving function:** Proteins can also be broken down in the body to provide energy. Each gram of protein yields about 4 Kcal. This, however, is not the major function of proteins and only takes place when the diet does not supply enough energy-giving nutrients such as carbohydrates and fats.

Digestion, absorption and utilization: Dietary proteins chiefly consist of proteins and small and large chains of amino acids. Digestion of proteins involves the breakdown of these amino acid chains to their constituent amino acids.

Since saliva contains no proteolytic enzyme (enzymes which bring about breakdown of proteins), protein digestion mainly occurs in the stomach and the small intestine. *Pepsin*, a proteolytic enzyme, present in gastric juice breaks down proteins into smaller amino acid chains. But pepsin itself cannot complete the digestion of proteins. Partly broken down proteins from the stomach are released into the small intestine where further digestion takes place in two steps : i) *Breakdown of partly digested proteins to smaller amino acid chains :* There are several proteolytic enzymes

called *proteases* in the small intestine which act on partly digested proteins and convert them to even smaller amino acid chains: ii) *breakdown of amino acid chains to amino acids:* Finally other kinds of proteolytic enzymes called *peptidases* act on amino acid chains and convert them to their constituent amino acids.

The metabolism of proteins is essentially the metabolism of amino acids as these are the end products of the process of digestion of proteins. After digestion, amino acids are carried by the blood to the liver. Here amino acids are used in three ways : a) some of them are used for building of blood proteins; b) some are retained in the liver and c) the rest enter the blood circulation as amino acids. Some of the amino acids remain in circulation and others are taken up by body tissues for protein synthesis whenever needed. It must be emphasized here that only proteins of good quality are maximally utilized by the body for synthesis of its own proteins.

Foods of animal origin like milk, meat have proteins of good quality. This is because the animal proteins have the right proportions and amounts of all essential amino acids. Food of plant origin, on the other hand (like wheat, rice and pulses), have protein of poor quality because they generally lack one or more essential amino acids.

Thus the amino acids present in proteins of good quality can be used optimally for body protein synthesis. On the other hand, proteins of poor quality are less likely to be used for tissue protein synthesis. These proteins (amino acids) are more likely to be used for other purposes including release of energy. Like glucose, amino acids can also be oxidized or burnt in the body to produce energy.

Check Your Progress Exercise 2

1) Fill in the blanks.

   a) .....are the building blocks of all proteins.

   b) Pulses are lacking in the amino acid..... and rich in.....

   c) A good quality protein has the right:..... and..... of all essential amino acids.

   d) Amino acids in proteins are linked together by the ..... linkage.

2) Indicate whether the following statements are true or false. Correct the false statements.

   a) Cereals contain relatively poor quality protein. (True/False)

   .....

   b) The energy-giving function is the major function of proteins. (True/False)

   .....

   c) All hormones are proteins. (True/False)

   .....

   d) Haemoglobin is the red coloured substance present in the blood. (True/False)

   .....

   e) Combination of cereal and pulse in a meal greatly improves the quality of protein. (True/False)

   .....

3.3 FATS

Fats, like carbohydrates, are compounds of carbon, hydrogen and oxygen. However, they differ from carbohydrates in structure and properties. The term fat includes fats

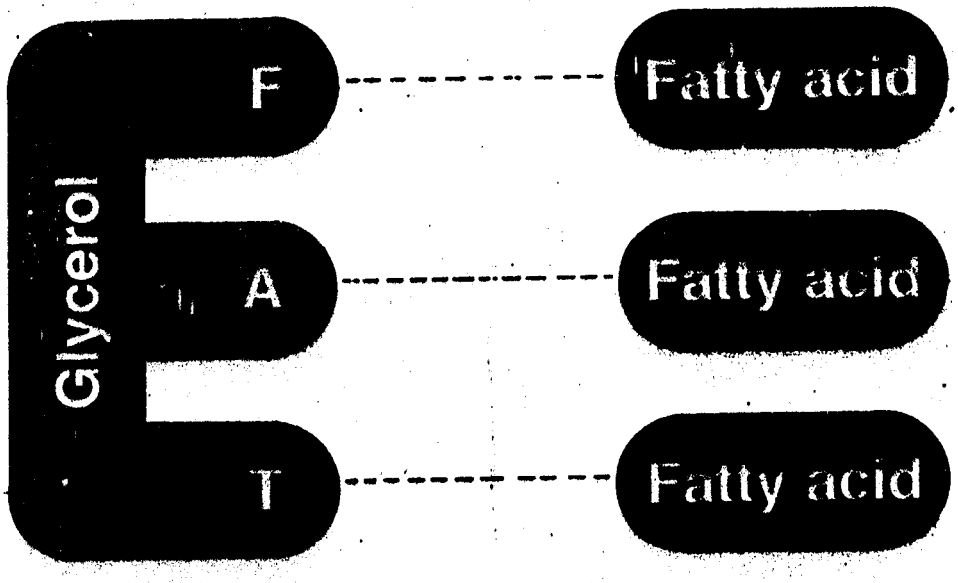
and oils which are greasy in feel and insoluble in water. In addition to fat and oils there are certain fat-like substances such as cholesterol which are important in the body. You can learn more about cholesterol from Box 3.1 given at the end of this section.

Let us first discuss the chemical nature of fats and oils. The major constituent of all fats and oils are *fatty acids* and *glycerol*. The fatty acids are composed of a chain of carbon atoms with other elements like hydrogen and oxygen. Some of the common fatty acids are palmitic, stearic, oleic and linoleic acids. The fatty acids can be classified in three categories on the basis of chain length. There are shorter chain fatty acids (10 or fewer carbon atoms), long chain fatty acids (12 to 20 carbon atoms) and very long chain fatty acids (20 or more carbon atoms).

Whenever we talk about fats and oils we come across terms like saturated fatty acids, unsaturated fatty acids and essential fatty acids. What do we mean by these terms? A fatty acid chain of specified chain length (in terms of number of carbon atoms) has a fixed maximum number of hydrogen atoms. Certain fatty acids have as many hydrogen atoms as the carbon chain can hold. They are called *saturated fatty acids*. On the other hand, *unsaturated fatty acids* have the capacity to accommodate more hydrogen atoms i.e. some hydrogen atoms are missing from the carbon chain.

Now let us learn about the essential fatty acids. There are two fatty acids which cannot be synthesized in the body. These fatty acids have to be provided in the diet and are referred to as *essential fatty acids*. These are linolenic and linoleic acids. Both these fatty acids are unsaturated in nature.

You may recall that fats and oils are made up of glycerol and fatty acid. In fact a molecule of fat or oil has three fatty acids and a molecule of glycerol. This is called a triglyceride (Figure 3.2). Fats and oils are composed of many triglycerides or fat molecules.



It is made up of a molecule of glycerol and three fatty acid molecules.

Fig. 3.2 A molecule of fat (triglyceride)

Let us now see what is the difference between fats and oils. Both fats and oils are triglycerides but fats are solid at room temperature and have a higher proportion of saturated fatty acids e.g. ghee and butter. Oils, on the other hand, have more unsaturated fatty acids and are liquid at room temperature e.g. mustard oil, groundnut oil. *Usually, the term fat is used for both fats and oils.*

Food Sources: Food sources of fats and oils include all common fats and oils like ghee, vanaspati, mustard oil, groundnut oil, soya oil, coconut oil. They are almost 100 percent fat.

The presence of fat is also evident in other foodstuffs like milk and milk products (curd, paneer, khoa), nuts and oilseeds (almond, groundnut, coconut, mustard seeds), eggs and flesh foods. These are known as *fat-rich foods.* They have 8 to 50 percent fat in them (Table 3.3).

Table 3.3: Fat-rich Foods

Foodstuff	Fat Content (g) (per 100g edible portion)
Almond	58.9
Cashewnut	46.9
Groundnut	40.1
Coconut (fresh)	41.6
Mustard seeds	39.7
Soyabean	19.5
Egg	13.3
Mutton	13.3

Source : *Nutritive Value of Indian Foods* by C. Gopalan, B.V. Rama Sastri, S.C. Balasubramanian; revised and updated by B.S. Narasinga Rao, Y.G. Deosthale and K.C. Pant; National Institute of Nutrition (1989).

You may be surprised to know that fat is present in very minute quantities in almost all foodstuffs. Even foods like cereals, pulses, fruits have fats in them in minute quantities (*invisible form*). These foods contribute a substantial amount of fat to Indian diets by virtue of being consumed in large quantities.

Functions: The term fat may be associated in your mind with a substance which is harmful for health. You may consider fats as substances which would make you overweight and may endanger your life by causing disease like heart attack. This is a negative view about fats. Fats as macronutrients play a crucial role in the body. Problems come up only if you take fats in excess amounts i.e. more than the requirement of the body. You would realize how important fats are for your body as you go through the following important functions:

1) **Source of energy:** Fat is a concentrated source of energy. Each gram of fat provides approximately 9 Kcal. This is more than double the amount of energy supplied by a gram of carbohydrate or protein. Usually only a small amount of fat is used to meet the energy needs of the body. Most of the excess fat is stored in the body in specific tissues called adipose tissue. Adipose tissue is present under the skin, and in the abdominal region among others.

2) **Satiety Value:** What happens when you consume fat-rich diets? Do you feel hungry sooner or later? In fact, as you would have noticed, you feel full and do not feel hungry for a long time. This is because fats remain longer in the stomach and take more time to digest. Hence, like fibre, fats also give satiety value.

3) **Insulation and padding:** You have read that fat is stored in the body in adipose tissues at specific places. Layers of stored fat under the skin act as an insulator and keep the body warm. A layer of fat is also present around the vital organs of the body like the kidney and the heart. This serves as a padding and protects them against injury.

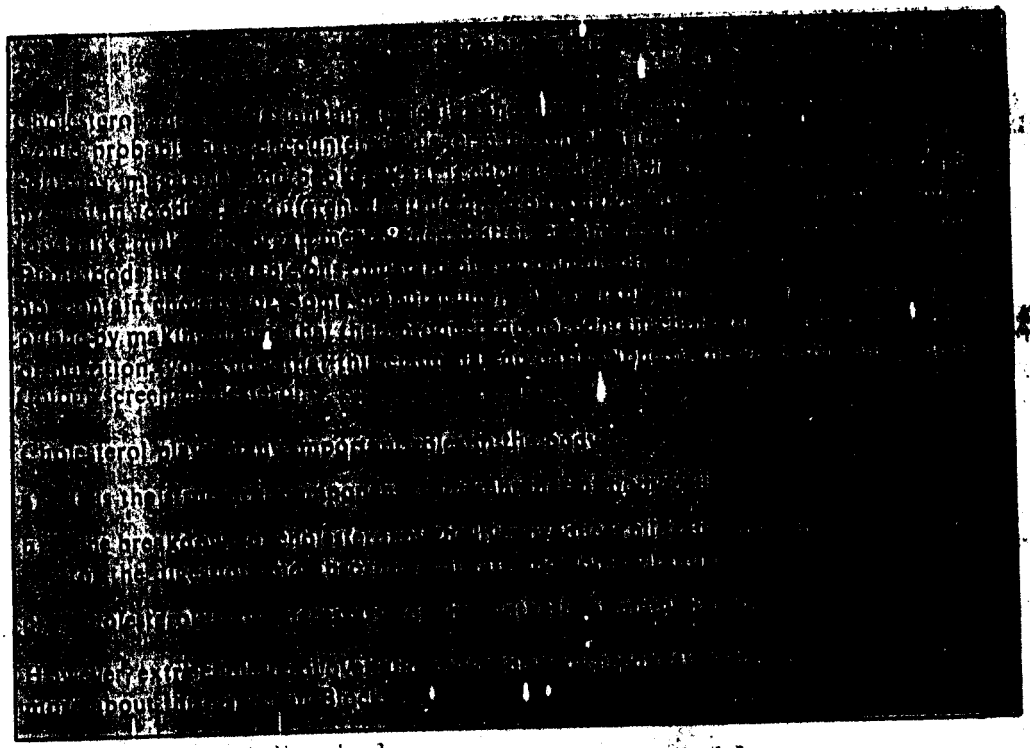
4) **Source of essential fatty acids:** Fats serve as sources of essential fatty acids which have important functions in our body.

5) **Carrier of fat-soluble vitamins:** You have read about a category of micronutrients called vitamins. Some of the vitamins are soluble in fats and are termed as fat-soluble vitamins. Fats serve as carriers of these fat-soluble vitamins in the body and also aid in their absorption.

Digestion, absorption and utilization: In the process of digestion fats are broken down to their constituent components i.e. glycerol and fatty acids. The two enzymes which aid in the digestion of fats are *gastric lipase* present in gastric juice and *pancreatic lipase* poured into the small intestine from the pancreas. For enzyme action, fats need to be dispersed or mixed in water. You know fats are insoluble in water. A secretion from the liver called bile helps in fat digestion by breaking fat into small droplets. These fat droplets are then dispersed in the liquid digestive juice and are easily acted upon by enzymes. Since bile is not present in the stomach, the action of gastric lipase is not very significant. This is the reason why fats are chiefly digested in the small intestine where pancreatic lipase breaks them into glycerol and fatty acids aided by the action of bile.

The end products of fat digestion i.e. glycerol and fatty acids present in the intestine move into the intestinal cells. The fatty acids cannot enter intestinal cells as such. Bile salts play an important role in fat absorption by dispersing the fatty acids into small, tiny water-soluble units called *micelles* which can easily move into the intestinal cells.

Fatty acids and glycerol then get transported from the intestinal cells to blood circulation. They do not travel directly into the bloodstream but first enter the network of vessels (present in the villi of the small intestine) called lymph vessels. Then fatty acids from the lymph vessels enter the heart and from there move into the blood. Blood then carries them either to the adipose tissues where they are stored as concentrated sources of energy or to cells where they are broken down to provide energy (in a similar fashion as glucose and amino acids).



Check Your Progress Exercise 3

1) How are saturated fatty acids different from unsaturated fatty acids?

.....

.....

.....

.....

2) Name the two essential fatty acids.

.....

.....

3) Fill in the blanks.

a) All fats and oils are made up of.....and.....

b) Each gram of fat provides approximately.....Kcal.

c) The amount of energy supplied by a gram of fat is.....the amount of energy supplied by a gram of carbohydrate or protein.

d) .....is essential for digestion and absorption of fats and. oils.

e) A molecule of fat has.....fatty acids and a molecule of glycerol and is called a .....

3.4 LET US SUM UP

The discussion in this unit is on two categories of macronutrients i.e. proteins and fats. You have read that :

- Amino acids are the building blocks of proteins. Food and body proteins contain 22 different amino acids. These 22 amino acids are classified into two categories : essential and non-essential amino acids. The quality of food proteins depends on the relative proportion of essential amino acids present in them. As animal proteins generally contain enough of all the essential amino acids needed by the body, they are considered superior in quality as compared to plant proteins. The quality of plant proteins can be improved by combining plant foods with other plant foods or animal foods e.g. cereal-pulse combinations or cereal-milk combinations.

  The end products of protein digestion in the body are amino acids which after absorption are utilized for several functions in the body. The chief function of proteins is growth and maintenance.

- Fatty acids are the chief constituents of all fats and oils. Fatty acids can be saturated or unsaturated depending on the number of hydrogen atoms present in the carbon chain. A molecule of triglyceride or fat is made up of three fatty acids and one molecule of glycerol. During the process of digestion triglycerides present in the food are broken down to their constituent fatty acids and glycerol. The fatty acids released as a result of digestion are concentrated sources of energy.

3.5 GLOSSARY

Essential amino acids	:	The amino acids which cannot be synthesized in the body and hence have to be provided in the diet
Fatty acid	:	An organic compound composed of carbon, hydrogen and oxygen. In combination with glycerol, fatty acids form fat
Hormone	:	Secretions of some glands of the body which travel through the blood to specific target organs to exert their specific effects e.g. the hormone insulin is secreted by a gland (pancreas) and travels in blood to the target organ (i.e. muscle and adipose tissue)
Haemoglobin	:	A protein-containing compound present in the blood which helps to carry oxygen from the lungs to the body tissues and carbon dioxide from the body tissues to the lungs
Non-essential amino acid	:	An amino acid which can be synthesized in the body and hence does not have to be provided in the diet

Reserve	:	Reserve here refers to stores of various nutrients in the body at specific sites
Triglyceride	:	A molecule of fat which is made up of glycerol and three fatty acids

3.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) Cereals are lacking in one of the essential amino acids (lysine). Their protein quality can be improved by combination with other foods which are rich in lysine i.e. pulses or animal foods like milk, egg, meat.

2) Answer from your own experience.

Check Your Progress Exercise 2

1) a) Amino acids b) methionine, lysine c) proportion and amount d) Pepude.

2) a) True b) False. The major function of protein is body-building. c) False. Some hormones are proteins. d) True e) True.

Check Your Progress Exercise 3

1) Saturated fatty acids contain all the hydrogen atoms which the carbon chains can hold whereas in unsaturated fatty acids some of the hydrogen atoms are missing from the carbon chain. The degree of unsaturation will vary according to the number of missing hydrogen atoms. The two essential fatty acids are also unsaturated in nature.

2) Linoleic acid and linolenic acid.

3) a) fatty acids and glycerol b) 9 c) double d) Bile e) three, triglyceride.

NOTES

NOTES

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Nutrition for the Community

Block

2

BASIC CONCEPTS IN NUTRITION — II

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Nov, 1993 (Reprint)

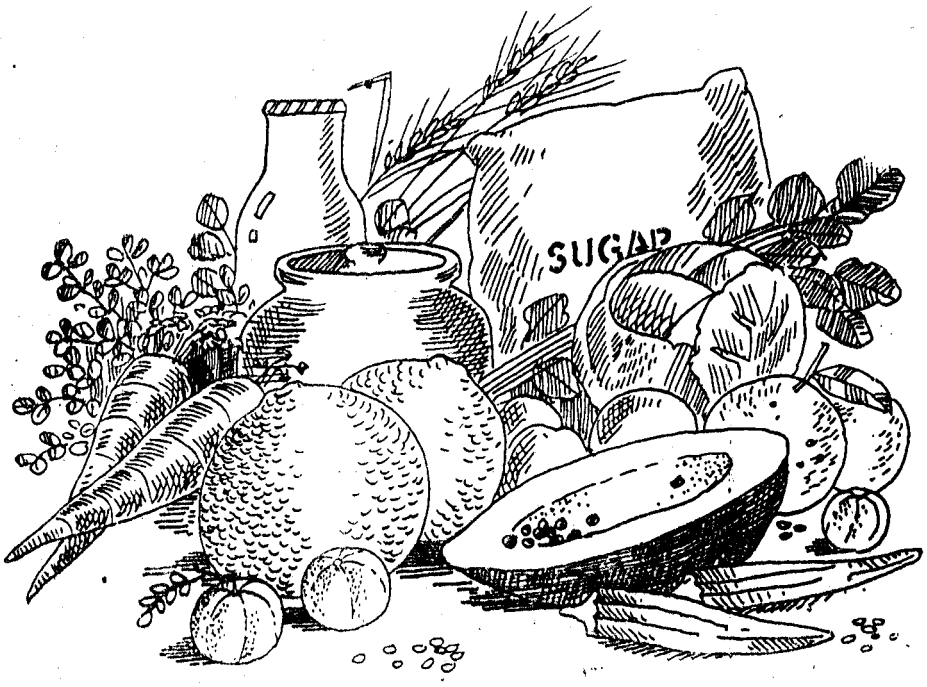
ISBN-81-7263-286-X

BLOCK INTRODUCTION

In Block 1 we began our study of the basic concepts in nutrition. We talked about food and its interrelationship with nutrition and health. We also focussed on the macronutrients — carbohydrates, water, proteins and fats. Their nature, sources and the role they play in our body were discussed. In this block we continue our study of basic concepts. The two focal points of this block are the micronutrients — vitamins and minerals — and the planning of balanced diets.

Micronutrients, as you know, are as important for our health and well-being as macronutrients. They are, in fact, remarkable substances. We require them in very small amounts and yet what crucial functions they perform! What are these functions? Which foods are rich in micronutrients? How does the body handle these nutrients? You will find the answers to these questions in this block.

The second major focus of interest in the block is the planning of balanced diets. The word "balanced" has the same meaning as the phrase "nutritionally adequate". In other words this means that when we plan a balanced diet for an individual we would be providing all nutrients in the amounts and proportions needed. Unit 6 will introduce you to the concept of balanced diets. It will also provide simple hints and guidelines to help you in planning balanced diets.



UNIT 4 THE MICRONUTRIENTS — I : VITAMINS

Structure

4.1 INTRODUCTION

You learnt about the sources, functions and utilization of macronutrients in Block 1. We will now begin our discussion on micronutrients with the study of vitamins in this unit.

The "vita" part of the word "vitamin" means "life". Vitamins are, in fact, vital and essential for life and health. They regulate metabolism, help in the growth and maintenance of our body and protect against disease. You will learn a great deal about these functions in the unit.

Vitamins (like carbohydrates, fats and proteins) are organic compounds. Unlike these nutrients, however, vitamins are present in minute quantities in food. This does not mean we need vitamin pills to meet our needs! We can meet our requirements for vitamins quite easily by consuming the right types of foods.

Some of the vitamins are soluble in water while others are soluble in fat. They are hence classified into two categories: water-soluble vitamins and fat-soluble vitamins. This unit will introduce you to the different vitamins included in each of these categories. You will learn about the food sources, functions and absorption of these vitamins.

Objectives

After studying this unit, you will be able to:

- differentiate between fat-soluble and water-soluble vitamins
- identify the food sources of each vitamin
- describe the mechanism of absorption of each vitamin
- describe the storage of fat-soluble vitamins and
- state the important functions of each vitamin in the body

4.2 FAT-SOLUBLE VITAMINS

Vitamins A, D, E and K are known as the fat-soluble vitamins. These vitamins are, therefore, present in food in close association with fats. An interesting fact about fat-soluble vitamins is that after being used for specific functions, the excess amount of these vitamins is stored in the body. Let us now learn more about each of these vitamins.

4.2.1 Vitamin A

Vitamin A or *retinol* is found only in the foods of animal origin. Animal foods like milk, butter, ghee, egg, fish and liver are rich sources of vitamin A. Liver oils of fish like halibut, cod, and shark are the richest sources.

Plant foods do not contain retinol. They contain certain orange or yellow coloured pigments called carotenoids which can be converted to retinol in the body. In other words these carotenoid pigments are precursors of vitamin A. The word "precursor", of course, refers here to a substance which can be converted to the vitamin in the body.

Beta carotene is the most widely distributed carotenoid in plant foods. Most of the yellow and orange colour of vegetables and fruits is due to these carotenoid pigments as we mentioned earlier. Ripe fruits such as mango, papaya and yellow/orange vegetables like carrot and pumpkin are rich in beta carotene. Green leafy vegetables also contain carotenoid pigments. Here the yellow and the orange colour of the carotenoid pigments is masked due to the presence of another pigment called chlorophyll which, as you may know, is green in colour. Green leafy vegetables such as spinach, mustard leaves and fenugreek leaves are very rich sources of beta carotene.

We earlier mentioned specific animal foods which are rich sources of vitamin A. However, you know that animal foods are expensive. Most Indians do not consume enough animal foods to meet the vitamin A needs of the body. Hence they depend on plant foods to meet their vitamin A needs. Plant foods, as you know, do not have retinol. They contain beta carotene instead. The conversion of beta carotene to vitamin A or retinol is not very efficient in the body. In fact only half of the beta carotene absorbed is converted to retinol. Thus people who consume less animal foods need to consume enough plant foods such as green leafy vegetables and orange-yellow fruits to meet vitamin A needs.

Absorption and storage: You have read that vitamin A is ingested either in the form of retinol or carotene. After absorption from the intestinal cells, retinol forms a complex with some fat-containing particles called chylomicrons and is taken to the bloodstream. Carotene is absorbed in much the same way as retinol. After absorption most of the carotene is converted to retinol in the cells of the small intestine itself.

Retinol (whether absorbed as such or formed in the body from carotene) is transported by the blood to the liver as part of the chylomicrons. Approximately 90 per cent of the total absorbed vitamin is stored in the liver and the remaining 10 per cent is distributed in other organs and glands like the kidneys, lungs and adrenal glands.

Being a fat-soluble vitamin, the presence of bile and fats greatly aids in vitamin A absorption. Further, proteins help in its transport from the liver to other body tissues. This is an example of how nutrients interact with each other.

Functions: What does vitamin A do in the body? This remarkable substance has, in fact, three important functions as listed below:

1) **Maintaining normal vision:** Vitamin A plays an important role in maintaining normal vision. To understand this better we must first be familiar with the structure of the eye. Look at Figure 4.1. Can you spot the retina?

   The retina has two kinds of cells — rods and cones. Both rods and cones are sensitive to changes in light but they react differently and perform different functions. While rods are sensitive to dim light, the cones respond to bright light.

   Let us take a closer look at the rods. The rods contain a pigment called rhodopsin. Rhodopsin is formed by the combination of a specific form of vitamin A with a protein. The amazing thing about rhodopsin is that it breaks down into its components when exposed to bright light. In the dark these components — vitamin A and protein — again combine to regenerate rhodopsin.

   Now, what is the significance of rhodopsin in maintaining normal vision? Rhodopsin helps us to see in dim light. Consider the following situation. There must have been many occasions when you walked into the dark from a brightly lit room. You would definitely remember not being able to see for a short while. Why does this happen? It's all because the rhodopsin has broken

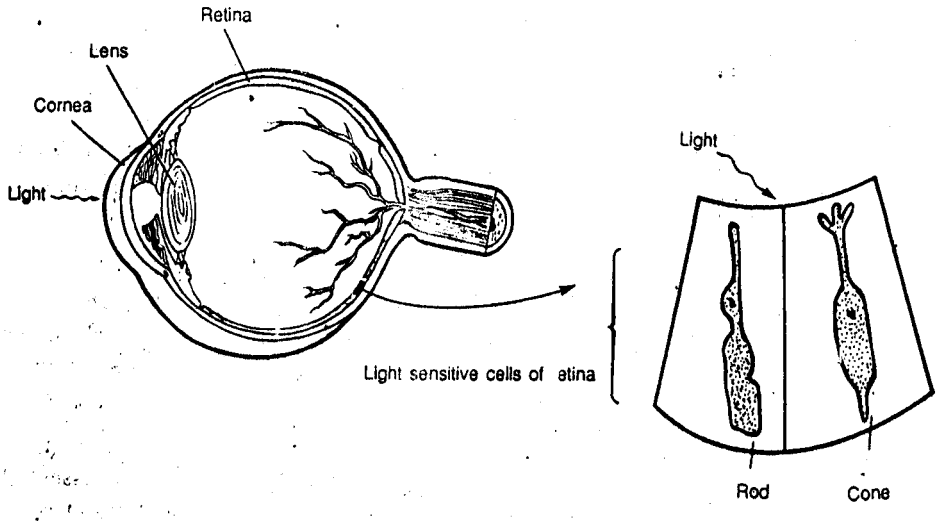


Fig. 4.1 Structure of the eye

Adapted from illustration in *Essentials of Nutrition and Diet Therapy* by Sue R. Williams, Times Mirror/Mosby College Publishing, 1986 (4th edition)

down into its two components. It is, therefore, no longer able to perform its functions. How, then, did you begin to see in the dark? This happened because rhodopsin is regenerated once again in the dark. If you look at these events closely you would notice that we started with rhodopsin and now we have gone through a process by which it is broken down and then regenerated. This is an example of a "cycle" in metabolism and is called the visual cycle (Figure 4.2).

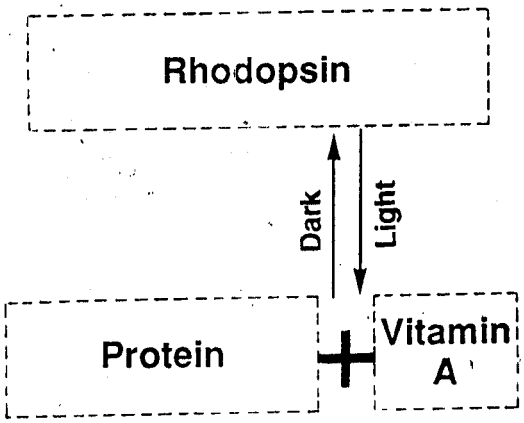


Fig. 4.2 Simplified version of visual cycle

2) **Supporting growth:** Vitamin A is essential for the growth of the skeleton and soft tissues. The exact role of the vitamin in the growth of the body is still not understood. Research studies in this area have indicated that with the deficiency of vitamin A in the body, bones do not grow to their full length and the overall growth of the body is affected.

3) **Protecting against disease:** Vitamin A plays an important role in keeping epithelial tissues moist and healthy. Some examples of epithelial tissues are

the skin, the lining of our eyes and the lining of organs like the intestine and lungs. Without vitamin A the epithelial tissue will become dry and cracks will appear in the skin or inner walls of the digestive tract or lungs. This makes it easy for the germs to enter and cause diseases like diarrhoea, respiratory infections and eye infections. Various research studies have supported this and shown that vitamin A plays a beneficial role in preventing common illnesses in young children. When body levels of vitamin A are low the chances are more that the young child will develop infectious diseases. If these diseases are sufficiently severe they can even cause death. This is the reason why the deficiency of vitamin A is associated with child death.

4.2.2 Vitamin D

Vitamin D is also called the "sunshine vitamin". This is because it is manufactured from a substance present in our skin on exposure to sunlight. As a result of this, we do not necessarily have to depend on dietary sources of vitamin D. The easiest way of obtaining the vitamin is, in fact, enough exposure to sunlight.

Which foods contain vitamin D? Foods of animal origin like eggs, liver and butter contain the vitamin in significant amounts. It is, however, the fish liver oils which are the richest sources. On the other hand, most of the commonly used foods of plant origin do not contain vitamin D.

Absorption and storage: What happens to vitamin D in the body? The vitamin D we take in is absorbed along with fats from the small intestine. Bile is essential for effective absorption of fats and therefore, of vitamin D. Once absorption is completed, vitamin D enters the bloodstream as a part of the chylomicrons. Vitamin D formed in the skin on exposure to sunlight also enters the bloodstream. Whatever the source, the vitamin is then taken to the liver. Some of it is stored there and the remaining is distributed by the blood to various body tissues.

Functions: You might have heard that vitamin D makes bones strong and healthy. This is absolutely correct. How does vitamin D help in this? Read on to find out. Minerals like calcium and phosphorus, when deposited in the bones, make them strong and hard. The process of deposition of minerals in the bones is termed as mineralization of bones. Vitamin D *aids the process of mineralization* in two ways:

i) by increasing the absorption of calcium and phosphorus and
ii) by helping in the deposition of calcium and phosphorus in bones.

d) Rods of the retina are sensitive to dim light. (True/False)

.....

e) Vitamin D is also known as the "sunshine vitamin". (True/False)

.....

4.2.3 Vitamin E

Vitamin E is present in almost all foodstuffs. Vegetable oils like groundnut, soya, cottonseed and safflower are rich sources of vitamin E. Other good sources are whole grain cereals, dark green leafy vegetables, pulses, nuts and oilseeds. Foods of animal origin are low in vitamin E. However, foods like egg yolk, butter and liver contain some amount of the vitamin.

Absorption and storage: Like the other fat-soluble vitamins, absorption of vitamin E also requires the presence of fat and bile. After absorption from the upper part of the small intestine, vitamin E (as part of chylomicrons) is carried to the liver through the blood stream and is distributed to various body tissues. Almost all the body tissues have a small amount of the vitamin but it is mainly stored in muscles and adipose tissue.

Functions: The main role of vitamin E in our body is the protection it gives to other substances like unsaturated fatty acids, vitamins A and C. It prevents their destruction in the body as well as in foods.

4.2.4 Vitamin K

Among plant foods, green leafy vegetables like spinach, cabbage and lettuce are rich sources of vitamin K. Other good sources include animal foods such as egg yolk, milk and organ meats like liver. Vitamin K is also manufactured by certain helpful bacteria which are normally present in the small intestine. Approximately half of the vitamin K needed by us gets manufactured in the intestinal tract and the other half is obtained from animal and plant foods.

Absorption and storage: The absorption of vitamin K requires bile since vitamin K is fat-soluble. After absorption from the upper part of the small intestine the vitamin is distributed to various body tissues. Vitamin K is stored in very small amounts in the body and its concentration is not high in any particular tissue.

Functions: Have you ever observed what happens when you cut your finger? Your finger, of course, starts bleeding. But after a while blood stops oozing out. Why? This is because a clot is formed on the wound and seals it off. Vitamin K plays an important role in clotting of blood and is therefore also termed as the "antibleeding vitamin" (one which prevents uncontrolled bleeding). How does vitamin K help in clotting of blood? It helps in the formation of a protein called *prothrombin* which, in turn, is essential for blood clotting.

Check Your Progress Exercise 2

1) Match the following.

a) Vitamin A	i) Prevention of destruction of unsaturated fatty acids
b) Vitamin D	ii) Vision in dim light
c) Vitamin E	iii) Coagulation or clotting of blood
d) Vitamin K	iv) Absorption of calcium and phosphorus

2) Fill in the blanks.

i) ..... are the richest sources of vitamins A and D.
ii) Rods of the retina are sensitive to .....
iii) Presence of ..... and ..... aids in the absorption of fat-soluble vitamins.
iv) Vitamin K is also known as the ..... vitamin.

4.3 WATER-SOLUBLE VITAMINS

We have so far studied the fat-soluble vitamins. Let us now move on to the water-soluble ones. Vitamin C and vitamins of the B-complex group are known as water-soluble vitamins owing to their solubility in water. Unlike the fat-soluble vitamins, these vitamins cannot be stored in our body in considerable amounts. The excess amount of these vitamins is instead excreted from the body in the urine.

4.3.1 Vitamins of the B-Complex Group

As the name indicates, this is a group of vitamins with similar functions. Vitamins of the B-complex group include: thiamine (B_1), riboflavin (B_2), folic acid, niacin and vitamin B_{12}. They usually occur together in foods. The B vitamins act as *coenzymes* and help in the metabolism of carbohydrates, proteins and fats. You are already familiar with enzymes. What are coenzymes? Coenzymes are substances which are needed by enzymes to do their job effectively. Hence they can be considered as the helpers of specific enzymes. In fact these enzymes cannot function in the absence of their specific coenzymes (Figure 4.3).

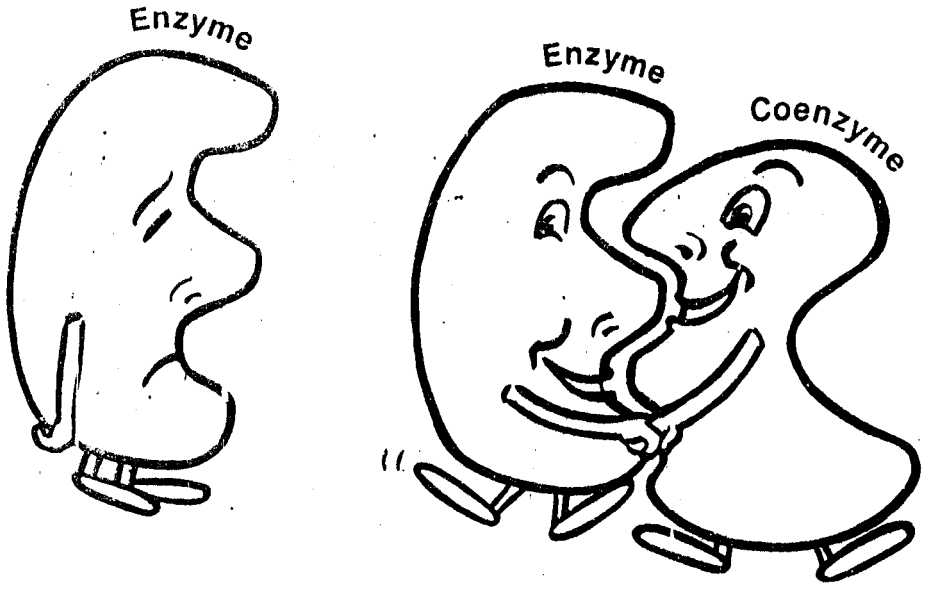


Fig. 4.3 Enzymes and coenzymes act together

Let us now learn more about the food sources, absorption, storage and functions of each of these vitamins.

Thiamine or B_1: Thiamine or B_1 is widely distributed in animal and plant foods. Almost all the foodstuffs except fats, oils and sugar contain small amounts of thiamine. Plant foods such as whole grain cereals (i.e. wheat and rice) and whole pulses are also rich sources of thiamine.

Among the foods of animal origin lean meats, poultry and egg yolk are good sources. One point that needs to be emphasized here is that the processing of cereals and pulses can significantly alter their thiamine content as well as the content of some of the other vitamins. You will find more information on this aspect in Highlight 1. The discussion is relevant not just to thiamine but to other vitamins as well.

HIGHLIGHT 1

Influence of Processing on Nutritive Value

We use various methods to process our foodstuffs. Processing, in fact, includes all those procedures which foods are subjected to from the time of harvest to

consumption. This means pre-preparation and preparation/cooking are also forms of processing. Here we will look at some specific examples of processing— processing of wheat, processing of rice and the pre-preparation procedures like sprouting and fermentation.

Processing of wheat: Wheat is usually not consumed in the form of wheat grains as such but in the processed form e.g. whole wheat flour (atta), refined wheat flour (maida and suji/rawa). Most of the thiamine and other B vitamins are present in the outer covering or bran and the germ layer of the wheat grain (Refer to Figure 2.5, Block 1). Atta or whole wheat flour has most of the bran and part of the germ layer in it and is a good source of thiamine. However, maida and suji have very little bran and germ and hence are poor sources of thiamine and other B-complex vitamins in general.

Processing of rice: Polished rice is very poor in B-complex vitamins — thiamine in particular. What do we mean by polishing? Paddy (or rice with husk) is either ground in machines or pounded by hands to remove the outer husk. After this the grain is further cleaned to give it a white, polished appearance. Removal of husk and polishing both cause heavy losses of thiamine as well as some of the other B vitamins.

Rice is also available in another form called parboiled (sela) rice. Parboiled rice is prepared by soaking raw rice in water for 2 to 3 days, boiling or steaming and then drying. During this process most of the nutrients present in the outer layers of the grain move to its interior. Thus thiamine and the other vitamins are not lost when the outer layers of rice are removed during subsequent processing.

Sprouting and fermentation: Sprouting and fermentation of whole grains (cereals or pulses) increases their content of B-complex vitamins and vitamin C. Sprouting, as you know, is the process of growing or germination of seeds or grains by first soaking them in water and then leaving the grains moist for about 24 hours by wrapping them in moist cloth (Figure 4.4). You can sprout whole pulses like green gram and use them for making raita (a curd preparation), stuffed paranthas or eat them as such in the form of salads.

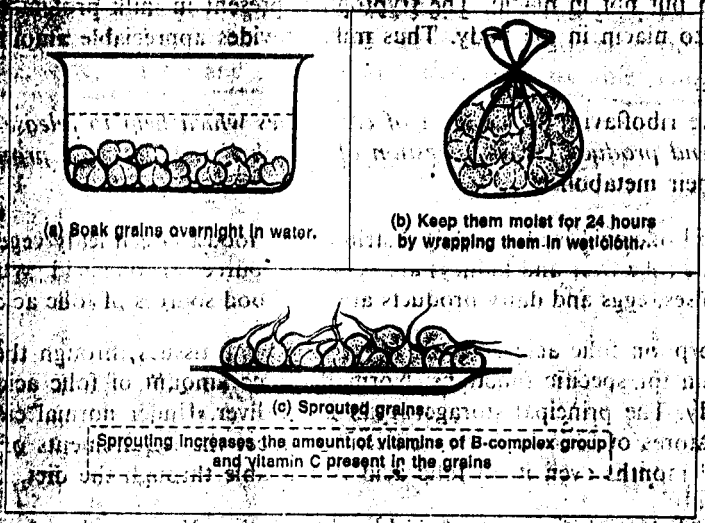


Fig. 4.4 Sprouting of grains

Fermentation, on the other hand, refers to the chemical changes taking place in certain foods when mixed in a ground form with added fluid and kept overnight at a suitable temperature. During this time certain beneficial bacteria multiply and grow in the food mixture and bring about some desirable changes in it. You may already be familiar with these changes.

Fermentation makes the mixture light and fluffy in appearance and more digestible. Let us now talk about some fermented foods. Idlis are commonly consumed in the south and are made by steaming a fermented mixture of rice and urad dal. Similarly dhokla, a dish consumed in West India (Gujarat), is prepared by steaming a fermented mixture of curd and besan (Bengal gram flour).

After ingestion, thiamine is absorbed and enters the bloodstream. It is utilized to perform several important functions. Excess thiamine (i.e. the amount in excess of the body needs) is excreted in the urine.

You would now be interested in finding out what exactly thiamine does in the body. Thiamine plays an important *role in the metabolism of carbohydrates.* We mentioned coenzymes before. Thiamine forms a part of a specific coenzyme involved mainly in carbohydrate metabolism. The main function of this coenzyme is its role in the burning or oxidation of glucose to produce energy.

Riboflavin or B_2: Riboflavin or B_2 is widely distributed in plant and animal foods. Milk, liver, kidney, eggs and green leafy vegetables are good sources of riboflavin. Whole grain cereals and pulses contain fair amounts. On refining there is some loss of the vitamin. However, sprouting and fermentation of whole grain cereals and pulses can markedly increase their content of riboflavin and other B vitamins as mentioned in Highlight 1. An average mixed diet including milk, green leafy vegetables, whole cereals and pulses (especially when sprouted) can take care of the riboflavin needs of vegetarians. Non-vegetarians can also obtain riboflavin from animal foods.

The riboflavin which we ingest is absorbed from the upper part of the small intestine into the bloodstream and is taken to various body tissues to perform specific functions. Like other water-soluble vitamins, excess riboflavin is excreted in the urine.

How is riboflavin used by the body? Riboflavin plays an *important role in the metabolism of carbohydrates, fats and proteins.* This is because of the fact that it forms part of two distinct coenzymes which help to release energy from the end products of digestion of carbohydrates, fats and proteins.

Niacin: Niacin is another member of the B-complex family. The good sources of niacin include meat, fish, poultry, cereals, pulses, nuts and oilseeds. One interesting point about niacin is that it can also be formed in the body from an amino acid called tryptophan. Milk is a good example of a food rich in tryptophan but not in niacin. The tryptophan present in milk protein can be converted to niacin in the body. Thus milk provides appreciable amounts of niacin.

Niacin (like riboflavin) is also *part of coenzymes which help to release energy from the end products of the digestion of carbohydrates, fats and proteins.* It thus helps in their metabolism.

Folic acid: Folic acid is also widely distributed in foods. Green leafy vegetables and organ meats (like liver and kidney) are very rich sources of folic acid. Whole grain cereals, pulses, eggs and dairy products are also good sources of folic acid.

After absorption folic acid is taken to various body tissues through the bloodstream for specific functions. Normally some amount of folic acid is stored in the body. The principal storage organ is the liver. Under normal circumstances, the body stores of folic acid are sufficient to meet the requirements of the body for several months even if no folic acid is available through the diet.

Folic acid plays an *important role in blood formation.* You may be aware that blood has three kinds of cells — red blood cells, white blood cells and platelets — suspended in a fluid called plasma. Folic acid is important for the proper development of red blood cells.

Vitamin B_{12} or Cobalamin: Vitamin B_{12} or cobalamin is present only in the foods of animal origin. Liver, kidney, milk, eggs and sea foods (e.g. shrimps, crabs, lobsters) are rich sources of vitamin B_{12}. Plant foods do not contain the vitamin. Vitamin B_{12} is also synthesized in our body in the intestinal tract by certain helpful bacteria.

Vitamin B_{12} can only be absorbed in the presence of a specific chemical substance called intrinsic factor. This substance is secreted by the cells of the stomach. Vitamin B_{12} ingested combines with intrinsic factor and is absorbed from the small intestine. Bacteria present in the intestine can also produce vitamin B_{12}. But this cannot be absorbed without the intrinsic factor which is found only in the

stomach. The vitamin B_{12} produced by the bacteria is hence excreted from the body through faeces.

Our body's requirement for vitamin B_{12} is very small. Consumption of even small amounts of animal foods like milk can take care of the vitamin B_{12} needs of the body.

Vitamin B_{12} is necessary for the *proper functioning of the digestive tract, nervous system and the bone marrow*. In the bone marrow, vitamin B_{12} (like folic acid) is also involved in the *formation of normal red blood cells*.

Check Your Progress Exercise 3

1) What are coenzymes?

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2) Which B vitamins play a significant role in blood formation?

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4.3.2 Vitamin C

Vitamin C or ascorbic acid is also termed as the "fresh food vitamin" because fresh fruits and vegetables are its major sources (Figure 4.5). Fresh citrus fruits (like orange, lime and lemon) and other fruits and vegetables like guava, amla, papaya, green leafy vegetables, tomatoes, green chillies and capsicum are some of the excellent sources of vitamin C. Root vegetables like potato and sweet potato contain small amounts of the vitamin and they contribute significant amounts only when consumed in large quantities. Cereals and pulses as such are poor in vitamin C but when sprouted and fermented become good sources. Animal foods like fish, meat, milk, poultry and eggs contain little or no ascorbic acid.

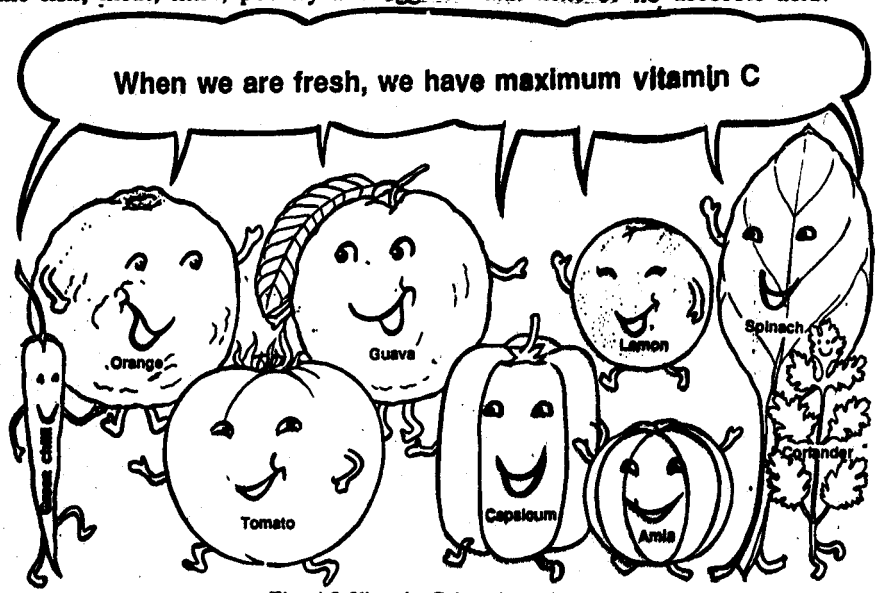

Fig. 4.5 Vitamin C is a fresh food vitamin

Fruits like amla, guava, green leafy vegetables and green chillies are examples of some of the cheap sources of vitamin C. In fact, amla is the cheapest source and provides 20 times or more ascorbic acid as compared to the expensive citrus fruits.

Ascorbic acid is readily absorbed from the digestive tract and is then distributed to various body tissues. Organs and glands like the spleen, bone marrow, liver, pancreas, kidney and the retina of the eye have a high concentration of ascorbic acid.

Functions: Do you know that vitamin C

- plays a role in healing of wounds
- aids in the absorption of iron (a mineral which plays a role in blood formation)
- helps to overcome conditions of injury, infection and other stresses and
- prevents destruction of certain substances present in the body as well as in some foodstuffs.

These are some of the interesting facts about the functions of vitamin C. Wouldn't you like to know more about them? Let us now take each of the above mentioned functions and study them in some detail. Vitamin C plays a role in:

1) **Wound healing:** Vitamin C plays an important role in the formation of a special kind of protein called collagen. The formation of collagen at the site of wound or injury aids in its healing. This protein is found in the connective tissue which holds together different other tissues much like cement holds bricks together. For example, collagen present in blood vessels makes them firm. Deficiency of vitamin C in the diet may result in fragile blood vessels which can easily rupture.

2) **Dealing with stress:** Ascorbic acid plays an important role in the release of two hormones – epinephrine and norepinephrine – from the adrenal glands of the body. These hormones help the body to deal with stressful situations like day-to-day tensions, stresses of infections and injury.

3) **Absorption of iron:** Iron is an essential component of red blood cells. Vitamin C aids absorption of iron by converting it into a more suitable form for absorption.

4) **Protecting certain substances from destruction:** Like vitamin E, vitamin C protects certain substances e.g. vitamin A and unsaturated fatty acids from being destroyed.

Check Your Progress Exercise 4

1 Give reasons for the following:

i) Refined flours like maida and suji have less thiamine as compared to atta or whole wheat flour.

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ii) Milk can help to meet niacin needs.

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iii) Ascorbic acid is termed the "fresh food vitamin".

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iv) Deficiency of thiamine in the diet can interfere with carbohy[illegible] metabolism.

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4.4 LET US SUM UP

Vitamins are organic compounds (other than carbohydrates, fats and proteins) which are needed only in small amounts by the body. They are divided into two

categories—fat-soluble vitamins and water-soluble vitamins. Important functions and food sources of fat-soluble and water-soluble vitamins are summarized in Tables 4.1 and 4.2 respectively.

Table 4.1 : Summary of Fat-soluble Vitamins

Vitamin	Sources	Functions
Vitamin A	• **Retinol** Liver, egg yolk, cream, butter, ghee, milk • **Beta Carotene** Yellow and orange vegetables, green leafy vegetables	• Maintenance of health of epithelial tissues. • Vision in dim light. • Growth of skeletal and soft tissues
Vitamin D	• Action of sunlight on skin • Animal foods like eggs, butter, fish liver oil	• Calcium and phosphorus absorption • Deposition of calcium and phosphorus in bones
Vitamin E	• Vegetable oils, whole grains, deep green leafy vegetables, pulses, nuts and oilseeds	• Protection of unsaturated fatty acids, vitamins A and C from destruction in the body/food
Vitamin K	• Dark green leafy vegetables, egg yolk, liver • Bacterial synthesis	• Clotting of blood

Table 4.2 : Summary of Water-soluble Vitamins

Vitamin	Food Sources	Functions
Vitamins of the B-complex Group		
Thiamine or B_1	Whole grain cereals, pulses, nuts, egg yolk, meat	• Role in carbohydrate metabolism in particular
Riboflavin or B_2	Green leafy vegetables, milk, eggs, organ meats like liver, kidney	• Role in the metabolism of carbohydrates, fats and proteins
Niacin	Cereals, pulses, milk, nuts and oilseeds, organ meats, fish	• Role in the metabolism of carbohydrates, fats and proteins
Folic acid	Whole grain cereals, leafy vegetables, milk and eggs, organ meats like liver and kidney	• Role in the formation of normal red blood cells in the bone marrow
Vitamin B_{12}	Animal foods like milk, eggs, organ meats	• Role in the formation of normal red blood cells in the bone marrow and proper functioning of the digestive tract and nervous system
Vitamin C	Citrus fruits, amla, guava, capsicum, green leafy vegetables, green chillies	• Role in collagen formation and hence in wound healing • Role in absorption of iron and prevention of destruction of other substances

4.5 GLOSSARY

Beta carotene : A fat-soluble carotenoid pigment present in plants which is a precursor of vitamin A.

Coenzymes : Specific substances which are essential for proper functioning of certain enzymes.

Processing : Refers to the treatment/preparation of foods/foodstuffs using specific techniques.

Refining : A processing procedure involving the removal of the outer covering of whole cereal or pulse grains.

Susceptible : Easily affected.

4.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) Carotenoids are yellow and orange coloured pigments present in plant foods. These carotenoids can be converted to vitamin A in the body and hence are termed precursors of vitamin A. Green leafy vegetables, yellow and orange vegetables like carrot and pumpkin and fruits like mango, papaya are rich sources of beta carotene.
2) a) True b) False; we meet most of our vitamin D needs from exposure to sunlight. c) False; vitamin A keeps the epithelial tissues moist. d) True e) True

Check Your Progress Exercise 2

1) a) -ii); b) -iv); c) -i); d) -iii)
2) i) Fish liver oils ii) dim light iii) fat, bile iv) antibleeding

Check Your Progress Exercise 3

1) Coenzymes are the substances which are essential for the activity of some of the enzymes. They are also termed as helpers of enzymes. Specific coenzymes are needed for specific enzymes. Most of the B vitamins act as coenzymes and help in metabolism of carbohydrates, fats and proteins.
2) Folic acid and vitamin B_{12}

Check Your Progress Exercise 4

i) Whole wheat flour has most of the bran and part of the germ layer in it and is a good source of thiamine. However, maida or refined flour has very little bran and germ. Since bran and germ are rich in thiamine and other B-complex vitamins, whole wheat flour is rich in thiamine while refined flour is poor in thiamine.

ii) Milk is a rich source of tryptophan. Tryptophan can be converted to niacin. This is why milk can help to meet niacin needs.

iii) Ascorbic acid is called the 'fresh food vitamin' because it is present in substantial quantities in fresh fruits and vegetables.

iv) Thiamine is a part of coenzymes which play a role in metabolism of carbohydrates. Deficiency of thiamine in the diet can therefore interfere with carbohydrate metabolism.

UNIT 5 THE MICRONUTRIENTS—II : MINERALS

Structure

5.1 INTRODUCTION

In the earlier units you studied about the complex organic compounds—carbohydrates, fats, proteins and vitamins. These vital compounds carry out various body functions. They provide energy, support growth and development and also perform protective and regulatory functions. Along with these compounds a set of inorganic elements called minerals are also required by the body. *Minerals* are defined as *those elements which largely remain as ash when plant or animal tissues are completely burnt.*

Like vitamins, minerals are micronutrients which perform regulatory and protective functions. The human body contains as many as 19 minerals in widely varying amounts. The total mineral content of the body is, however, small and accounts for only 4-6 per cent of the total body weight. Some of the important minerals found in our body include calcium, phosphorus, iron, iodine, sodium, potassium, zinc and chloride. All these minerals are, of course, derived from the food we eat.

Of the minerals we have just mentioned some are required in larger amounts and others in much smaller amounts as you will learn in this unit. Remember, however, that the total amount of minerals required by the body is small. Let us now study some of the minerals required by our body, the role they play, their food sources and their absorption and utilization by the body.

Objectives

After studying this unit, you will be able to:

- define the term mineral
- differentiate between minerals required in larger amounts and smaller amounts
- describe the functions performed by these minerals in the body
- list the food sources of each of these minerals and
- discuss the absorption and excretion of each specific mineral

5.2 MINERALS REQUIRED IN LARGER AMOUNTS

We have just mentioned some of the minerals required by our body. Of these calcium, phosphorus, sodium, potassium, chloride and magnesium are the minerals required in larger amounts by the body. This set of minerals constitute more than three-fourths of the total mineral content of the body. Figure 5.1 reflects this proportion.

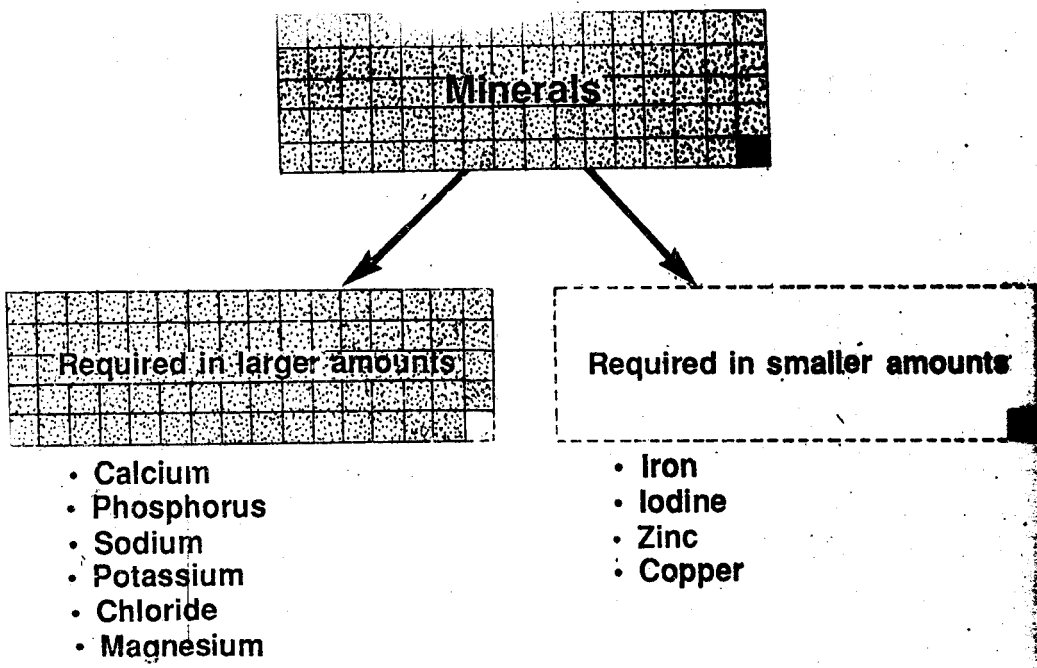


Fig. 5.1 Some minerals required by the body

Let us now begin the study of minerals with calcium and phosphorus. You may wonder why we are discussing calcium and phosphorus together. This is because they work in coordination with each other. In fact such coordinated activity is typical of minerals.

5.2.1 Calcium and Phosphorus

Of all the minerals found in our body calcium and phosphorus are by far present in the largest amount. Together these two minerals account for 75 per cent of the total mineral content of the body. The human body contains approximately 1200 g of calcium, most of which is present in bones and teeth and the remaining in soft tissues and in the body fluids. On the other hand, only 400-700 g of phosphorus is contained in the body. Like calcium most of it is also present in bones and teeth and the remaining in soft tissues and body fluids.

Functions: What role do calcium and phosphorus play in our body? Calcium and phosphorus basically serve two important functions in the body—one relating to the development of bones and teeth and the other to the regulation of body processes.

1) **Development of bones and teeth:** Calcium and phosphorus are mainly present in bones and teeth. The ratio of calcium and phosphorus in the bones is roughly 2:1. Calcium in the bone combines with phosphorus, some other minerals and water to form a compound. It is this compound which provides rigidity and firmness to the bones. Teeth, like the bones, also require calcium for their proper development. It is for this reason that the need for calcium is the most during the growing years.

2) **Regulation of body processes:** Apart from building bones and teeth, calcium and phosphorus perform regulatory functions as well.

Calcium helps in:

a) regulating the contraction and relaxation of muscles especially that of the heart
b) regulating the passage of substances into and out of the cells
c) conveying messages from one nerve cell to another and
d) the clotting of blood.

Phosphorus, also performs several important functions. It is required for the:

a) formation of a substance which aids in transport of fat in the blood
b) synthesis of certain coenzymes which play a crucial role in metabolism
c) formation of certain basic genetic material. This genetic material is involved

in passing on of specific characteristics from parents to children and

d) capture and storage of vital energy in the cells of many tissues by forming a high-energy compound. Muscle tissue is a prominent example where phosphorus helps in energy storage and thus fuels muscle contraction.

Food sources: Which foods provide good amounts of calcium? Milk and milk products like curd, khoa, channa (cottage cheese) are excellent sources of calcium. Foods like fish (e.g. chingri, chela) especially dried fish and other sea foods (e.g. crab, shrimp) provide substantial quantities of calcium.

Among the plant sources, ragi (a millet grown in South India) is particularly rich in calcium. Pulses like bengal gram, black gram, green gram, moth beans, rajmah, soyabean contribute substantial amounts of calcium. Green leafy vegetables (like amaranth leaves, colocasia leaves, fenugreek leaves, mustard leaves) also contain good amounts. Among nuts and oilseeds, gingelly (til) seed is particularly rich in calcium. Others like coconut, almonds, walnuts have a fairly good amount of calcium.

As for the sources of phosphorus, a diet that furnishes enough protein and calcium would normally provide sufficient phosphorus. Eggs, milk, poultry, fish are excellent sources of phosphorus. Cereals too are rich sources of this mineral.

Absorption and utilization: Calcium is absorbed chiefly from the upper part of the intestine. Normally it is seen that from an average Indian diet only 20-30 per cent of calcium gets absorbed. The rest is excreted in the faeces. The absorbed calcium is then used to perform various functions as has been discussed earlier. Part of the absorbed calcium is also excreted in the urine but the amount is very small.

We mentioned earlier that only a small proportion of the calcium in the diet is absorbed. What are the reasons for this? You will find the answer as you read about the factors influencing calcium absorption. Let us now study these factors and try to understand how they influence calcium absorption. The factors include:

a) **Body need:** The efficiency of absorption of calcium increases during periods of rapid growth i.e. infancy, childhood, pregnancy, lactation. When the body's demand for calcium increases the absorption of calcium also increases to meet this increased demand. You will study more about this in Block 3.

(b) **Nutrients in the diet:** Certain nutrients like vitamin D, protein and carbohydrate present in the diet help to improve absorption of calcium (Figure 5.2).

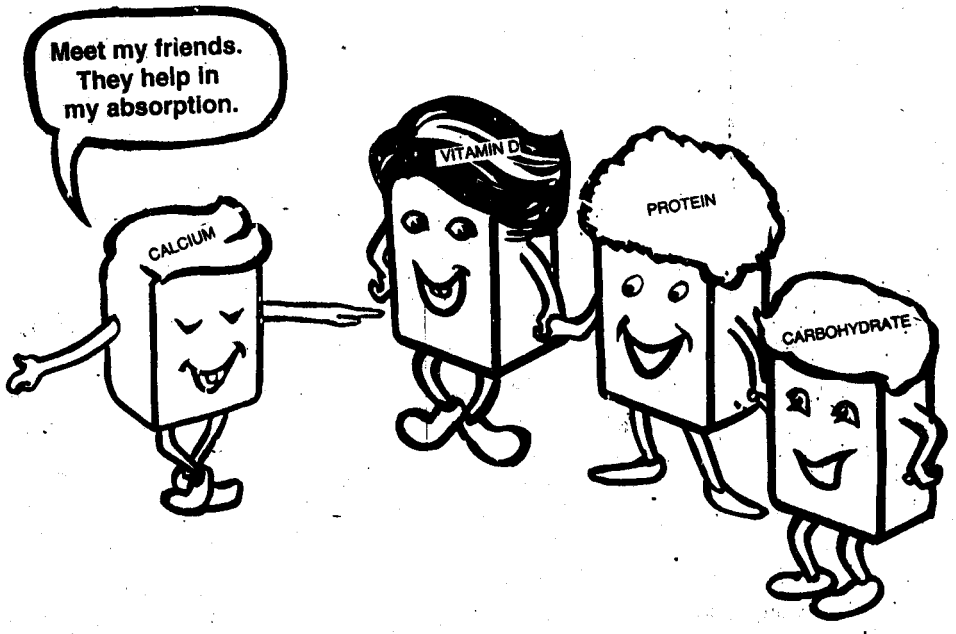


Fig. 5.2 Nutrients that increase calcium absorption

Another nutrient that influences calcium absorption is phosphorus. In fact, the proportion of calcium and phosphorus in the diet affects calcium absorption. Excess phosphorus tends to lower calcium absorption.

c) **Inhibitors:** Inhibitors are substances present in food which hinder calcium absorption. You have learnt earlier that cereals and green leafy vegetables are rich in calcium. But all the calcium present in these foods is not available to the body. This is because these food items have some substances (such as phytates in cereals and oxalates in green leafy vegetables) present in them which bind calcium and inhibit its absorption.

So far you have read about absorption and excretion of calcium. Let us now study about absorption and excretion of phosphorus. As in the case of calcium, absorption of phosphorus also takes place from the upper part of the small intestine. However, a considerable amount of phosphorus in cereals, pulses and nuts exists in a bound form which is not absorbed. The body takes in only the free form. The absorbed phosphorus then gets used in the body and performs various functions as has been discussed earlier.

Check Your Progress Exercise 1

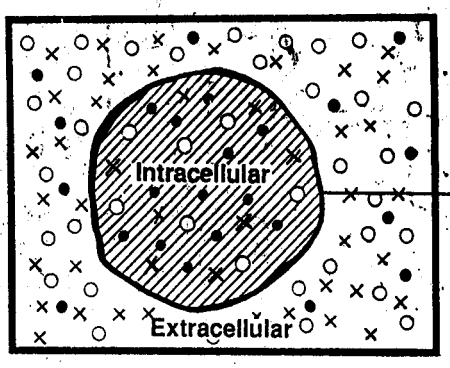
1) Fill in the blanks.
   a) The total mineral content of the body amounts to ..... per cent of the total body weight.
   b) The minerals ..... and ..... are present in the largest amounts in our body.
   c) ..... and ..... are rich sources of calcium.
   d) Absorption of calcium/phosphorus takes place in the .....
   e) ..... present in green leafy vegetables and cereals interfere with absorption of calcium/phosphorus.

2) List the factors that increase and decrease calcium absorption.

Factors increasing calcium absorption	Factors decreasing calcium absorption

5.2.2 Sodium

An adult body contains approximately 120 g of sodium. Most of this is present in the extracellular fluid. Extracellular fluid refers to the fluid outside the cell just as intracellular fluid refers to fluid inside the cell (Figure.5.3). One example of extracellular fluid is blood plasma. You may remember that blood has two parts — cells and plasma. The term plasma refers to the fluid part of the blood. Let us now learn what role sodium plays in our body.



(•) Potassium is mainly present in the fluid inside the cell (Intracellular)
(×) Sodium and (○) Chloride are present mainly in the fluid outside the cell (Extracellular)

Fig. 5.3 Minerals present in the body fluids

Functions: Some of the important functions of sodium are listed here:

a) **Regulating the balance of extracellular and intracellular fluid:** Sodium, the principal mineral in the extracellular fluid, is responsible for maintaining the fluid balance. By fluid balance we mean the process of maintaining a balance between the fluid present within the cells (intracellular) and that circulating outside the cells (extracellular). Sodium along with potassium (another mineral) helps to maintain this balance.

b) **Regulating the alkalinity and acidity of the body fluids:** Sodium tends to make the body fluids alkaline. Another mineral namely chloride present in the body fluids tends to make them acidic. Sodium combines with chloride in the fluid and together they help maintain the balance between the alkalinity and acidity of the body fluids.

c) **Aiding in the passage of messages** from one nerve cell to another.

d) **Aiding the contraction of muscles** and

e) **Regulating the passage of substances** into and out of the cell.

Food sources: Do you know what items in our diet provide maximum sodium? You are familiar with common table salt which is nothing but sodium chloride. Common table salt is the principal source of sodium in our diet. One teaspoon of salt provides almost 2000 mg sodium. Other rich sources of sodium include milk, egg white, meat, poultry, fish among the animal foods and green leafy vegetables (such as spinach, fenugreek leaves) and pulses among the plant sources.

Absorption and excretion: Sodium ingested is readily absorbed by the digestive tract and used for various body functions. The excess amount of sodium over and above body needs is lost from the body through urine, sweat, and faeces. Sodium losses are high whenever we sweat more as in hot weather. Any disease condition in which water is lost from the body also causes excessive sodium loss. A common example is diarrhoea i.e. loose motions. Excessive sodium loss is not good as it affects the fluid balance of the body. This requires special attention. Intake of fluids and salt should be increased during such times so as to make up for the loss.

The major regulation of the amount of sodium in the body is done by the kidneys by varying the total amount of urine excreted. When intake of sodium increases, excretion increases and when intake decreases, excretion decreases. This process helps to keep the body concentration of sodium within normal limits.

5.2.3 Potassium

Potassium is present in twice as much amount as sodium in the body. Approximately 250 g of potassium is contained in the body and most of this is present in the cells i.e. in the intracellular fluid. When you read this section, you will find how closely the functions of sodium and potassium are interlinked.

Functions: The functions of potassium include:

a) **Regulation of the balance of intracellular and extracellular fluid: Potassium along with sodium helps maintain fluid balance within the cell and outside the** cell. You have learnt earlier that sodium is the main mineral present in extracellular fluid (the fluid outside the cell). Potassium, on the other hand, is the principal mineral in the intracellular fluid (Figure 5.3). Together these two minerals help maintain fluid balance.

b) **Regulation of the alkalinity/acidity of body fluids:** Potassium, like sodium, is alkaline. It combines with chloride which is acidic and together they help maintain the acidity/alkalinity of body fluids.

c) **Role in muscle activity:** Potassium has a significant role in the activity of skeletal and heart muscle. It helps in the transmission of messages which results in the contraction of muscle tissue.

Food sources: Potassium is widely distributed in foods. Meat, poultry and fish

are good sources. Among the plant foods, pulses, fruits, vegetables especially the green leafy vegetables are good sources of potassium. The water of the tender coconut is, however, the best source of potassium. Among the other fruits and vegetables, bananas, potatoes, carrots, tomatoes and lemons contain appreciable amounts of this mineral. Whole grain cereals also provide some amounts of potassium.

Absorption and excretion: What happens to potassium once it enters the body? Potassium gets absorbed from the upper part of the intestine. The absorbed potassium then gets used up to perform the various body functions discussed earlier. Excess potassium is excreted in the urine and the faeces.

5.2.4 Chloride

The body contains approximately 100 g of chloride and most of this is found in the extracellular fluid (especially in the blood plasma). The rest of the chloride is present inside the cell. Chloride is present in the extracellular fluid as sodium chloride and in the cell as potassium chloride.

Functions: The functions of sodium, potassium and chloride are closely interlinked as is evident from our earlier discussion. Chloride combines with sodium and potassium and helps regulate fluid balance and acidity/alkalinity of body fluids.

Food sources: Chloride is widely distributed in all plant foods. But the most important source of chloride in our diet is common table salt i.e. sodium chloride.

Absorption and excretion: Chloride is readily absorbed from the upper part of the intestine. Excess chloride, as in the case of sodium, is excreted in the urine and to a lesser extent through the sweat and the faeces.

Check Your Progress Exercise 2

1) Define the following.
   a) Extracellular fluid

      .....

      .....

   b) Intracellular fluid

      .....

      .....

   c) Fluid balance

      .....

      .....

2) Fill in the blanks.
   a) ..... is the main mineral present in the intracellular fluid and ..... present in extracellular fluid.
   b) Chloride is present in ..... as sodium chloride and in ..... as potassium chloride.
   c) ..... is the principal source of sodium and chloride in our diet.
   d) Bananas, potatoes, lemons, tomatoes contain large amounts of .....
   e) The ..... play a major role in regulating the amount of sodium in the body.

5.2.5 Magnesium

The adult human body contains approximately 20-25 g of magnesium. About 60-70 per cent of this magnesium is present in the bones in combination with calcium and phosphorus. The remaining 30-40 per cent is distributed in various tissues and body fluids mostly in the intracellular fluid.

Functions: Magnesium helps in:
a) regulating the passage of substances into and out of the cells

b) maintaining **the activity of many enzymes.** Magnesium functions as a coenzyme in metabolism
c) building **bones and teeth.** It is involved in bone mineralization
d) maintaining **the functions of the nervous system,** whereby it helps in the passage of messages from one nerve cell to another
e) maintaining **smooth muscle action** and
f) building **proteins.**

Sources: Which are the food sources that are rich in magnesium? Magnesium is widely distributed in plant foods. The most concentrated sources of magnesium include nuts (groundnut, cashewnut, walnut, almond), oilseeds (sesame seeds), pulses (rajmah, moth beans, soyabean), whole grains (wheat, bajra, jowar). Among sea foods shellfish is particularly rich in magnesium. Other foods which contain appreciable amounts of magnesium include dark green leafy vegetables, peas, lotus stem, fish (salmon, haddock), sea foods (crab, oyster) and meat.

Absorption and excretion: Magnesium is absorbed from the small intestine. The absorption of magnesium in the body is somewhat similar to that of calcium. When the body's demand increases, the absorption increases so as to meet the increased demand. Further, factors that interfere with calcium absorption such as the presence of inhibitors in the diet also interfere with magnesium absorption.

The excretion of magnesium by the body is regulated by the kidneys.

5.3 MINERALS REQUIRED IN SMALLER AMOUNTS

You have just studied about the minerals required in larger amounts by the body. There are other minerals required in very small amounts by our body. These minerals are called *trace elements.* Just a tiny amount required, but what significant functions they perform! Minerals like iron, iodine, zinc and copper belong to this group. Let us begin our study of trace elements with iron.

5.3.1 Iron

Iron is a trace element present in the body to the extent of 3-5 g. Compare this to a mineral like calcium which, as you learnt earlier, is present in the body to the extent of 1200 g. Where is iron found in the body? Most of it is found in the blood (about 75 per cent). All cells and tissues especially the muscle tissues contain a little iron (about 5 per cent) and the rest of the iron i.e. about 20 per cent is stored in the body organs such as the liver, spleen, kidney and bone marrow collectively.

Functions: The study of iron and its functions is fascinating. After many years of research, there are still many puzzling aspects about the role of iron, especially about those related to brain functioning. Let us now study some of the known and well established functions of iron.

a) **Oxygen transport:** Iron is a major constituent of a red-coloured compound called *haemoglobin* present in the blood. Iron is present in the haem part of haemoglobin. What is the role of haemoglobin? Haemoglobin is necessary for transport of oxygen to various parts of the body. Haemoglobin carries oxygen from the lungs to the tissues and in turn helps in carrying carbon dioxide from the tissues to the lungs as indicated in Figure 5.4. From the lungs carbon dioxide is then exhaled out. Carbon dioxide, in fact, is a waste product formed in all cells as a result of metabolism and it needs to be removed from the body.

b) **Provision of oxygen for muscle contraction:** Iron is also present in the muscle in the form of *myoglobin.* Myoglobin has the capacity to store oxygen. This oxygen is used for muscle contraction and for other immediate needs of the muscle cells.

c) **Promotion of oxidation within cells:** Iron facilitates the complete oxidation of carbohydrates, fats and proteins within the cell. This, of course, would result in the release of the energy locked up in these molecules. The role of iron in oxygen transport and release of energy is now clear to you. You know that energy is required for the various physical activities we perform every day. This is the reason why iron is crucial in helping us to perform physical work.

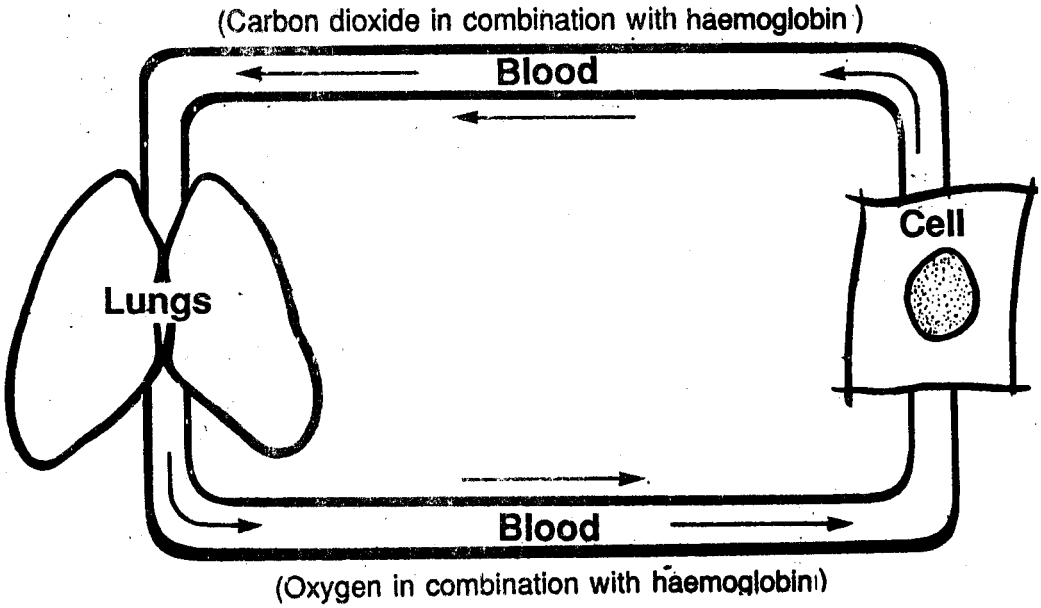


Fig. 5.4 Haemoglobin as a carrier for oxygen and carbon dioxide

d) Iron plays an important role in maintenance of specific brain functions like immediate memory, capacity to learn and attention span.

e) Iron forms a vital component of certain enzymes and substances that aid in metabolism.

f) Iron has protective functions as well. Like vitamin A, iron too helps in preventing infections.

Food sources: Are you familiar with the rich food sources of iron? Liver is an excellent source. Other organ meats like kidney, spleen also contain substantial amounts of iron. Among the plant foods the list of iron sources includes green leafy vegetables (like amaranth leaves, mustard leaves, colocasia leaves, mint leaves), cereals (like whole wheat flour, rice flakes, bajra, ragi, jowar) and pulses (especially the whole ones). Soyabean is an example of a pulse containing good amounts of iron. Jaggery is another food that contains fair amounts of iron.

We have mentioned several foods which contain substantial amounts of iron. However, we have a paradoxical situation here. There is so much of iron present in food and yet very little gets into the body. Why is this so? You would find the answer to this question in the subsequent section.

Absorption and excretion: What happens to iron once it enters the body? The ingested iron gets absorbed from the upper part of the intestine. The extent of iron absorption from different foodstuffs varies. In general, its absorption from animal foods is high. But the amounts of iron absorbed from many of the plant sources is very low. This is because certain substances present in plant foods bind iron and hinder its absorption. These substances are called *inhibitors*. You would remember reading earlier that some plant foods such as green leafy vegetables and cereals contain fairly substantial amounts of iron. Unfortunately they also contain inhibitors which prevent much of the iron from being absorbed. On the other hand, there are substances like protein and vitamin C present in foods that aid in the absorption of iron. These substances can be called *enhancers* (Figure 5.5). It is, therefore, suggested that protein-rich foods like milk and vitamin C-rich foods like oranges, lime, amla and guava should be included in the diet so as to promote the absorption of iron. The inclusion of animal foods, if possible, in the diet greatly enhances iron absorption.

After absorption, iron is transported by the blood to the body cells where it performs its varied functions. Some amount of iron is also transferred to the storage sites in the body such as the liver, spleen, kidney and the bone marrow. Very small amounts of iron are lost through sweat and urine. In the case of women, iron losses include the above but in addition fairly substantial amounts are lost in the menstrual flow.

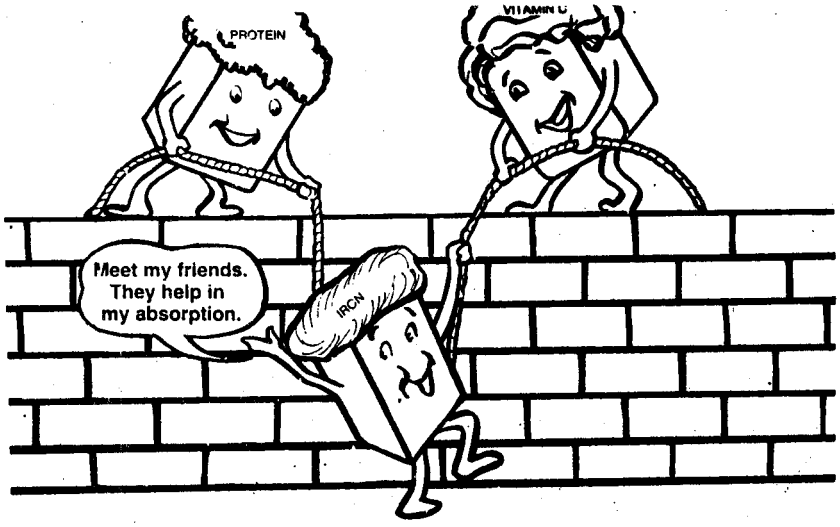


Fig. 5.5 Nutrients that increase iron absorption

Check Your Progress Exercise 3

1) List the foods containing inhibitors/enhancers that decrease/increase absorption of iron.

.....

.....

5.3.2 Iodine

Do you remember the last time you went to buy salt? You would probably have noticed the packets of *iodized salt* (Figure 5.6). Iodized salt, in fact, is table salt to which iodine is added. But why are we taking so much care to add iodine to the salt? Why is iodine so important? Let us try to find out.

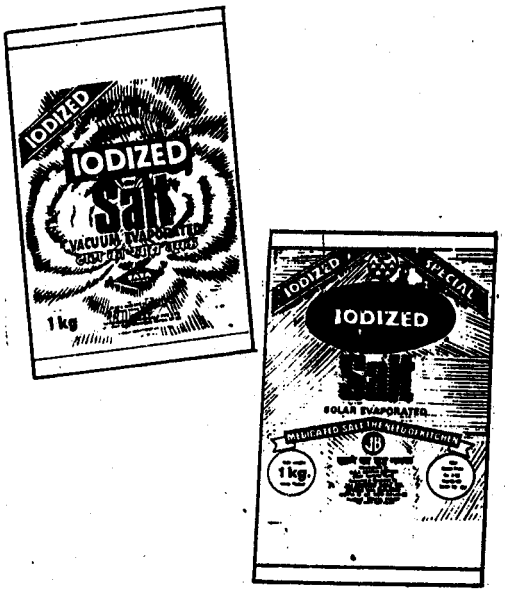


Fig. 5.6 Iodized salt

The adult body contains a very small amount of iodine which amounts to only 20-25 mg. The maximum concentration of this mineral is found in the thyroid gland which is located in the neck region.

Functions: Why do we need iodine? Iodine is a component of the hormone *thyroxine* secreted by the thyroid gland. Thyroxine regulates the rate of oxidation within the cells. If this regulation does not take place, both physical and mental growth will be affected. Iodine is also believed to help in the functioning of nerve and muscle tissues.

Food sources: The amount of iodine in most foods is limited and it varies widely depending on the iodine content of soil and water. Crops such as vegetables especially those grown in coastal areas where iodine content of the soil is high have substantial amounts of iodine. In hilly areas, however, the iodine content of both the soil and water is low. Hence the crops grown in such areas contain little iodine.

The iodine content of animal foods like eggs, dairy products and meat depends, of course, on the iodine content of the food that is part of the animal's diet. Sea foods like fish, shell fish are among the best sources of iodine.

It is now known that soils are deficient in iodine not only in the hilly regions but in several other parts of our country. This means that the foods grown in these areas would also be poor in iodine. In such a situation it becomes important to ensure that iodized salt forms a part of the daily diet.

Another aspect that needs mentioning here is that certain plant foods like cabbage, cauliflower, radish, ladies finger, groundnuts and oilseeds contain substances called *goitrogens* which interfere with the body's ability to produce and use thyroxine. Goitrogens can be easily destroyed on thorough cooking. Hence it is advisable to cook the foods mentioned above properly before eating.

Absorption and excretion: Dietary iodine is absorbed in the small intestine in the form of iodides (compounds of iodine). These iodides are carried by the blood to the thyroid gland. About one-third of the iodine is picked up by the thyroid gland and the rest is excreted.

Check Your Progress Exercise 4

1) Match the items in Column A with those in Column B.

Column A	Column B
i) Iodine	a) Storage of oxygen in the muscles
ii) Iron	b) Synthesis of thyroxine
iii) Myoglobin, a iron-protein complex	c) Poor utilization of thyroxine
iv) Goitrogens present in cabbage, cauliflower	d) Synthesis of haemoglobin

2) Indicate whether the following statements are true or false. Correct the false statements.

a) Plant foods enhance the absorption of iron. (True/False)

.....

.....

b) Iodine content of food is influenced by the iodine content of soil/water. (True/False)

.....

.....

c) Iron influences the capacity to work. (True/False)

.....

.....

d) Maximum concentration of iodine is found in the blood. (True/False)

.....

.....

e) Iron is stored in the bones. (True/False)

.....

.....

f) Thyroxine carries oxygen to the cells. (True/False).

.....

.....

g) Vitamin C helps in the absorption of iron. (True/False)

.....

.....

h) Most of the iron and iodine present in food is absorbed by the intestine. Only a small part is excreted. (True/False)

.....

.....

5.3.3 Others

Zinc and copper are two of the other trace elements present in our body. Though present in traces, these minerals perform certain vital functions. Zinc is essential for growth and like iron has protective functions as well. Copper helps in haemoglobin synthesis and is an essential constituent of certain enzymes.

Zinc and copper are widely distributed in nature and are not usually lacking in Indian diets.

5.4 LET US SUM UP

In this unit you studied about the inorganic substances called minerals. Minerals constitute only 4 per cent of the total body weight but perform major functions in the body. They provide protection against diseases and regulate metabolic processes. Some, like calcium and phosphorus, help to build the body.

Body requirements of minerals vary. Minerals like calcium, phosphorus, sodium, potassium are required in larger amounts by the body. They are basically concerned with development of bones and teeth and with the regulation of body processes (Figure 5.7). On the other hand, minerals like iron, iodine, zinc, copper are required in much smaller amounts and constitute a very small proportion of the body's inorganic material. These minerals are called trace elements and each performs its own specific functions. Iron is a major constituent of haemoglobin which helps in the transport and release of oxygen in the cells. It has a vital role in maintaining physical work capacity and cognition and has protective and regulatory functions as well. Iodine, on the other hand, is required for the synthesis of the thyroid hormone thyroxine, which regulates the rate of oxidation within the cells.

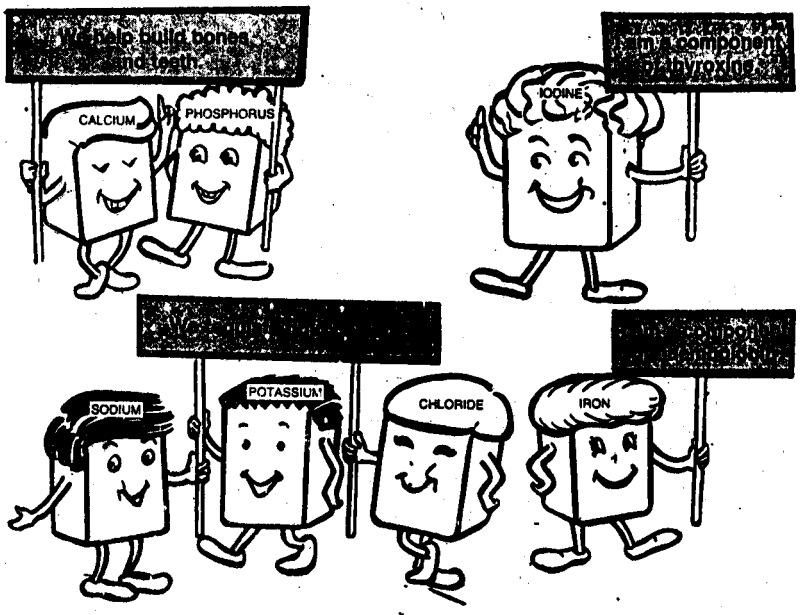


Fig. 5.7 Key functions of minerals

The absorption, utilization and excretion of each of these minerals varies in the body. The absorption of some of the minerals like calcium and iron is dependent

on the presence of inhibitors and enhancers in foods.

5.5 GLOSSARY

Ash : The residue left when any matter is burnt.

Extracellular fluid : Refers to the fluid present outside the cell.

Immediate memory : The memory of an event immediately preceding a given moment.

Intracellular fluid : The fluid present inside the cells.

Mineralization : The process of deposition of minerals in the bone.

Synthesis : The process of forming or producing a substance in the body.

5.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) a) 4-6 per cent
   b) Calcium, - phosphorus
   c) Milk, - green leafy vegetables
   d) Upper part of the small intestine
   e) Inhibitors

2)

Factors increasing calcium absorption	**Factors decreasing calcium absorption**
a) Body need	a) High phosphorus content
b) Vitamin D	b) Inhibitors in green leafy vegetables and cereals
c) Protein	
d) Carbohydrate	

Check Your Progress Exercise 2

1) a) Extracellular fluid is the fluid present outside the cell. Examples are blood plasma and the fluid surrounding the cells.
   b) Intracellular fluid is the fluid present inside the cells.
   c) Fluid balance refers to the balance between the fluids circulating within the cells and that circulating outside the cells.

2) a) Potassium, sodium b) extracellular fluid, intracellular fluid
   c) common salt d) potassium e) kidneys

Check Your Progress Exercise 3

1) Foods containing enhancers—protein-rich foods like milk; vitamin C-rich foods like oranges, lime.

   Foods containing inhibitors—green leafy vegetables, cereals.

Check Your Progress Exercise 4

1) (i) —b; (ii) —d; (iii) —a; (iv) —c.

2) a) False; protein-rich foods like milk and vitamin C-rich foods like citrus fruits (oranges, lemon etc.) enhance the absorption of iron.
   b) True
   c) True
   d) False; maximum concentration of iodine is found in the thyroid gland.
   e) False; iron is stored in the liver, spleen, kidney and the bone marrow.
   f) False; thyroxine regulates the rate of oxidation within the cells.
   g) True
   h) False; most of the iron/iodine present in the food is excreted. Only a small amount gets absorbed.

UNIT 6 PLANNING BALANCED DIETS

Structure

6.1 INTRODUCTION

In the previous units you have been introduced to a number of nutrients—an amazing array of elements and compounds all with vital functions in our bodies. Each one of us needs these nutrients in specific amounts. How do we ensure that we meet our nutrient needs? Is there any easy way by which we can plan diets that supply adequate amounts of all the nutrients?

This unit will answer these questions. You will find that the key to planning nutritionally adequate or in other words balanced diets lies in selecting the right foods in the right amounts for each individual.

How do we know which foods to select? The best way of selecting the right kinds of foods for each meal is by using food groups. Each food group includes a specific list of food items which share the same function and contribute similar nutrients. As you know, the functions of the foods are dependent on the major nutrients they supply. Once the food groups have been identified, items can be selected from each food group for individual meals. If each meal is planned along these lines, one can be reasonably sure that all nutrients will be provided by the day's diet.

After deciding on the foodstuffs to be included, we need to decide on the amount to be consumed. This would, of course, depend on how much of each nutrient is required. Recommendations for daily nutrient intakes have been laid down in our country by the Indian Council of Medical Research (ICMR). These recommended dietary intakes (RDIs) are the basis for planning balanced diets.

This unit will introduce you to various ways of classifying food into groups as well as the use of food groups in planning balanced diets. It will also discuss in brief the use of RDIs for deciding on the amounts to be consumed.

Objectives

After studying this unit, you will be able to:

- describe the concept of a balanced diet
- discuss the classification of food
- distinguish between requirements and recommended dietary intakes
- discuss the use of food groups and recommended dietary intakes in planning balanced diets
- identify the major factors influencing planning of balanced diets and
- list the steps involved in planning balanced diets

6.2 CONCEPT OF A BALANCED DIET

A balanced diet can be defined as *one which contains different types of foods in such quantities and proportions that the need for calories, minerals, vitamins and other nutrients is adequately met and a small provision is made for extra nutrients to withstand short durations of leanness.* Figure 6.1 illustrates this concept.

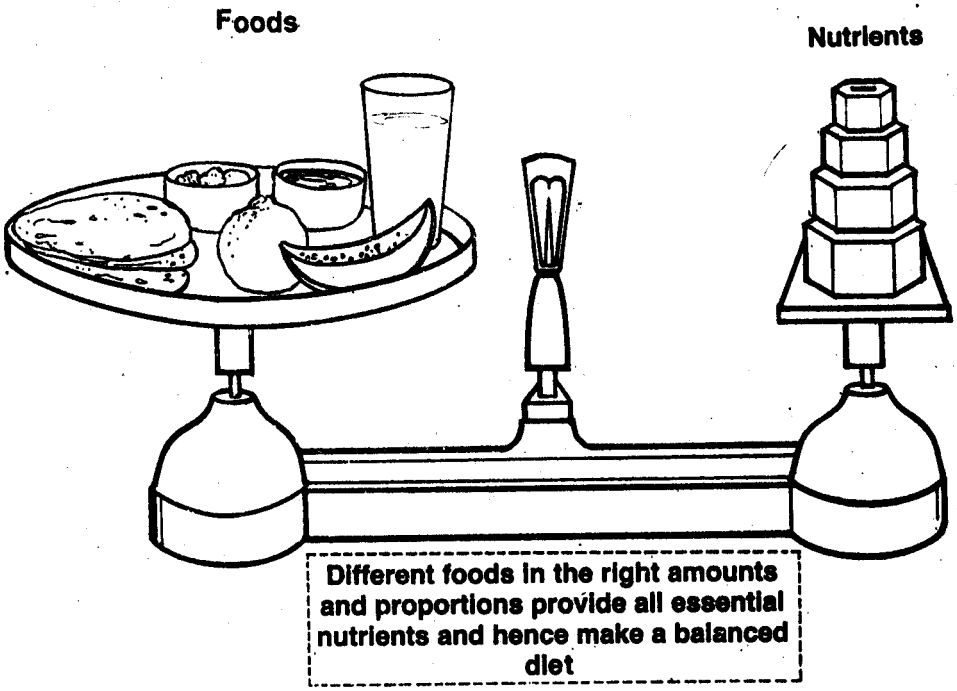


Fig. 6.1 Concept of a balanced diet

If you look at the definition carefully, you would realize that a balanced diet

- consists of different types of food items
- meets the need for nutrients and
- provides for periods of leanness when the diet may possibly not supply adequate amounts of all nutrients.

Let us talk about each of these aspects.

A balanced diet consists of different types of food items: A balanced diet includes a variety of foods. But how do we select these foods? The major aim is to ensure that all nutrients are supplied. This can be achieved by first classifying food into groups—each group supplying certain specific nutrients and then selecting items from each food group to plan a balanced meal or diet. Including items from each food group ensures that all the nutrients will be supplied. These aspects will be clearer when you read through subsection 6.3.1 which discusses the use of food groups in planning balanced diets.

A balanced diet meets the nutrient needs: A balanced diet meets nutrient needs because of the amounts and proportions of the foods selected.

How much should a person consume of individual foods to meet his needs? This would be based on the recommended dietary intakes (RDIs) laid down for the individual for whom the diet is planned. You will study more about RDIs in the subsection 6.3.2.

Balanced diets provide for periods of leanness: We have now examined the first two aspects of the definition of a balanced diet. Balanced diets also provide for periods of leanness. This implies that there is a "safety margin" or a "little extra" for those times when you do not meet your nutrient needs adequately. A normal individual consumes a variety of foods. It is possible that on a given day he may not consume foods in the amounts he requires. How, then, can we provide for such periods of leanness? Actually we do not need to make any special adjustments because RDIs already include a margin of safety. Planning diets on the basis of RDIs would take care of this aspect as well.

6.3 PLANNING BALANCED DIETS

Now that we have studied the concept of a balanced diet, we can move on to the planning of balanced diets. We have to arrive at simple techniques whereby we can plan diets for various individuals depending on physiological factors such as

age and sex. This section will introduce you to the basics of planning balanced diets i.e.

- the selection of the right kind of foods and
- the inclusion of suitable amounts of these foods so as to meet nutrient needs.

Let us first look at the usefulness of classifying food in helping us to include the right types of foods in our diet.

6.3.1 Use of Food Groups in Planning Balanced Diets

What is a food group? A food group, quite simply, consists of a number of food items sharing common characteristics. What are these common characteristics? Depending on which way of classification is used, the common characteristic may be

- the source or
- the physiological function performed.

Let us now examine these two ways of classifying food into groups.

A. Classification based on source: The simplest and most obvious classification is based on the interrelatedness of certain food items in terms of similar sources. The following categories are commonly identified even by a lay person:

- Cereals and millets
- Pulses
- Nuts and oilseeds
- Green leafy vegetables
- Root vegetables
- Other vegetables
- Fruits
- Milk and milk products
- Sugar and jaggery
- Fats and oils
- Flesh foods (fish, meat, poultry)
- Eggs
- Condiments and spices

Table 6.1 summarizes the major nutrients supplied by these food groups.

Table 6.1 : Nutrients Supplied by Food Groups (based on source)

	Food group			Nutrients supplied
i)	Cereals and millets e.g. rice, wheat, maize, bajra, ragi, jowar	Major nutrient Others	: :	Carbohydrate Some protein (not of good quality; quality improves in combination with pulses; major contribution to protein content of Indian diets because of quantities consumed) B vitamins especially niacin and thiamine, iron (bajra in particular), calcium (ragi in particular), carotene (only yellow maize)
ii)	Pulses e.g. red gram, green gram, lentils, bengal gram	Major nutrient Others	 :	Protein (not of good quality; quality improves in combination with cereals) Carbohydrate; B-vitamins especially thiamine, niacin; vitamin C (only in sprouted pulses)
iii)	Nuts and oilseeds e.g. groundnuts, almonds, cashewnuts, til (sesame) seeds, mustard seeds	Major nutrients Others		Protein, fat B-complex vitamins, calcium and other minerals

iv) Green leafy vegetables e.g. spinach, amaranth, fenugreek leaves, mustard leaves, drumstick leaves			Calcium, iron, carotene, vitamin C, B vitamins (especially riboflavin and folic acid), fibre
v) Root vegetables and tubers e.g. tapioca, potato, sweet potato, yam, colocasia	Major nutrient Others	: :	Carbohydrate Carotene (yellow yam); vitamin C (potato, sweet potato, tapioca)
vi) Other vegetables e.g. brinjal, ladies finger, french beans			Supply some amount of vitamins, minerals and fibre
vii) Fruits			Specific fruits are major sources of the following: Vitamin C (guavas, amla, citrus fruits); carotene (mangoes, apricots, oranges, papaya); iron (dried fruits such as dates and raisins)
viii) Milk and milk products e.g. milk, curd, cheese (cottage and processed)	Major nutrient Others	: :	Protein Carbohydrate, fat, calcium, riboflavin
ix) Sugar and jaggery			Carbohydrate (sugar is almost 100 per cent carbohydrate)
x) Fats and oils e.g. ghee, vanaspati, butter, vegetable oils (mustard, soyabean, groundnut)	Major nutrient Others	: :	Fat Retinol (butter, vanaspati) vitamin D (butter, vanaspati)
xi) Flesh foods e.g. meat, fish, poultry	Major nutrient Others	: :	Protein (good quality) B vitamins, retinol (liver), calcium (small fish consumed whole)
xii) Eggs			Rich source of most nutrients particularly protein (good quality)
xiii) Condiments and spices			Carotene (coriander leaves), vitamin C (green chillies). Contribution to diet insignificant: because quantities consumed are small.

Check Your Progress Exercise 1

1) Fill in the blanks.

a) A food group consists of a number of food items which share common .....

b) Nuts and oilseeds supply substantial amounts of both ..... and .....

c) Bajra is a good source of .....; ragi supplies substantial amounts of .....

d) The only cereal containing carotene is .....

e) Green leafy vegetables are good sources of vitamin ....., folic acid and carotene.

f) Sprouting of pulses improves the content of vitamin .....

(g) Liver is a good source of vitamin .....
(h) ..... and ..... are two major nutrients supplied by fruits.
(i) Sugar is almost hundred per cent .....
(j) A balanced diet provides for short periods of leanness when ..... intake is not adequate.

Classification of food based on function: The first classification you have studied is based on source. This classification is difficult to use in day-to-day life for planning diets because there are so many groups. Just imagine juggling with thirteen food groups! We need a much simpler classification. If you look at Table 6.1 you would notice that several groups are important for their content of the same nutrient and would, therefore, perform the same major function in the body. For example, eggs, milk and flesh foods all supply protein and therefore perform body-building functions. To overcome this problem of overlap and to make the groups easier to use, other ways of classification have been devised. Let us now study one of these—*the three group classification* based on function.

Food, as you learnt in Unit 1 of Block 1, has three basic physiological functions—energy-giving, body-building and protective/regulatory functions. You are also familiar with the fact that food performs these functions because of the specific nutrients it contains. Foods rich in carbohydrates or fats or both provide energy for instance. Similarly, foods rich in protein aid in body-building or in other words, addition of new tissues and repair of worn out tissues. Vitamins and minerals present in food contribute to preventing disease. This is called the protective function. Water, fibre and of course, the vitamins and minerals play a role in regulating body functions as you have learnt in Units 2 and 3 of Block 1 and in the previous units of this block. Food can, therefore, be classified into the following three categories based on function (see Figure 6.2):

Group 1. Energy-giving foods
Group 2. Body-building foods
Group 3. Protective/regulatory foods

The *energy-giving* category includes three types of foods:

1) Carbohydrate-rich foods A	• Cereals • Roots and tubers
2) Carbohydrate-rich foods B	• Sugar • Jaggery
3) Fat-rich foods	• Fats and oils

The primary nutrients provided by these foods, as you see, are carbohydrate/fat. In addition to carbohydrate, cereals also provide some protein, vitamins and minerals as you learnt in Table 6.1. Similarly, fats and oils provide fat-soluble vitamins in addition to fat.

The *body-building* group includes those foods which are rich in protein. The group includes:

- Milk and milk products
- Meat and meat products
- Fish
- Eggs
- Pulses
- Nuts and oilseeds.

The primary nutrient provided by all these foods is protein. These foods provide several other nutrients as well, some of them in significant amounts. Nuts and oilseeds, for example, are excellent sources of fat in addition to protein.

The third food group is called the *protective/regulatory* group. The primary nutrients provided by foods in this group are vitamins and minerals.

Foods in the protective/regulatory category include:

Fruits	• Yellow and orange fruits (e.g. mango, papaya) • Citrus fruits (e.g. lemon, lime, orange) • Others (e.g. plum, banana)

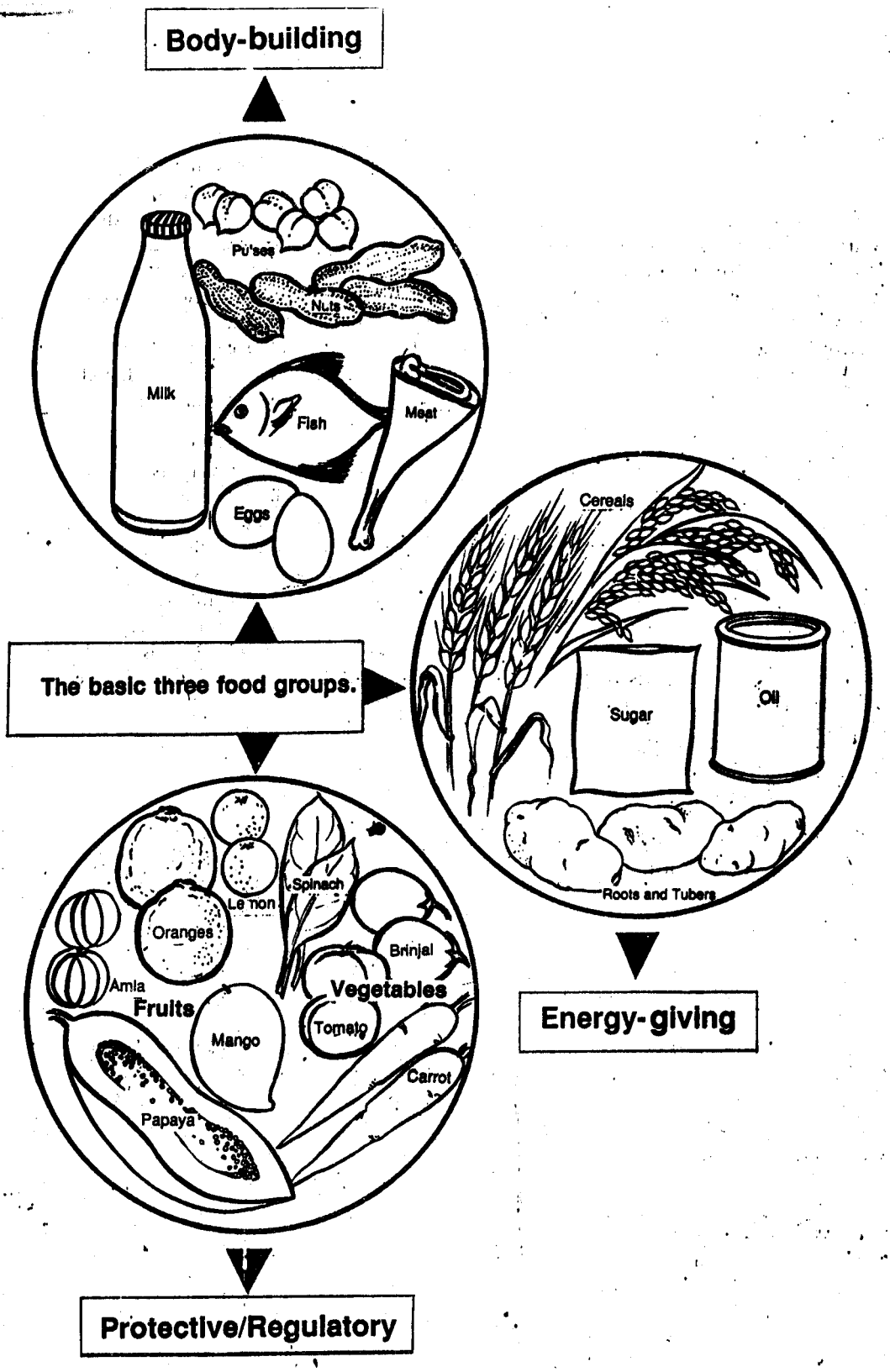


Fig. 6.2 The three group classification of food

Vegetables

- Green leafy vegetables (e.g. spinach, fenugreek, mustard)
- Yellow and orange vegetables (e.g. carrot, pumpkin)
- Others (e.g. ladies finger, brinjal, cauliflower, cabbage)

Green leafy vegetables, yellow and orange fruits and vegetables and citrus fruits are emphasized because they are particularly rich in carotene/vitamin C as well as minerals.

This is a simple classification. However, it is useful in planning meals/diets and is the most commonly used classification. *One has to ensure that each and every meal includes foods from the energy-giving, body-building and protective/regulatory groups. In this manner the diet would supply all essential nutrients and would become balanced.*

Now that we have studied this simple way of classifying food, let us try to understand how food groups can be used to plar meals. Let us take lunch as an example.

Meal: Lunch
Food groups — Thc three group classification

Food group	Food items selected	
	Alternative 1	Alternative 2
Energy-giving	Rice, fat	Wheat, fat, sugar, potato
Body-building	Rajmah	Green gram, milk
Protective/ regulatory	Onion, beans, tomato	Carrot, onion, tomato

Two alternative lists of food items selected from each food group are mentioned. Now we must translate this into a list of dishes to be served. Such a list is called a menu. The following chart gives you an idea of how to ccnvert these lists of food items into the magic of menus.

Alternative	Name of dish	Ingredients used for preparation
Alternative 1	Rice	Rice
	Rajmah curry	Rajmah, onion, tomato, fat
	Beans vegetable (dry preparation)	Beans, onion, fat
Alternative 2	Chapatis	Wheat flour
	Dal	Green gram, onion, tomato, fat
	Carrot-potato vegetable	Carrot, potato, fat
	Sweet curd	Curd, sugar

Let us now take an example typical of the south for tiffin (a meal consumed in the afternoon after a heavy breakfast consumed mid-morning).

Food group	Foods selected	Menu (ingredients)
Energy-giving	Rice, fat, potato	• Idlis (rice and urad dal)
Body-building	Urad dal, arhar or tur dal	• Sambar (arhar dal, ladies finger, potato, drumstick, brinjal, fat)
Protective/ regulatory	Ladies finger, drumstick, brinjal	

You can use the three group classification to plan for any meal. Remember to include a cereal and a source of fat—it could be ghee, vanaspati or a vegetable oil—

from the energy-giving group in each meal. If you are including a sweet item, sugar would also be part of the energy-giving group. You would also have noticed that *it is not necessary to include three items in a menu because there are three food groups* In fact, *a single dish can also be a balanced meal.* The following example will make this point clear.

Food group	Food item selected	Menu
Energy-giving	Rice, fat	
Body-building	Green gram dal	Khichri
Protective/ regulatory	Spinach, onion, tomato	

You have now gained a good idea of how to plan balanced meals. Some more important aspects regarding the planning of balanced diets will be discussed later in this unit.

Check Your Progress Exercise 2

1) List the menu for the lunch you consumed yesterday. Was the meal balanced or not? Evaluate the meal on the basis of the three group classification.

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6.3.2 Use of Recommended Dietary Intakes in Planning Balanced Diets

The *Recommended Dietary Intake* (RDI) is *the amount of a nutrient to be actually consumed in order to meet the requirements of the body.* Recommended dietary intakes are hence based on requirements. Now what do we mean by the term "requirement"? The *requirement* for a particular nutrient is *the minimum amount that needs to be consumed to prevent symptoms of deficiency and to maintain satisfactory levels of the nutrient in the body.*

As mentioned earlier, recommended dietary intakes are based on requirements. How do we convert a requirement figure into recommended dietary intakes or RDIs? The *RDIs are basically the requirement plus a safety margin* (Figure 6.3).

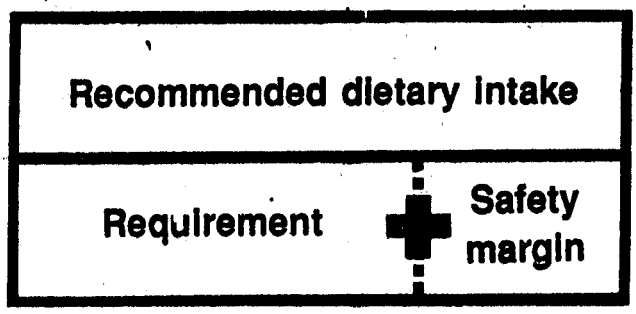

Fig. 6.3 Relationship between requirement and recommended dietary intake

The safety margin is added on to cover factors like:

- variation in requirement from individual to individual
- periods of low intake (periods of leanness)
- nature of diet
- cooking losses

Some of these points can be well illustrated with the following example. In experiments conducted with adults it was found that when the intake of vitamin C was 20 mg/day, vitamin C deficiency or scurvy could be prevented and satisfactory levels of vitamin C could be maintained in the body. Since all the persons studied were able to satisfactorily maintain body vitamin C levels at an intake of 20 mg/day, there was no need to make allowances for individual variation. Now, how is this figure for requirement converted into an intake figure for adults? Vitamin C is easily destroyed on cooking. On the average, a figure of 50 per cent cooking losses was considered reasonable. The recommended intake was therefore fixed at double the requirement i.e. 40 mg per day.

In addition to the factors already discussed, the nature of the diet has a significant influence on the RDIs fixed for certain specific nutrients. Take protein for example. Many Indians cannot afford animal protein and hence they consume a diet which supplies vegetable protein. Since vegetable protein is utilized to a relatively lower extent, more protein needs to be consumed and therefore RDIs increase. Similarly, in the case of iron, the availability of iron to the body depends on the type of food consumed. Absorption of iron from typical Indian diets is low as you learnt in the previous unit. Therefore more iron needs to be consumed to meet the requirement i.e. the RDI is fixed at a higher level.

You have now gained an idea about the concepts of requirement and recommended dietary intakes. There are three important points that you need to remember.

1) **RDIs are set high enough to meet the needs of almost all healthy people:** In other words, a generous margin is usually given for individual variation in a population of normal, healthy individuals.

2) **RDIs do not apply to people who are suffering from a disease which influences the nutrient needs:** A disease can cause an increase or decrease in the requirement of one or more specific nutrients. Sometimes medicines prescribed during illness influence nutrient need. For instance, when one takes antibiotics one also has to consume more of the B-complex vitamins. The RDIs only apply to individuals who are normal and not suffering from a disease likely to influence nutrient requirements.

3) **Recommended dietary intakes for adults are based on sex, age, body size and activity level:** In the case of adults, there are substantial variations in RDIs particularly for energy and protein depending on the age, body weight and activity pattern. This is why working out RDIs on the basis of a "reference individual" is useful. RDIs have, in fact, been fixed using this principle. The *Reference man* is an Indian man in the age group of 20-39 years doing moderate work and weighing 60 kg. Similarly, an Indian woman 20-39 years old doing moderate work and weighing 50 kg is referred to as the *Reference woman* (Figure 6.4). You would notice that the age range, weight and activity level have been specified in both cases.

Adjustments can be made in the case of RDIs for individuals who deviate from the standard references. You will learn more about the reference man and woman in Unit 7 of Block 3.

Let us now examine the recommended dietary intakes for Indians (Table 6.2). The table lists the RDIs for several nutrients.

Some of the salient features of recommended dietary intakes and how they are expressed are summarized in the following points You will also come across explanations for various terms used in the table

i) **RDIs are expressed in kilocalories (Kcal), grams (g), milligrams (mg) or micrograms (μg):** RDIs for energy are expressed in Kcal. One kilocalorie is the amount of heat required to raise the temperature of one kilogram of water through 1°C.

Table 6.2: Recommended Dietary Intakes for Indians

Group	Particulars	Net Energy (Kcal)	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)	Vit.A(μg) Retinol	Vit.A(μg) β-Carotene	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Ascorbic acid (mg)	Folic acid (μg)	Vit.B12 (μg)
Man	Sedentary Work	2425							1.2	1.4	16			
	Moderate Work	2875	60	20	400	28	600	2400	1.4	1.6	18	40	100	1
	Heavy Work	3800							1.6	1.9	21			
Woman	Sedentary Work	1875							0.9	1.1	12			
	Moderate Work	2225	50	20	400	30	600	2400	1.1	1.3	14	40	100	1
	Heavy Work	2925							1.2	1.5	16			
	Pregnant Woman	+300	+15	30	1000	38	600	2400	+0.2	+0.2	+2	40	400	1
	Lactation													
	0-6 Months	+550	+25	45	1000	30	950	3800	+0.3	+0.3	+4	80	150	1.5
	6-12 Months	+400	+18						+0.2	+0.2	+3			
Infants	0-6 Months	108/kg	2.05/kg		500				55 μg/kg	65 μg/kg	710 μg/kg	25	25	0.2
	6-12 Months	98/kg	1.65/kg				350	1200	50 μg/kg	60 μg/kg	650 μg/kg			
Children	1-3 Years	1240	22			12	400	1600	0.6	0.7	8		30	
	4-6 Years	1690	30	25	400	18	400		0.9	1.0	11	40	40	0.2-1.0
	7-9 Years	1950	41			26	600	2400	1.0	1.2	13		60	
Boys	10-12 Years	2190	54	22	600	34	600	2400	1.1	1.3	15	40	70	0.2-1.0
Girls	10-12 Years	1970	57			19			1.0	1.2	13			
Boys	13-15 Years	2450	70	22	600	41	600	2400	1.2	1.5	16	40	100	0.2-1.0
Girls	13-15 Years	2060	65			28			1.0	1.2	14			
Boys	16-18 Years	2640	78	22	500	50	600	2400	1.3	1.6	17	40	100	0.2-1.0
Girls	16-18 Years	2060	63			30			1.0	1.2	14			

Source : Nutrient Requirements and Recommended Dietary Allowances for Indians, ICMR (1990)

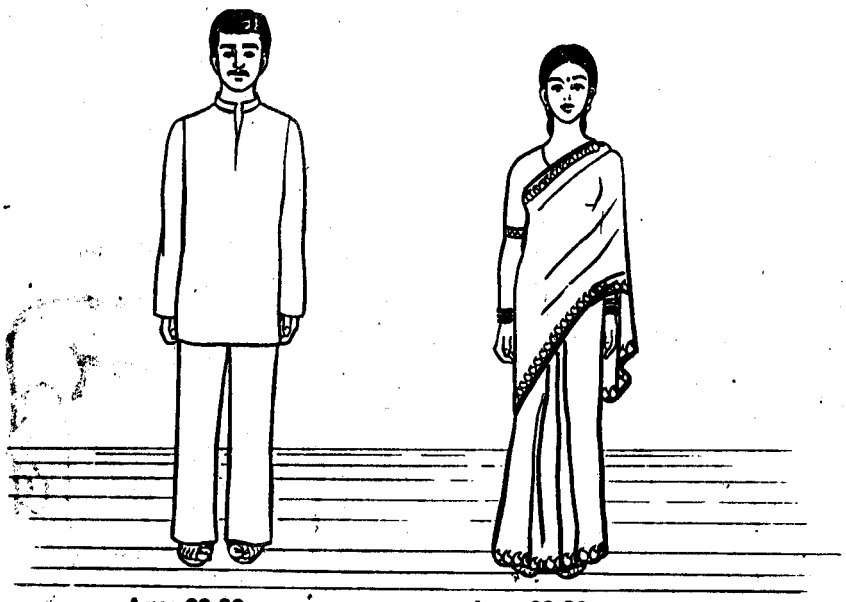

Fig. 6.4 The reference man and woman

1000 milligrams (mg) make one gram and 1000 micrograms (µg) make one milligram. The RDIs for protein are given in grams while RDIs for vitamins are expressed in milligrams or micrograms.

ii) **RDIs for energy for adult men and women are based on activity levels:** Activity levels can be described as sedentary (light), moderate or heavy. The more the activity, the higher would be RDIs for energy. You will learn more about this in Unit 7 of Block 3.

iii) **RDIs for thiamine, riboflavin and niacin are dependent on RDIs for energy:** The relationship between the RDIs for these vitamins and energy is as follows:

RDI for thiamine = 0.5 mg/1000 Kcal; RDI for riboflavin = 0.6 mg/1000 Kcal; RDI for niacin = 6.6 mg/1000 Kcal. Can you explain why such a relationship exists? We discussed this aspect in Unit 4 of this block. You would remember that these three vitamins play a vital role in the release of energy from carbohydrates, fats and proteins.

iv) **RDIs for protein are based on body weight:** The relationship can be expressed as 1 g protein per kg body weight in the case of the adult. It varies for other age categories.

v) **RDIs for energy and protein are given as additional intakes in pregnancy and lactation:** Pregnancy and lactation are periods of "physiological stress" because nutrient needs increase considerably to meet the needs of the growing foetus (in the case of pregnancy) and production of milk (in the case of lactation when the mother breastfeeds the baby). RDIs are given in terms of additional intakes (indicated by a "+" sign) for some nutrients like energy and protein. RDIs for the other nutrients are given as total intake figures.

vi) **In infancy RDIs for energy, protein, iron, thiamine, riboflavin and niacin are expressed per kg body weight:** Here the expression "body weight" refers to the body weight expected for a healthy, normally growing infant of a particular age. Infancy is also a period of physiological stress just like any period characterized by rapid growth.

vii) **RDIs for vitamin A have been given in terms of retinol or alternatively in terms of beta carotene:** Carotene is a precursor of vitamin A, as you know. The body cannot utilize all the carotene consumed to make retinol. About half of the beta carotene consumed is absorbed. Further, only about 50 per cent of the amount absorbed can be converted to retinol. In other words, only 25 per cent of the consumed beta carotene is actually converted into retinol. Hence for every 100 units of beta carotene taken in, only 25 is available to the body as retinol. This is why the carotene-retinol ratio is 4:1 (Figure 6.5)

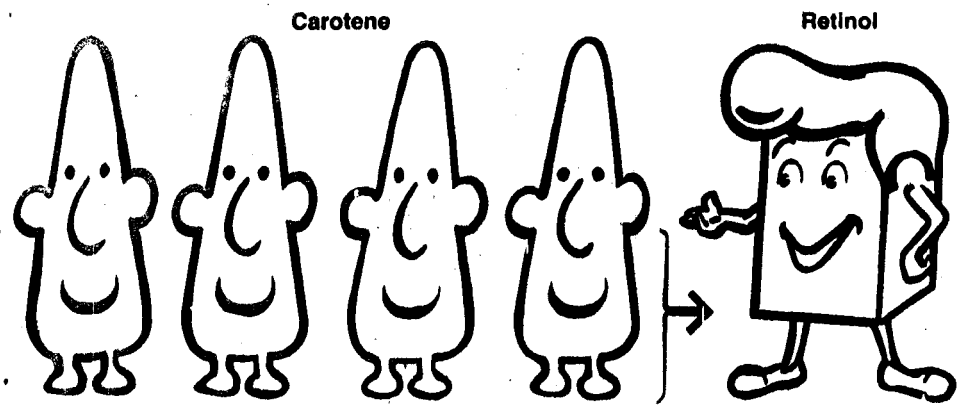

Fig. 6.5 Four units of carotene make one unit of retinol in the body

Most diets provide both retinol and carotene. However, RDIs are given in terms of either retinol or beta carotene. It would therefore help if we express the total vitamin A content of the diet either as retinol or beta carotene. To express the total vitamin A content of the diet in terms of retinol, the following relationship can be used:

$$\text{Total Vitamin A as retinol (in micrograms)} = \text{Retinol (micrograms)} + \frac{\text{Beta Carotene in micrograms}}{4}$$

Example: Assume a diet supplies 50 micrograms retinol and 2800 micrograms beta carotene. The total vitamin A supplied by the diet would be

$$50 + \frac{2800}{4} = 50 + 700 = 750 \text{ micrograms}$$

We have so far studied the concepts of requirement and recommended dietary intake. We have also examined the RDIs for Indians. Now we can move on to the study of how these are used in planning balanced diets.

The amounts of different foods to be consumed would depend on the RDIs. The higher the RDI for a particular nutrient, the more should be the consumption of foods rich in that nutrient. The amount of cereal consumed by a heavy worker, for example, should be more than that consumed by a light worker. Why is this so? This is because of the fact that energy requirements are far more for heavy workers and because cereals are a source of carbohydrates and, therefore, energy. Detailed information on planning balanced diets for infants, preschoolers, school children, adolescents, pregnant and lactating women is given in Block 3. In all these cases, the amount of food to be consumed would be dependent primarily on the RDIs.

Check Your Progress Exercise 3

1) Fill in the blanks.
   a) The RDI for thiamine is ..... mg per 1000 kilocalories.
   b) One microgram of retinol is equivalent to ..... micrograms of carotene.
   c) ..... micrograms make one milligram.

d) During periods of physiological stress nutrient needs are .....
e) ..... intakes of energy and protein become necessary in pregnancy.

2) Differentiate between requirement and recommended dietary intake.

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6.4 GUIDELINES FOR PLANNING BALANCED DIETS

You have gained considerable knowledge about the principles underlying the planning of balanced diets. Let us now look at some more important aspects. We have to remember that balanced diets are:

- individual-specific
- region-specific and
- income-specific

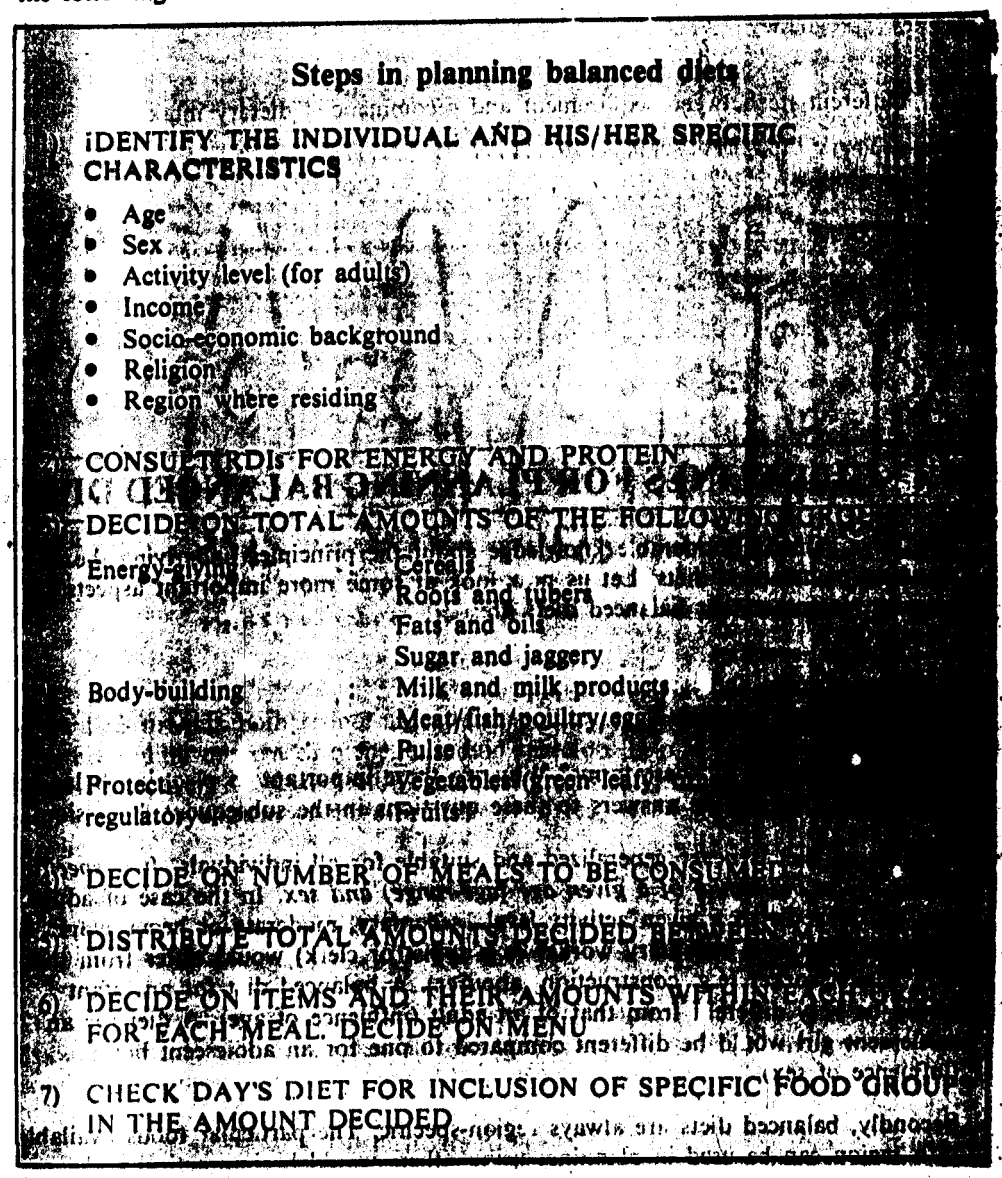
What do we mean by these terms? Why are these important in planning balanced diets? You will find the answers to these questions in the subsequent discussion.

A balanced diet is never generalized and suitable for all individuals. *It is specific firstly, to an individual of a given age (age-range) and sex.* In the case of adults, it is also specific to a given activity level—sedentary, moderate or heavy work. A balanced diet for a sedentary worker (e.g. typist or clerk) would differ from that of a heavy worker (e.g. construction labourer). A balanced diet for an infant would be very different from that of an adult (influence of age). A diet for an adolescent girl would be different compared to one for an adolescent boy (influence of sex).

Secondly, balanced diets are always region-specific. The particular foods available in a region can be used in planning; using others would be impractical and unsuitable. There is no point in including a cereal like ragi in a diet meant for a North Indian because ragi is grown only in the south. *A balanced diet for a particular region must reflect the characteristic meal patterns, the social and religious practices of that region.* These factors are taken into consideration to ensure that the diet planned is acceptable.

Thirdly, balanced diets are income-specific. Balanced diets for an individual of a given age and sex (and activity level where relevant) vary depending on income. A balanced diet would imply the use of all food groups—energy-giving, body-building and protective/regulatory — in each and every meal. However, the *selection of foods and the amounts in which they are consumed would vary depending on income.* As income increases, consumption of cereals reduces and consumption of milk and other animal protein foods, vegetables and fruits, fat and sugar tend to increase. While planning balanced diets for the affluent these trends are kept in mind but excessive amounts of fat and sugar are not recommended. Having more money does not mean spending more on fat, sugar and expensive foods like meat/cheese, nuts and dry fruits. It means consuming the amounts absolutely necessary so as to maintain good health and avoid putting on weight and developing other health problems. Having more money, however, enables a person to add more variety to the diet; unusual foods or foods not locally available can be purchased or ordered from elsewhere. Judicious selection of food is, however, as important for the rich as for the poor. The ultimate aim is always to meet the nutritional requirements

Let us now study the major steps in planning balanced diets. These are given in the following chart.



Let us now discuss each of these steps.

1) **Identify the individual and his/her specific characteristics**
You know the individual's characteristics and background would determine the type of diet planned. Income, socio-economic background, religion and the region where the individual stays are also important, as you are aware, in the planning of balanced diets.

2) **Consult RDIs for energy and protein**
Generally diets which meet energy and protein needs meet the needs of other nutrients as well if care is taken to include rich sources of vitamins and minerals. Therefore in planning diets the total energy and protein needs are specified first.

3) **Decide on total amounts of specific groups**
The amounts of cereals, fat, sugar, milk, meat/fish/poultry/eggs, pulse, vegetables and fruits to be consumed are decided based on the income. The amount included would be such that RDIs can be met for energy and protein. This will become clear to you when you study the Practical Manual.

4) **Decide on number of meals to be consumed**
Meal frequency varies depending on income, the work/school schedule and convenience. People belonging to the higher income group consume more meals. Consider the following lists of meals consumed in a day.

(A)	(B)	(C)	(D)
Breakfast	Breakfast	Breakfast	Bed tea
Lunch	Lunch	Mid-morning meal	Breakfast
Dinner	Tea	Lunch	Mid-morning meal
	Dinner	Tea	Lunch
		Dinner	Mid-afternoon meal
			Tea
			Dinner
			Bed time

(A) is typical of the low income group

(B) & (C) are common in the middle income group

(D) is common in the high income group

Variations are often necessitated because of age. A child may not be able to consume much at a time. So he would need to consume more meals. The work/school schedule also becomes important as you will learn in Block 3.

5) **Distribute total amounts decided between meals**
The total amount of each food group decided must be distributed over the day's meals. You will learn how to do this using the Practical Manual.

6) **Decide on items and their amounts within each group for each meal**
The dishes to be included for each meal are decided based on the amount of each item in each of the three food groups decided on earlier. For specific dishes to be included specific items are selected from each food group as you learnt earlier.

7) **Check day's diet for inclusion of specific food groups in the amounts decided**
By step 6 we have decided on the menu (i.e. the dishes to be served in each meal) and listed the amounts of each ingredient used in preparation of the dishes. Now we have to check that we have included each item in the amounts decided in step 3 according to the distribution arrived at in step 5.

You will actually learn diet planning in practice in the Practical Manual—Part I. In the Manual you would find those steps discussed in detail. So, if you haven't clearly grasped the points mentioned don't worry. The Practical Manual will give you all the information you need. But wait till you have gone through Block 3 as well. After studying Blocks 1 to 3 you would be able to understand and use the Practical Manual.

Check Your Progress Exercise 4

1) Evaluate the following meals and state whether they are balanced or not. Give reasons for your answer and suggestions for improvement. (Use the three group classification of food.)

a) Rice-curd-mango pickle

.....

.....

b) Khichri (with rice, pulse and a green leafy vegetable)

.....

.....

c) Rotis (with atta/whole wheat flour and besan/bengal gram flour) curd

.....

.....

d) Tea–toast with butter and jam

.....

.....

e) Idlis (urad dal, rice) —coconut chutney—sambar (arhar dal, vegetables)

.....

.....

2) List four specific characteristics of an individual which determine planning of balanced diets.

.....

.....

6.5 LET US SUM UP

This unit introduced you to the concept of food groups. Food groups were described as a set of food items with common characteristics. Foods, as you studied, can be classified on the basis of source or function. Including the three food groups (energy-giving, body-building and protective/regulatory) in each and every meal ensures that the meals and, therefore, the day's diet is balanced.

A balanced diet has been described as "a diet containing different types of foods in such quantities and proportions that the need for all nutrients is adequately met and a small provision is made for extra nutrients to withstand short durations of leanness". Balanced diets are planned on the basis of the recommended dietary intakes using the food groups. Various steps involved in planning balanced diets are also discussed starting with identifying the individual for whom we are planning and then selecting the right foods in the right amounts to be distributed over the day's meals.

Income, individual-specific and region-specific factors play an important role in determining food selection and meal patterns (Figure 6.6).

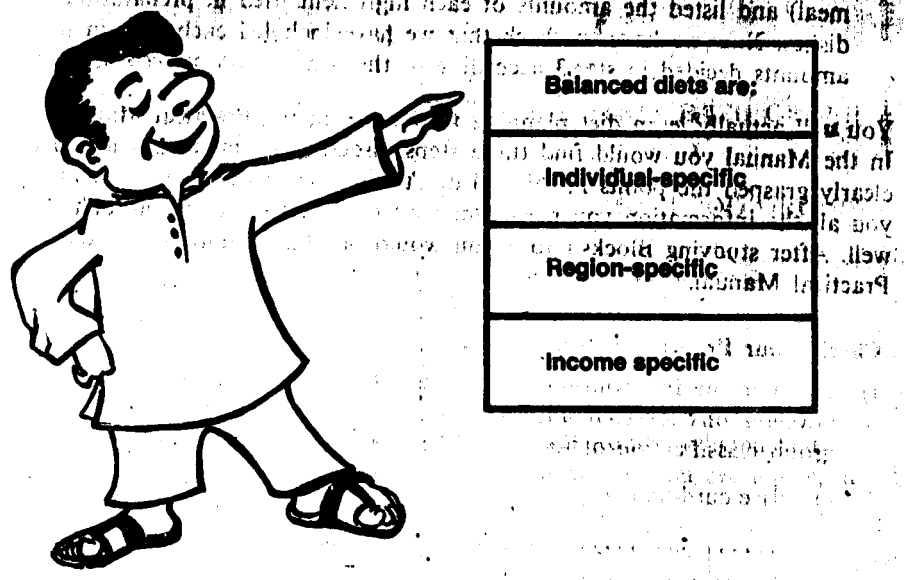


Fig. 6.6 Key points about balanced diets

6.6 GLOSSARY

Activity level	: Level of activity of a person—sedentary (light), moderate or heavy. Activity level is chiefly related to the occupation of an individual.
Foetus	: The unborn child
Lactation	: Period when the mother breastfeeds her infant.
Meal Pattern	: Number of meals consumed in a day and the timing and nature of different meals.

Mid-afternoon meal : Referring to a meal consumed between lunch and tea usually consisting of items like fruits, soups, beverages, snacks.

Mid-morning meal : Referring to a meal consumed between breakfast and lunch usually consisting of a beverage and a snack. Soups and fruit-based items are also served.

Physiological stress : Stress on the body due to normal physiological events unlike the stress caused by disease. Periods of physiological stress are generally rapid growth phases (e.g. infancy, adolescence, pregnancy and lactation).

6.7 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) a) characteristics b) protein, fat c) iron, calcium d) yellow maize e) vitamin C f) C g) A h) Vitamins, minerals i) carbohydrate j) nutrient

Check Your Progress Exercise 2

1) List the dishes you consumed for lunch and check for representation of all the three functional food groups.

Check Your Progress Exercise 3

1) a) 0.5 b) 4 c) 1000 d) high e) additional
2) Requirement refers to the minimum amount of a nutrient required to prevent deficiency and maintain satisfactory body levels of that nutrient for the majority of people. An additional safety margin for individual variation, cooking losses, periods of low intake is added to the requirement figure to arrive at the RDI.

Check Your Progress Exercise 4

1) (a) Rice and curd provide energy and protein respectively. The protective/regulatory group is represented only by the pickle. A vegetable preparation can be added to complete the meal even though curd does provide vitamins and minerals. (b) This is a balanced meal even though it is only one dish because energy (rice), protein (pulse) and vitamins and minerals (green leafy vegetables) are being provided. (c) A cereal-pulse combination is used to make the rotis. Cereals would provide energy. Both pulses and curd provide protein. Addition of vegetable to the rotis can help or a fruit can be given so as to include the protective/regulatory group. (d) This meal provides only calories and little of other nutrients. Milk and a fruit can be given. (e) This is a balanced meal. All the three food groups are represented.
2) Any four of the following: age, sex, activity, income, socio-economic/religious/regional considerations.

NOTES

NOTES

NOTES

Utter Pradesh
Rajarshi Tandon Open University

Nutrition for the Community

Block

3

MEAL PLANNING

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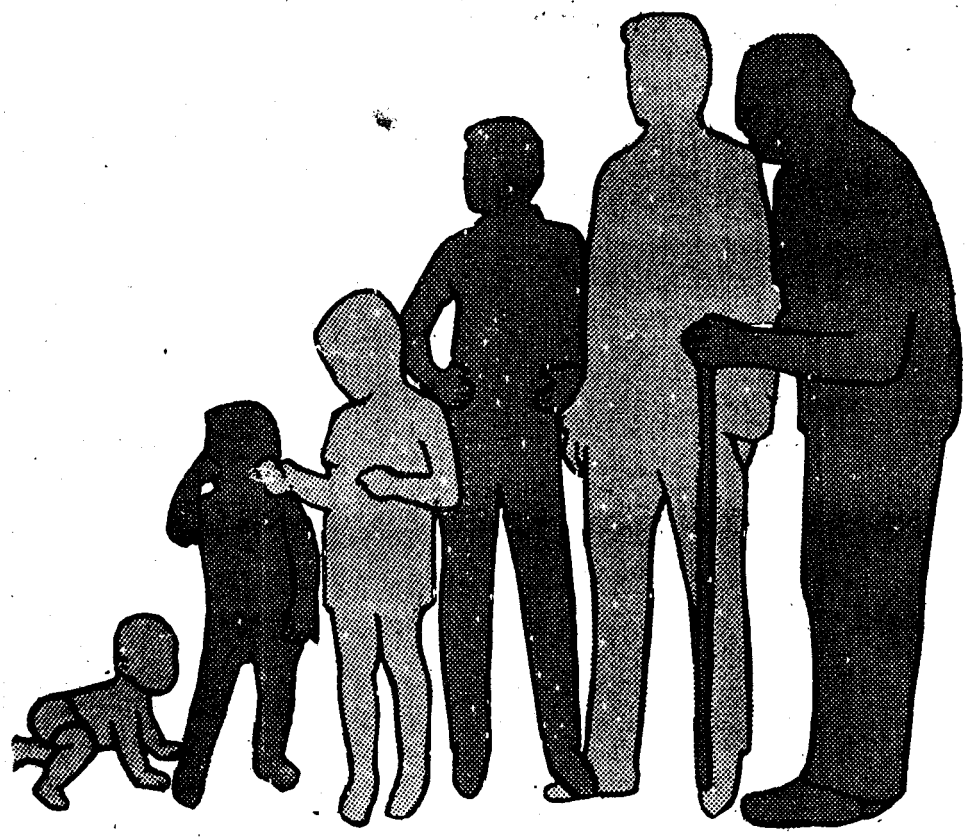
Sept 1994 (Reprint)

Reprinted by : Nitin Printers, 1 Old Katra, Manmohan Park, Allahabad.

BLOCK INTRODUCTION

It is amazing but all of us begin life as a single cell. This cell goes through several phases of growth and development till it becomes an individual like each one of us. Now what are these phases or stages in the lifespan?

We are aware that the lifespan begins with the unborn child growing in the mother's body and moves through infancy, the preschool years, the school years and adolescence before the final stage of adulthood. There are characteristic patterns of growth and development in each stage of the lifespan. Block 3 talks about the changes in the pattern of growth and development as well as their influence on nutrient needs in each of these stages. In Blocks 1 and 2 you learnt the basic concepts in nutrition. Now building on this foundation in Block 3 you will learn the principles involved in planning adequate meals and diets for individuals in different age groups and physiological stages. Unit 7 discusses the principles of meal planning and applies them to the adult. Units 8 through 10 focus on meal planning for pregnant and lactating women, infants, preschoolers, school children and adolescents.



Study Guide

This block is crucial to the study of planning meals and diets. Here are some specific points that you will find helpful in organizing your study.

1. Meal planning is discussed in a question–answer format covering the major steps you learned in the last block. The same format is followed in all four units in this block.
2. Units 7 to 10 focus on the main principles involved in meal planning. After reading this block you can begin on the *Practical Manual – Part I*. The Manual teaches you diet planning in practice.
3. You will find the Highlights given in this block useful. They focus on areas of special interest. You can treat the *Highlights* as additional information which will add to your understanding of the text. At some points you will find *Boxes* which will help you revise information you should be familiar with.
4. There are certain nutrients of particular importance for each age group / physiological state. These are mentioned in each unit. You must memorize the RDIs for these nutrients.
5. At the end of this block you will find *Annexures* 1 to 6. Annexure 1 is a set of cards you can cut out. They list the rich sources of the major nutrients. You can let the duplicate copy remain in the block. Annexures 2 to 6 list recipes and ideas for snacks, dishes and packed lunches. You may find these useful for developing your own recipes. But you need not limit yourself to these. In fact when you find the time you can make a recipe folder for yourself.

UNIT 7 PRINCIPLES OF MEAL PLANNING AND MEAL PLANNING FOR THE ADULT

Structure

7.1 INTRODUCTION

In Unit 6 of Block 2, you studied about balanced diets. A balanced diet, as you know, includes the right kind of foods in the right amounts and proportions so as to meet the nutrient needs of the individual for whom it is planned. A day's diet consists of three main meals say breakfast, lunch, dinner. If we ensure that each meal is balanced, the day's diet would be balanced as well. You have already learnt the essentials of planning balanced meals and diets. On going through this unit, you will find that balanced meals must be planned within the socio-cultural, economic and regional framework of the individual. This practical and useful exercise of planning acceptable and adequate meals is called meal planning.

In addition to the factors mentioned earlier, several others play a role in meal planning, such as individual preferences, saving on time and labour and providing variety in the diet. This unit will talk about these factors and how to apply them in order to plan suitable meals.

Using this knowledge of meal planning, we shall then learn how to plan balanced meals for adults. Adulthood, as you may be aware, is the last phase of the life cycle of an individual. It begins from the age of twenty years and extends through old age till the time of death. Great variation exists in the nutrient need of adults depending on age, sex and activity pattern. What are the nutritional needs of this population group? How does age, sex and activity pattern influence nutrient needs? What are the problems faced in meeting the needs specially with respect to older adults? How do we provide nutritious and inexpensive diets for adults? We shall examine all these aspects in this unit.

Objectives

After studying this unit, you will be able to:

- discuss the concept and aims of meal planning
- identify the factors that need to be considered while planning meals
- describe the period of adulthood
- list the recommended dietary intakes for adults and
- discuss meal planning for the adult

7.2 MEAL PLANNING

Any individual who carries the responsibility of providing meals has to take decisions regarding: what to serve, how much to serve, how much to spend, where to shop, how much to buy, how to prepare food, how to serve meals, at what hour to serve meal and so on. All such decisions are a part of planning meals. Extending this concept further, one could define meal planning as a simple practical exercise which involves applying the knowledge of food, nutrient requirement, individual preferences to plan adequate and acceptable meals. In other terms, ***meal planning means planning for adequate nutrition.***

Remember meal planning is just not an exercise of selecting the right kind of foods to help meet the nutrient needs. It also concerns with preparing/planning attractive and enjoyable meals for all persons. Meals must taste good, smell good. Because food is seen before it is tasted the eyes have a role as well, in food acceptance. Meals must 'look good' to be tasted to be enjoyed. To do this, the planner does not have to be knowledgeable only, but also imaginative and creative. The art of skilful blending of foods in terms of colour, texture and flavour must be known. In this context, therefore, it is said that meal planning is an art. It is an art which develops through thought and inspiration. Meal planning, in fact, is a skill which improves with practice.

7.2.1 Aims of Meal Planning

Why do we need to plan meals? Let us find the answer to this question with the following examples:

A. Meena and Raju are school-going children. They love eating hamburgers, chocolates, toffies and ice creams. Their eating habits are influenced by their friends and by the food advertisements on the television. Their mother, Seeta Devi, on the other hand, disapproves of their eating habits and is always coaxing them to drink milk, eat green leafy vegetables, chapaties/rice.

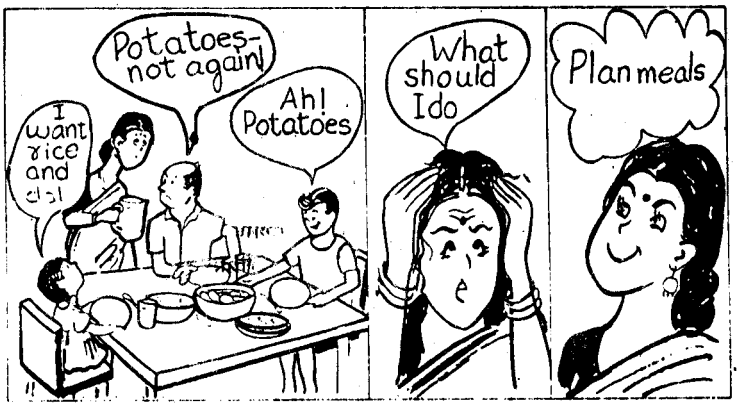
B. Mohan and Abha have invited friends for dinner. Abha is keen on preparing delicious and attractive dishes for her guests. She is trying various food combinations and preparation methods to provide variety and make the meal more appealing.

C. Rati is a working woman. She has limited resources — time and energy. Her consideration is to be able to prepare nutritious meals at reasonable cost within the time available.

From these examples what clues can we get on why we need to plan meals? Let us consider. In the case of Seeta Devi, you would have noticed that, consciously or unconsciously, she is trying to provide nutritious meals for her children. Abha, for sure, is aiming to prepare an attractive and satisfying meal for her guests. And Rati, like Seeta Devi, is also attempting to provide nutritious meals at reasonable cost. It is, therefore, evident that the effort of all the three (Seeta Devi, Abha and Rati) is to provide *satisfying, nutritious meals*. This, in fact, is the first and the foremost aim of meal planning. What are the others? Think. From your experience try listing down how planning meals would help you. You can tally your responses with the aims of meal planning listed below.

The aims in planning meals are to:

- fulfil the nutritional needs of the family members, taking into account the family size and composition
- plan meals within the family income, i.e. make maximum use of the money available, in the best possible way
- aid in the proper purchase, preparation and service of food
- economize on time, labour and fuel
- provide variety in the diet by making proper selection of foods from within each of the three food groups



Meal planning helps to ensure nutritious meals according to personal likes/dislikes.

Fig. 7.1 Aim of meal planning

- make meals appealing and palatable by proper selection of food in terms of colour, texture and flavour
- provide nutritious meals taking into account individual preferences (Figure 7.1)
- plan meals in advance, so that any pre-preparation required can be made and also the leftovers from the previous meals can be economically utilized.

7.2.2 Factors to be considered in Meal Planning

Providing a meal that would be enjoyed and accepted by one and all in the family is rather difficult. Why? Individual preferences, varied nutrient needs, varied food habits, are a few factors that would influence meal planning. The crucial aspect to be considered then, is how best to plan adequate and satisfying meals, within the socio-cultural, economic, regional and psychological framework of the individual. Here is a detailed discussion on this aspect. However , before we discuss these factors, let us first get to know certain terms that are often used in the context of meal planning. These are discussed in Box 7.1.

Box 7.1 Meal, Menu and Meal Pattern

Defined below are terms used frequently in meal planning.

Meal : Normally an individual eats 3-4 times a day. The foods consumed at a particular time of the day constitute a meal. For example, foods taken in the morning constitute a meal —breakfast. Similarly foods eaten in the afternoon are a part of lunch. Usually breakfast, lunch and dinner are the three main meals consumed in a day.

Menu : A menu is the list of dishes/food items served at a meal. Consider the examples of two menus given below :

Menu A	Menu B
Rice	Chapati/Rice
Sambar (Arhar dal/ vegetables preparation)	Rajmah
Curd	Aloo gobi (Cauliflower/ potato preparation)
	onion raita (curd preparation)

Menu A is common in a Tamilian household whereas Menu B is common in Punjabi households.

Meal Frequency : This term refers to the number of meals consumed in a day. For example, if you consume— breakfast, lunch, tea and dinner— in a day, the meal frequency is 4.

Meal Pattern : It refers to the number of meals (i.e. the meal frequency), the timing and nature of different meals consumed in a day.

Check Your Progress Exercise 1

1) Read the following paragraph :

Mohan is an accountant in a governent office in North India. His office timings are 9.00 a.m. to 5.30 p.m. His meal pattern is as follows. He has bed-tea early morning. Before leaving for his office the consumes a heavy breakfast. He carries a packed lunch to office (which he eats aroung 1.30 p.m.). Before lunch, aroung mid-morning, he usually takes tea alongwith his friends. Around 4-4.30 p.m. he has another cup of tea supplemented with a snack. He returns home around 7.30 p.m. and has dinner right away. Than late at night, before going to bed he drinks a glass of milk.

Now answer the following questions

a) What is the meal frequency adopted by Mohan?

.....

b) List the various meals Mohan has had in a day.

.....

.....

c) Can you suggest a menu for dinner for Mohan?

You have just been introduced to some new terms in Box 7.1. With this understanding let us now move on to discuss the major considerations in planning meals (Figure7.2). We begin with nutritional adequacy.

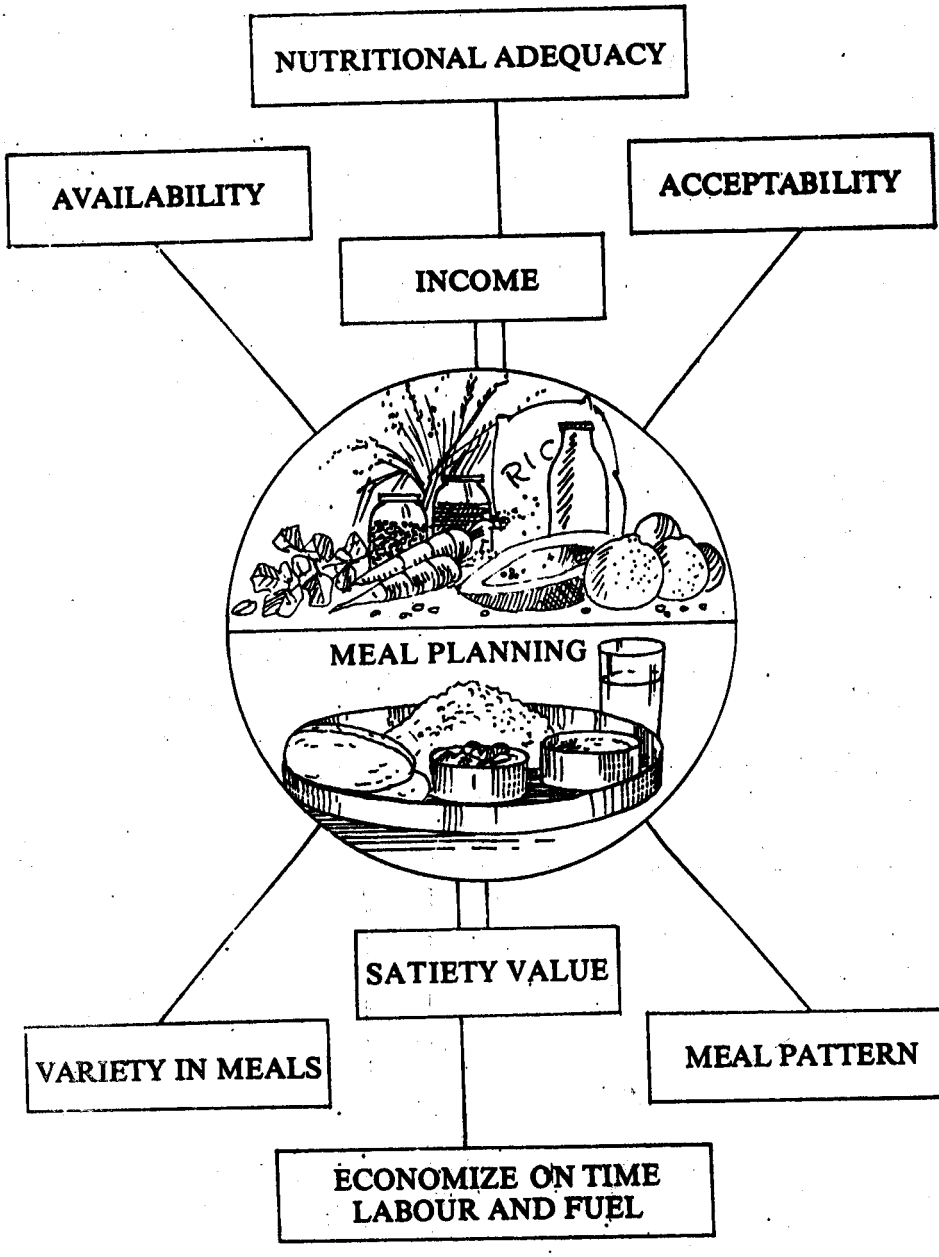


Fig. 7.2 Factors affecting Meal Planning

i) **Nutritional adequacy:** The nutritional requirement of the individual to be served an important consideration in meal planning. This point is particularly important when we are planning meals for a family. In a family, as you know, there might be different individuals — a child, an adolescent, an adult, a pregnant woman or an elderly person. Each of these individuals has his/her own specific nutrient requirements. *The basic aim while planning meals should be to fulfil the nutrient need of each individual.* How do we ensure this? This can be ensured by planning balanced meals according to the recommended dietary intakes for different individuals.

ii) **Plan balanced meals:** Do you recall the discussion we had in Block 2 on how to plan/prepare balanced meals? We talked about the three food groups namely — energy-giving, body-building and protective/regulatory food group. *Including food items from each of these three food groups in each meal can ensure balanced diets.*

What are the food items in each group? Can you list them? Think of all the food items available and list them in Chart I under the heading 'Food item' according to the group they belong to. For example, in the energy-giving group, cereals are included. List all cereals like wheat, rice etc. in the place provided in front of cereals as indicated in Chart I. Similarly, you could list the food items included in the other food groups.

CHART I: The three group classification of food

FOOD GROUPS		FOOD ITEMS
a) Energy-giving	*Cereals	Rice, wheat, ...
		.....
		.....
	*Roots and tubers	Potato, ...
		.....
		.....
	*Fats/oils	Vegetable oils, ...
		.....
		.....
	*Sugar	.....
		.....
b) Body-building	*Milk and milk products	.....
		.....
	*Meat/fish/poultry/ egg	.....
		.....
		.....
	*Pulses	.....
		.....
		.....
c) Protective/ regulatory	*Green leafy Vegetables	.....
		.....
	*Yellow and orange vegetables	.....
		.....
	* Other vegetables	.....
		.....
	*Citrus fruits	.....
		.....
	*Yellow and orange fruits	.....
		.....
		.....
	*Other fruits	.....

Now the problem is, which food items to include from this exhaustive list? The selection of food items from each food group would depend on how much the individual can spend on food and what is available and acceptable to the individual. These aspects are discussed in the subsequent points.

iii) **Economic considerations:** The income of the family, or more specifically, the amount of money available for food per person influences the kind and amount of food to be included in each meal. To understand this better consider the three income groups — low, middle and high.

- People with limited income or those belonging to the *lower income group* may not be able to include much of milk, meat and fruits in their daily diet as these are expensive foods. So the crucial decision is what food items to select that would

enable them to plan nutritious meals at low cost. Well, there are many ways in which one can ensure nutritious meals without increasing the cost. To begin with, one could use:

- more of the cheaper foods like cereals. It would further lower cost if high priced cereals such as rice or wheat are partially replaced by millets i.e. ragi, jowar, bajra and partially by roots and tubers i.e. potato, colocasia, tapioca
- jaggery instead of sugar
- seasonal and locally available fruits and vegetables only
- food combinations (cereal/pulse) and processes like germination, fermentation, to improve the nutritive value (as they add extra nutrients without extra cost)
- cheaper variety of pulses and cheap nuts such as groundnuts
- vegetable oils

- People belonging to *middle income group* can surely have more variety by including more of cereals (rice/wheat), pulses, milk, fruits and vegetables. They can have reasonable amounts of fats/oils and sugar in their diets. However, use of nuts/oilseeds and other miscellaneous foods like jam, jellies etc would be limited.
- As *income rises* one gets the freedom to choose from a wide variety of foods — in or out of season, locally available or purchased from outside. Consumption of milk and milk products, meat, vegetables, fruits, fats/oils etc.tends to increase. But care needs to be taken that foods like fats/oils, sugars, are not taken in amounts more than needed by the body.

iv) **Food Acceptance:** Individual likes and dislikes, religious taboos, socio-cultural practices are some of the factors that influence an individual's acceptance or rejection of certain foods. While planning one should take into consideration all these aspects and accordingly select the foods. Here are a few key points you could keep in mind:

- *Include traditional or region-specific foods in a meal.* For instance, rice and rice-preparations like idli, dosa, etc.are typical foods of the South (Tamil Nadu). Similarly, dhokla, khandvi etc. are typical of West India (Gujarat). Including such foods in a meal would make meals acceptable because people living in these regions are familiar with these foods and have been tuned to their specific taste and preparations.
- *Plan meals keeping the religious considerations in mind* since religion greatly influences food acceptance. For instance, you know that in certain communities eating meat and other flesh foods, is totally forbidden. Even among flesh foods, eating of beef is forbidden in one community and pork in another. A wise planner should know about the various food preferences of religious groups and accordingly provide meals.
- *Plan meals keeping in mind the likes/dislikes of the individuals.* But, remember likes/dislikes should not interfere with meeting the nutrient needs of the individual. Milk and green leafy vegetables, for example, are generally disliked by children and frequently not consumed. In such a situation, therefore, the diet could lack in certain essential nutrients. We need to avoid this. Keeping the dislike in mind it is always better to change the form of food and then include it in the diet and make it more acceptable (Figure 7.3). For instance,if milk is disliked then it is better to serve curd, cottage-cheese based preparations or any other milk product.

Fig. 7.3 The form in which food is served influences food acceptance

v) **Food Availability:** The availability of certain food items in a particular region influences meal planning. For instance, in the coastal regions, fish and other sea foods are easily available and cheap. These foods form an essential part of the diet of people residing in the coastal region. Similarly, rice is a common staple grown in the South. Hence, it should and usually does form the major ingredient in the meals planned for the Southern household. The availability of food according to seasonal variation is also to be considered. This is specially true of fruits and vegetables. A knowledge of fruits and vegetables and their season of availability would help us to include them in the meal when they are at their peak quality and at an affordable price.

So far we have talked about the various factors influencing the selection of food while planning meals. Now we move on to discuss the factors; influencing meal patterns.

vi) **Meal Frequency and Meal Patterns:** You may have noticed that in different households the number of meals consumed in a day vary. In some households only 2-3 meals daily are taken, whereas, in others as many as 5-6 meals may be eaten in a day. The timings of these meals may also vary. Why is this so? The income, activity pattern, physiological state and age of the individual influences meal patterns.

An individual belonging to high income group would generally consume more meals, as compared to an individual belonging to the low income group (income factor). A small child may not be able to eat much at a time. So he would need to be given small frequent meals (age factor). Similarly a pregnant/ lactating woman, whose nutrient needs increase considerably, may need to be given nutritious snacks and other foods preparations in between meals to accommodate her increased nutrient need (physiological state). The work schedule of the individual would also influence meal pattern—the timing of meals and the number of meals consumed at home and those eaten away from home.

This discussion demonstrates how important it is to *keep the age, income, activity pattern, physiological state and work schedule of the individual in mind, while deciding on the meal frequency and meal pattern.*

vii) **Economize on time, labour and fuel:** You are aware that one of the basic aims of meal planning is to economize on time, labour and fuel. This point is particularly important for the families where the woman is working or where income is limited. Consider the case of Rati, who is a working woman. Rati may not get enough time to plan/prepare elaborate meal. So she would probably prepare simple meals that are easy to cook, as well as, save time and energy. For example, instead of catering for individual items like rice/dal/vegetable/curd in a meal, she may cook only one-dish meals like khichri (rice/dal/vegetable preparation), bisi bella huliyanna (rice/sambar preparation) or at the most two-dish meals like vegetable pulao/curd; rice/sambar; chapati/palak-dal. *The need here is to prepare simple meals which are nutritionally balanced.*

Similarly, consider the case of Rani who belongs to the low income group. Limited resources may affect her choice of food and menu. She would rather prepare one-dish meals like poushtik roti, missi roti etc. which take less time and fuel to cook. These examples have illustrated one way in which we can economize on time, labour and fuel. Another simple way to economize on our resources is to:

- *Plan menus for several days in advance.* It is beneficial to plan weekly menus. Look at the weekly menu given in Table 7.1.

Table 7.1: Weekly Menu

	Breakfast	Lunch	Dinner
SUNDAY	Buttered toast Omelette (egg preparation) Milk	Poori Aloo (potato) curry Sitaphal (Pumpkin preparation) Boondi raita (Curd preparation)	Rice/Chapati, Urad dal Aloo-gobi Sabji (Cauliflower-potato preparation)

	Breakfast	Lunch	Dinner
SATURDAY	Plain parantha with butter Pickle Tea	Rice/Chapati Moong dal Aloo-baingan sabji (brinjal-potato preparation)	Chapati Palak-paneer (spinach-cottage cheese preparation) Onion-cucumber tomato salad
FRIDAY	Cauliflower stuffed parantha Pickle Milk	Rice/Chapati Kabuli chana Cucumber raita (curd preparation)	Khichri Mixed vegetables Curd Papad Pickle
THURSDAY	Toast with butter Fried egg Tea	Rice/Chapati Masoor dal Gajar-methi Sabji (carrot-fenugreek leaves preparation)	Poushtik roti (wheat flour/dal/ vegetable preparation) Curd Pickle
WEDNESDAY	Potato stuffed parantha Curd Pickle Tea	Chapati Chana dal Sag-palak (spinach preparation)	Vegetable pulao Mint raita (curd-mint preparation) Papad
TUESDAY	Porridge Toast with Jam Tea	Rice/Chapati Kari (besan-curd preparation) Aloo - gobi sabji (cauliflower - potato preparation)	Chapati Ghia kofta (bottle gourd preparation) Chana dal-karela sabji (Bengal gram dal-bitter gourd preparation)
MONDAY	Paneer stuffed parantha Pickle Tea	Rice/Chapati Rajmah Aloo-shimla mirch Sabji (potato-capsicum preparation)	Chapati Moong dal Gajar - matar (carrot-peas preparation)

These are sample menus for breakfast, lunch and dinner in a Punjabi household. You could prepare a similar weekly menu for your family based on the meal pattern of your region.

Setting out the menu at the beginning of the week will help to:

— *ensure minimum repetition of foods and food combinations*

— *purchase food items*. For example, staple foods like cereals, pulses could be bought in bulk once in two weeks or preferably once a month; vegetables like onion/ potatoes could be bought once a week. Perishable foods, specially milk ar certain vegetables, could be bought daily. *Remember buying in bulk saves on tim money and energy*.

— *use the leftover food from previous meals*. Suppose you have some dal leftover from lunch. This dal can be reused to prepare poushtik roti for dinner. Mix the leftover dal with whole wheat flour. To this mixture add onion and vegetables (li boiled carrots, green leafy vegetables). Knead the dough and prepare poushtik roti. This can be served with curd and pickle.

— *undertake pre-parations in advance:* for instance , if you want to cook bengal gram or any such whole pulse like rajmah/soyabean for lunch , it would be bet to soak the grams in water overnight. By doing so the outer hard covering of th

seed grain would soften, thereby, aiding in the cooking process and saving on time and fuel.
— *ensure efficient use of time and labour.*

viii) **Variety in meals:** One would definitely not like to eat the same kind of foods every day. That's why, while planning meals, one should include variety of foods in the meals. A mixed diet consisting of *foods from the three food groups,* as studied earlier, would help ensure nutritional adequacy. Further, *varying the choice of food items selected from each of the food groups* from day to day, would help avoid monotony in the diets. *A suitable combination of foods in terms of colour, texture, flavour and varying the methods of cooking* would help make meals look more appealing and attractive (Figure 7.4).

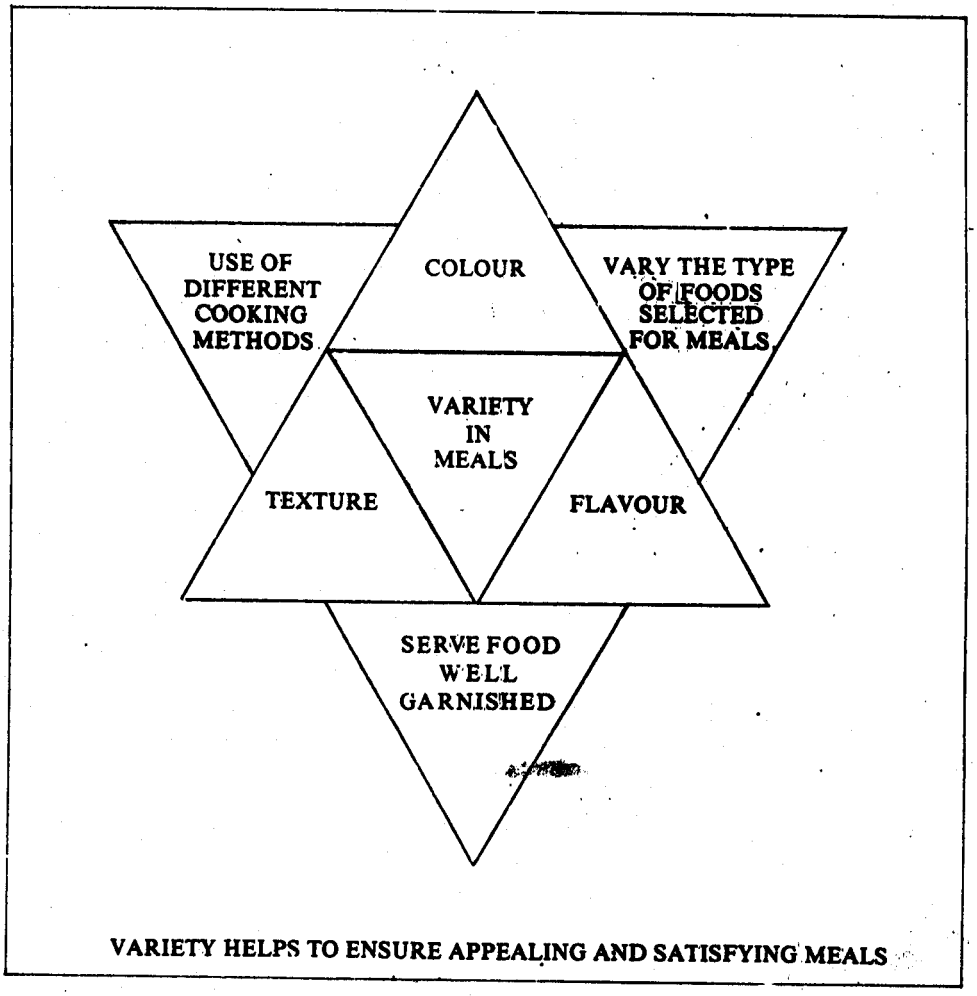


Fig. 7.4 Variety in meals

Here are a few handy tips on how to make meals appealing and attractive.

- *Include attractive colour combinations of food in the meals:* To illustrate , consider a meal consisting of black gram dal, palak bhaji (spinach vegetable) and chapati. This meal, though being nutritious, may not look appealing and attractive as all food items are black, or dark in colour. In contrast, a meal consisting of moong dal, palak-bhaji, chapati, curd and tomato-onion salad looks appealing and colourful as there is a beautiful blend of colours i.e. the yellow of dal, green of green leafy vegetables, white of curd and red of the tomato.
- *Include a combination of flavours in the meals:* There are a wide variety of foods with varying flavours. Foods like garlic, onion, cabbage, turnip have intense (strong) flavour. Foods that are delicate (mild) in flavour include the staple foods (i.e. wheat/rice, bread, potato), milk, vegetables like peas, cucumber and fruits like papaya, pear and banana. *Combine mildly flavoured foods with those that are strongly flavoured.* It is interesting to know that some flavours enhance others like butter with bread, mint chutney with pakora or coconut chutney with idli. On the other hand, some flavours mask others like onion with pickle. Some flavours are pleasing when foods are eaten together like rice/fish, rice/sambar, dal/roti. *The art of good meal planning actually lies in a judicious blend of the varying flavours.*

• *Include a combination of textures in the meals :* Combining soft and crisp. smooth and hard textures, would make meals more appealing. To illustrate, consider a meal consisting of rice, sambar, curd and papad. In such a meal rice, sambar, curd are soft and smooth. You can add crispness to this meal by including a papad or a raw salad.
• *Use a variety of preparation methods:* Variety in preparation should be part of meal planning. No two foods prepared in the same way should be included in one meal. Variety may be introduced by pre-preparation processes like germination or fermentation of food in addition to the usual methods of cooking, namely frying, boiling, roasting, steaming, baking. Foods can be varied further by serving them well garnished or by adding butter/ghee.

ix) **Satiety value:** Meals should be such that they have a good satiety value. By satiety we mean meals should relieve hunger and give a feeling of satisfaction and fulness. You know that fat and protein-rich foods have high satiety value as compared to carbohydrate rich-foods. Hence, some amount of fat and protein foods must be included in each meal so as to provide adequate satiety value and prevent the person from feeling hungry before it is time for the next meal.

From our discussion above you would have got a good idea of what points one needs to consider while meal planning. The points to remember given below, present a summary guideline to meal planning.

POINTS TO REMEMBER
Meal Planning

1. Plan meals according to the age, sex, income, activity pattern, work schedule of the individual.
2. Dc plan meals in advance.
3. Ensure that meals planned help to meet the recommended dietary intakes for each member of the family.
4. Include atleast one food item from each of the three food groups in each meal.
5. Include seasonal and locally available foods in the meals.
6. Economize on the resources—time, labour and fuel.
7. Include in the meals those foods/dishes which are liked by family members.
8. Prepare the dishes in the way people know or are familiar with.
9. Introduce variety by including foods of different colour, texture and flavour in each meal.
10. Avoid repetition of foods and method of preparing food.
11. Ensure that meals prepared relieve hunger and give a feeling of datisfaction and fulness.

Check Your Progress Exercise 2

1) Eack of the following statements highlights the role of a particular factor in meal planning. Identify the factor in each case.

a) A family abstains from eating beef.

.....

b) A meal consisting of dal, palak-sag (green leafy vegetable preparation), rice/chapati and tomato salad looks appealing and attractive.

.....

c) In the northern region wheat and other wheat preparations are more commonly consumed.

.....

d) Some amount of fat, protein, carbohydrate and vitamins/minerals should be included in each meal.

.....

e) Processes like germination/ fermentation, combinations (cereal/pulse) are used to make meals nutritionally adequate.

.....

f) A woman prepares khichri (cereal/pulse/vegetable mixture) for lunch rather than a full meal of rice/dal/vegetable etc.

.....

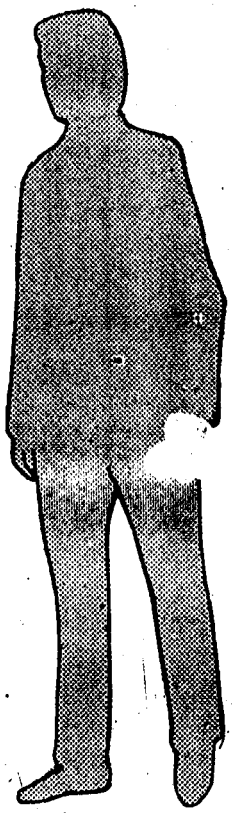
2) Give any three reasons to justify why meal planning is important.

.....

.....

.....

.....



7.3 THE ADULT

The term 'adult' refers to any individual *in the age group of twenty years and above.* The period beginning from twenty years and extending through old age till the time of death is considered the period of adulthood. Adulthood represents the stage in life when an individual has completed his/her growth in terms of body size. The nutritional need is for maintenance of body functions rather than for growth.

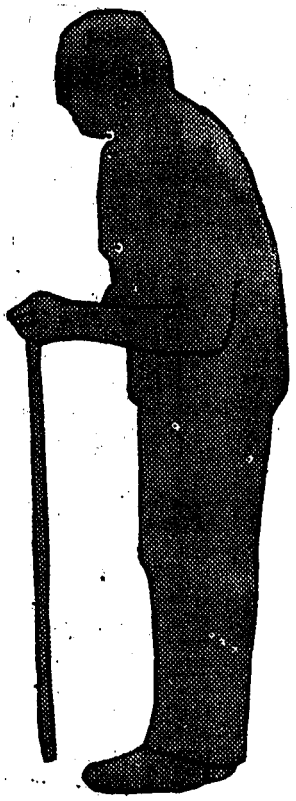
As an individual ages there is a gradual and progressive change in body functioning. Why does this happen? This is because there is an increased breakdown of tissues and the renewal of worn out tissue is also much less. These changes associated with ageing are common to all individuals, but, there is great variation from person to person. In some individuals the changes become significant relatively early, whereas, in other cases these changes appear much later in adulthood.

The entire period of adulthood can be divided into two stages:

The Young Adult: A person in the early years of adulthood representing the stable state in life, when tissue breakdown is not predominant or significant. The body retains the capacity to adequately replace the worn out tissue; and

The Older Adult: A person in the latter years of adulthood. This period is characterized by excessive breakdown of tissues and cells. The body can no longer compensate for tissue loss adequately.

What are the changes associated with ageing? How do these changes affect the functioning of body systems? You will find the answer to these questions in the subsequent section.



Physiological changes during ageing: The effect of ageing on the functioning of some specific body systems is discussed here:

1) **Kidney functions:** During ageing there is a marked reduction in the number of functioning kidney cells. This affects kidney functioning. As a result, the body wastes are not effectively removed from the body.

2) **Digestive tract functioning:** The number of taste buds present in the mouth decrease with ageing, which reduces the sensitivity to taste. There may also be a reduction in the amount of saliva secreted, thus making swallowing somewhat difficult. To add to this, is the problem of loose teeth which makes chewing difficult. Further there is a decrease in the amount of acid and other digestive juices secreted by the digestive tract, as a result, the food is not digested and absorbed properly. The food stays in the stomach for a longer time because of which a feeling of fullness and heaviness is commonly experienced. The muscles of the digestive tract also become weak and the movement of food in the tract slows down. Constipation commonly sets in.

3) **Skeletal system:** Skeletal bone loss occur with ageing and may have serious consequences among the elderly. You have studied earlier that bone is chiefly made up of two minerals namely, calcium and phosphorus. With ageing there is some thinning of bone tissue due to the loss of these minerals. In some individuals, however, there is an abnormal thinning of bone tissue, as a result, Osteoporosis develops. Osteoporosis is the condition when the bones become weak and britlle. Old people, specially women are vulnerable to osteoporosis. But it is important to remember that these acute bone changes do not occur in all elderly persons.

Let us now study how these changes influence the nutrient need of adults.

7.3.1 Recommended Dietary Intakes for the Adult

The dietary intake for adults is expressed in terms of a reference man/reference woman. What do we mean by reference man/woman? Do you recall the discussion we had on reference man/woman in Unit 6 of Block 2?

The Indian *reference man* you learnt belongs to the age group 20-39 years and weighs 60 kg. Let us get to know some more details about him. He is free from disease and physically fit for active work. On each working day he is employed for 8 hours in an occupation that usually involves moderate activity. When not at work, he spends 8 hours in bed, 4-6 hours sitting and moving about and 2 hours in walking and in active recreation or household work.

Similarly, consider an Indian woman in the age group 20-39 years who weighs 50 kg. This, as you know, describes the Indian *reference woman*. She may be engaged for 8 hours in general household work, in light activity or in other moderately active work. Apart from 8 hours in bed, she spends 4-6 hours sitting or moving around only through light activity and 2 hours in walking or in active recreation or household duties.

From our discussion above, it is evident that the age, body size and activity level of the reference individual is defined. But you may be wondering why we need reference individuals to compute RDIs for adults. This is because there is great variation in the nutrient needs of adults based on age, sex, body weight (i.e. the body size) and of course physical activity. RDIs are given for reference individuals and adjustment is then made in the nutrient need of adults who deviate from this reference.

Let us now look at the recommended dietary intakes of adults given in Table 7.2.

Table 7.2 : Recommended Dietary Intakes for Adults

	Man (weight – 60 kg)			Woman (weight – 50 kg)		
Nutrient	Sedentary work	Moderate work	Heavy work	Sedentary work	Moderate work	Heavy work
Energy (Kcal)	2425	2875	3800	1875	2225	2925
Proteins (g)	60	60	60	50	50	50
Calcium (mg)	400	400	400	400	400	400
Iron (mg)	28	28	28	30	30	30
Vitamin A (μg)						
Retinol	600	600	600	600	600	600
or						
Carotene	2400	2400	2400	2400	2400	2400
Thiamine (mg)	1.2	1.4	1.6	0.9	1.1	1.2
Riboflavin (mg)	1.4	1.6	1.9	1.1	1.3	1.5
Niacin (mg)	16	18	21	12	14	16
Ascorbic acid (mg)	40	40	40	40	40	40
Folic acid (μg)	100	100	100	100	100	100
Vitamin B_{12} (μg)	1	1	1	1	1	1

Source: Nutrient Requirements and Recommeded Dietary Intakes for Indians, ICMR (1990).

In Table 7.2 you would have noticed that:

- the nutrient requirements for adults are given under the three categories based on activity level — sedentary, moderate and heavy work and
- the nutrient requirements for men and women are given separately.

Why is it so? This is because the activity level, sex, body size/composition all influence the nutrient need. Let us consider each of them separately.

a) **The influence of activity level on RDIs for adults:** Based on the nature of work and level of activity different occupations are classified into three categories — sedentary, moderate and heavy (Figure 7.5).

- *Sedentary meaning light work:* A sedentary person is one who does most of the work sitting at one place using only his hands and head. A few examples of individuals undertaking sedentary work include teachers, tailors, typists, clerks, office executives, housewives who have household help.

- *Moderate meaning neither too light nor too strenuous/hard work:* A person is said to be moderately active individual if his/her work involves use of both hands and feet continuously but not very strenuously. A few examples of people who would belong to this group would include postmen, housemaids, servants, fishermen, agricultural labourers, housewives who do most of the housework themselves manually.
- *Heavy meaning hard, strenuous work:* A person is a heavy worker if he/she is involved in hard/strenuous work using hands and feet very fast and continuously for a long period each day. Rickshaw pullers, stone cutters, mine workers, coolies belong to this group.

Fig. 7.5 The three categories based on activity level

The nature of work influences the nutrient need. A man doing heavy, strenuous work needs an additional supply of energy as compared to a man doing moderate or light work. *The RDIs for energy and B vitamins are based on activity level.* As the activity level increases energy requirements increase and so does the B vitamin need as can be seen from Table 7.2. What about the other nutrients.? The requirement for all other nutrients is not influenced by the activity level.

We just talked about how activity level influences energy requirements. However, activity level is not the only factor determining energy requirements. Which is the other factor? Read Highlight 1 for more details on this interesting aspect.

HIGHLIGHT 1

Estimating energy requirements

Consider a situation when an individual is resting or sleeping. What would be the energy requirement of the body under such a situation. You could argue that no physical activity is being performed so the body does not need energy. Is this true? Haven't we forgotten something? The heart beats, the blood circulates and respiration, digestion, absorption and maintenance of body temperature continues even when the body is at rest. Some amount of energy is required by the body to maintain these vital metabolic body functions. *The amount of energy used in performing these functions when the body is at complete rest (both mentally and physically) is termed basal metabolism. The rate at which energy is required to carry on these functions is known as the Basal Metabolic Rate (BMR) of an individual.*

What then is the total energy requirement of an individual? How do we calculate it? We take the basal metabolic rate of an individual as the foundation for calculating the total energy requirement. To the basal metabolic rate, the energy required for performing other physical activities like walking, playing, as well as, manual work (which could be light, moderate or heavy) is added, and that is how the total energy requirement of an individual is calculated (Figure 7.6).

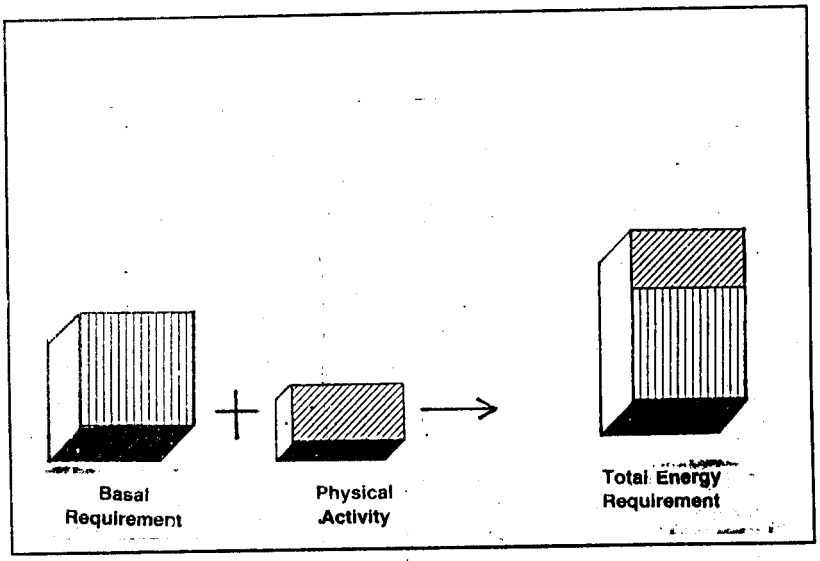


Fig. 7.6 Major components of energy requirement

One other question that comes to mind is—does the BMR, like physical activity, differ from individual to individual? What do you think? The answer is, yes. The BMR varies from one pereson to the other. The age, sex, body size/composition, growth, fever, stress, fasting, malnutrition are some of the factors that influence BMR. In general. BMR is higher in growing children, pregnant women, adult males and in people with fever or under stress. BMR is lowered by fasting/starvation, malnutrition

b) **The influence of body size/composition on RDIs for adults:** In Table 7.2 you would have noticed that the nutrient needs of men and women vary (sex difference). The

energy and protein requirement of the woman is lower than that of a man of corresponding age and activity level. You might be wondering why this is so? Well, the basic difference lies in the body size/composition. In the case of the man, the body has more of active tissues such as the muscles. The woman, on the other hand, has more of the relatively inactive fatty tissue. How does this influence energy needs? The muscle tissue requires more energy for its activity. As a result, the basal metabolism of the man is higher than that of the woman and hence the energy requirement of the man increases. The RDIs for proteins, on the other hand, are linked to body weight. In Unit 6 of Block 2 you learnt that an adult requires 1 g protein per kg body weight. Men (60 kg) weigh more than women (50 kg) of the corresponding age and hence have higher protein needs.

What about the requirement of other nutrients? The iron requirement for women is much more than that of men. This is so because extra iron is required to compensate for iron losses through menstruation in the woman in the reproductive age group. The requirement for all other nutrients is the same for both the man and the woman.

Now, let us study what happens to the nutrient requirement of adults with ageing.

c) **The influence of age on RDIs for adults:** The age of the adult influences the requirement for some of the nutrients. You have learnt earlier that with ageing there is a decrease in the body functioning and performance. Hence, body metabolism is lowered. This factor, together with the reduced physical activity creates less demand for energy. Table 7.3 tells you how energy requirement decreases with age.

Table 7.3 : Changes in RDIs for Energy with Age

Age (years)	% of RDI for energy
20-39	100
40-49	95
50-59	90
60-69	80
70-79	70

Source: Nutrient Requirements and Recommended Dietary Intakes for Indians, ICMR (1990)

Using this table, let us learn how to calculate the energy requirement. Consider a sedentary adult man. You learnt earlier that this man requires 2425 Kcal. This is 100 per cent RDI. By the age of 40 he would require 95 per cent i.e. 95/100 of 2425=2304 Kcal. Similarly, when he is 60, his energy requirement would further decrease to 1940 Kcal i.e. 80/100 of 2425. This calculation can be used for both men and women of any activity level.

It is clear, then, that with ageing the energy requirement decreases. What about the requirement for other nutrients? Do they also decreases? Well, in contrast to energy, the requirement for other nutrients namely protein, iron, B vitamins remains the same as that of a younger adult. This is so because *these nutrients* are requied to compensate for wear and tear and for excessive breakdown of tissues common in old age. One mineral that need emphasis and possible increase is calcium. Recent studies have shown that increased calcium intake during old age help prevent calcium loss (from the tissues) and development of osteoporosis. But still there is some controversy regarding nutrient requirement for older adults.

Check Your Progress Exercise 3

1) List any two important physiological changes which take place during ageing.

.....

.....

.....

2) State whether the following statements are correct or incorrect. Correct the false statements.

a) Adulthood represents a period from 50 to 80 years. (True/False)

.....

b) During old age, there is an increase in the active tissue i.e. the muscles.

(True/False)

.....

c) Women require as much energy as men of the corresponding age, activity level. (True/False).

.....

d) At the age of 65 years there is reduction in the requirements for protein and calcium. (True/False)

.....

e) All old men and women suffer from osteoporosis. (True/False)

.....

f) Energy requirements for adults are based on the activity pattern of the individual. (True/False)

.....

3) Calculate the energy requirement of a sedentary woman aged 55 years.

.....

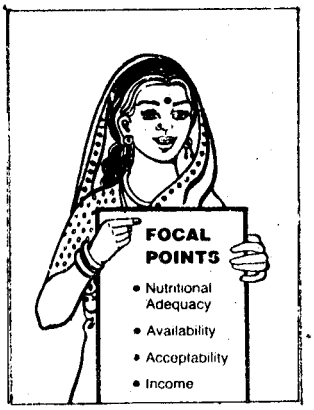
.....

.....

.....

7.3.2 Meal Planning for the Adult

You have so far studied the nutrient needs of adults. Let us now learn as to how to translate these RDIs into meals or food items to be consumed that would help maintain optimum nutrition. In this section we shall learn how to plan meals for bo the young adult and the older adult.



You are aware that the nutrient needs of adults vary based on the age, sex, and activity level. To help meet the varying needs it is obvious that the meals planned f adults would also be varied.

In general, whatever be the nutrient need, remember meal planning should take in consideration the basic four factors listed in the *margin here.*

Certain other considerations that need to be kept in mind while planning meals include:

- Whom are we planning for?
- Which nutrients are of particular importance?
- Which foods to select?
- What should be the meal pattern?
- What are the specific considerations?

In this unit and subsequent units we will discuss meal planning under these heading

We begin meal planning by first identifying :

Whom are we planning for?

Is the adult we are planning for:

- old or young
- men or women
- sedentary, moderate or heavy worker
- belong to low, middle or high income level?

Information about these specific characteristics would help you determine the nutrient need, the kind and amount of food needed and the meal pattern to be followed. Based on the information you can list the RDIs.

Which nutrients are of particular importance?

During adulthood nutrients are required basically for the maintenance of body functions. The diet should, therefore, include sufficient amounts of all three →

categories of nutrients namely:

- Energy-giving (carbohydrates/fats)
- Body-building (proteins)
- Protective/regulatory (minerals/vitamins)

However, depending on the age, sex and activity level of the adult, the amount of nutrients required from each of the three categories would vary. For instance:

- an older adult would require less energy-giving nutrients as compared to a younger adult
- a woman would require less energy-giving and body-building nutrients but more iron as compared to a man of the same age and activity level
- a heavy worker would require more energy-giving nutrients than a sedentary worker.

Which foods to select?

To provide a nutritionally adequate and a well-balanced diet one should include at least one food item from each of the three food groups (i.e. energy-giving, body-building and protective/regulatory). The day's diet for an adult should essentially contain:

- *a cereal* i.e. wheat, rice, bajra, jowar or any other staple commonly used
- one or more of *the pulses*, (preferably in combination with cereals) or *meat, fish, chicken if acceptable*
- some amount of *milk or milk products*
- at least *one green leafy vegetable* like spinach, fenugreek leaves, mustard leaves etc.
- *other vegetables* like cauliflower, carrot, brinjal etc.
- some *seasonal fruits*
- *fats* and *oils* in adequate amounts
- *sugar/jaggery* according to taste.

We have just gone through a simple guide on what food items to include in a diet. But remember the kind and amount of food selected would be influenced by the income and activity pattern of the individual. Which foods to select when income is limited or when income is high has already been discussed earlier in Section 7.2.2. Now let us examine how the activity pattern influences the selection of foods.

Consider the case of Hari. Hari is a rickshaw puller, who travels long distances carrying people from one place to another. He is a heavy worker. Obviously, his requirement for energy would be much higher as compared to a sedentary worker. What about the protein need? You know protein need is not influenced by activity level. The need would be the same as that for a sedentary or moderate worker. Hence, while planning meals for Hari, we would need to include more of energy-rich foods such as cereals (including roots and tubers), fats/oils, sugar/jaggery so as to help meet the increased need for energy. Protein-rich foods like pulses, milk and protective/regulatory foods like fruits, vegetables may be given in just sufficient amounts to maintain body functions.

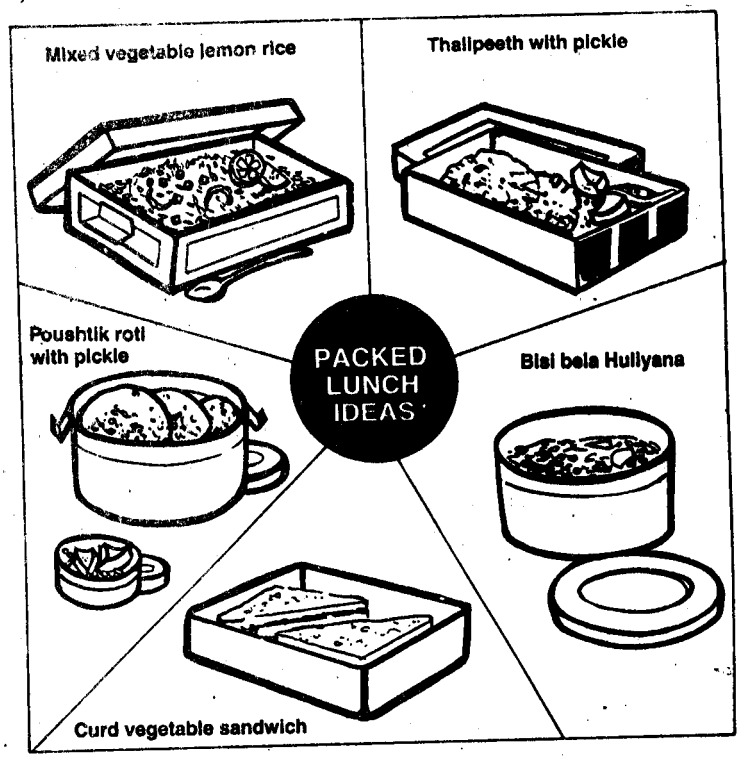
What should be the meal pattern?

The daily routine of the adult influences the meal pattern. Let us first consider those *adults who are engaged in an occupation. For them the work-timing is important.* It is commonly observed that *most people work for 8 hours* (the timings being 9 a.m. to 5 p.m. or 10 a.m. to 6 p.m.). The meal timing, number of meals and the kind of meals planned, therefore, need to be adjusted according to these work timings. The common meal patterns likely to be followed would be as under:

A	B	C	D
Breakfast	Breakfast	Brunch	Bed tea
Packed lunch	Mid-morning meal	Packed lunch	Brunch
Dinner	Packed lunch	Tea	Packed lunch
	Tea	Dinner	Tea
	Dinner		Dinner
			Bed time

i) Lunch and dinner are the two main meals consumed in a day. Ensure that lunch and dinner provide atleast 1/3rd of the total day's calories. Breakfast and the rest of the meals together should provide the remaining 1/3rd of the total day's calories.

ii) Packed lunches are commonly carried by working adults. By packed lunch we mean any food preparation carried to the place of work which is consumed in the afternoon. It is essential that the packed lunches carried be balanced. The packed lunch must include at least one food item from the three food groups, namely energy-giving, body-building and protective/regulatory foods. This, however, does not mean that we include three items (one for each group) in a packed lunch. One-dish meals can also provide most of the nutrients. A few interesting ideas for packed lunches (Figure 7.7) include—Paneer/dal stuffed paranthas with pickle, poha (preparation made of rice-flakes, vegetables and groundnut), vegetable upma (preparation of semolina, vegetable and pulse), poushtik roti with pickle, lemon-vegetable rice, curd rice with vegetables, thalipeeth (preparation of wheat, bengal pulse and green leafy vegetables) with pickle, bisi bella huliyanna (rice/sambar preparation). For details refer to Section 4 of Practical Manual 1.



Nutritious one-dish meals

Fig. 7.7 Ideas for packed lunches

iii) Brunch in meal pattern C refers to a heavy breakfast. It is actually a heavy meal consumed in the morning. Including more of fat and protein-rich foods in this meal would be advantageous as they would provide adequate satiety value and prevent the person from feeling hungry before it is time for the next meal.

iv) Dinner is one meal which the adult can eat at leisure and hence it could be an elaborate meal. But this does not mean that it should be heavy.

If the person is not working then the meal pattern followed would be the same as suggested earlier in Unit 6, Block 2.

So far we have talked about how to provide adequate, well balanced meals for young adults. Now, let us examine the specific considerations one would keep in mind, in addition to the points discussed above, while feeding older adults.

What are the specific considerations for the older adult?

Various physiological changes take place during ageing. These changes (specially the digestive tract changes) necessitate certain modifications in the kind and amount of food to be included in the meals, the number of meals to be consumed, the method of preparation to be adopted. What are these modifications? Let's learn:

i) During ageing there is a problem of loose teeth. As a result, chewing becomes difficult. What does one do in such situations? A change in the texture and method of preparation of food is recommended. *Include only soft, well cooked, mashed or finely cut foods in the diet.* All hard foods, with skin or seeds should be avoided unless they can be softened by mashing or grating (Figure 7.8).

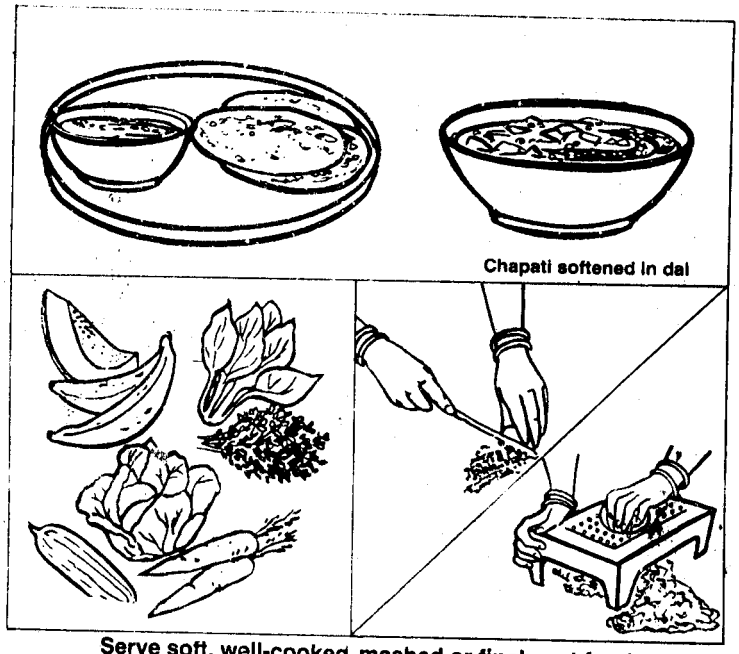


Fig. 7.8 Modifications in the food preparations for older adults

ii) During ageing there is the problem of impaired taste sensitivity. As a result, the pleasure of eating is partially lost. It is,therefore,advisable that the meals for the aged should be made more attractive and appealing by *including a variety of foods and colour combinations so as to encourage/motivate the elderly person to eat. Any strongly flavoured foods or foods with a strong smell or totally bland foods should be avoided.*

iii) Particular *attention has to be given for including protective foods (fruits/vegetables) in the diet of the elderly person,* since these foods are frequently overlooked or omitted.

iv) Old people commonly complain of having a feeling of fullness or heaviness. In such cases, therefore, *small meals at frequent intervals should be given* so as to help in the digestion process. Any *fried or fatty foods or highly concentrated foods like sweets should be avoided.*

v) Constipation is a common complaint during old age. To overcome this problem *include plenty of fibre rich foods/water and fluid in the diet.* Fluid in the form of butter milk, juices, tea, soups and other beverages can be given, in addition to water. An intake of six to eight glasses of water a day is recommended.

Some tips on how to provide adequate and satisfying meals for older adults are listed below in points to remember.

POINTS TO REMEMBER

Older Adults

Do's	Don'ts
1. Ensure sufficient intake of milk, green leafy vegetables cereals and other calcium-rich foods	1. Do not serve big pieces of raw or hard foods
2. Include more of protective foods such as fruits and vegetables in the diet	2. Avoid serving strongly flavoured foods or food with strong smell
3. Include plenty of water and fluids in the diet	3. Bland foods need not necessarily be given
4. Serve soft, well cooked, mashed or finely cut food in the meals if there is a problem in eating	4. Do not give spicy foods if poorly tolerated
5. Include fibre-rich foods in the meals	5. Cut down fatty, fried foods

Do's

6. Increase the meal frequency
7. Reduce the total amount of food served at one meal
8. Encourage a regular pattern of food intake
9. Encourage the elderly person to eat with the other members of the family
10. Ensure that an elderly person does not skip meals

NOTE : REFER TO SECTION 5. OF THE PRACTICAL MANUAL-PART I FOR A STEP-BY-STEP GUIDE TO THE PLANNING OF DIETS FOR THE ADULT. SECTION 6 DISCUSSES MODIFICATIONS FOR SEX AND ACTIVITY LEVEL.

Check Your Progress Exercise 4

1) Fill in the blanks.

a) Meals planned for any individual should be.....and.....

b) A meal plan for a heavy worker, would have more of..... rich foods.

c) A.....meal pattern should be followed for an adult belonging to the lower income group.

d) An old man cannot digest food properly. Hence avoid..... and.....foods in the diet.

e) Selecting the right kind of food in the right..... and.....would help ensure balanced meals.

2) What two major aspects would you keep in mind while planning meals for a coal-mine worker?

.....

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.....

3) List any three dietary considerations you would keep in mind while planning meals for your grandmother.

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.....

7.4 LET US SUM UP

In this unit you studied the importance and need for meal planning. Meal planning, you learnt, means planning for adequate nutrition. It involves proper selection of food to ensure balanced meals. It helps to make meals look more attractive and appealing through the judicious blend of colour, texture and flavour. It also helps to make the best possible use of available money, time and energy. There are many factors which influence meal planning, some of which include nutritional adequacy, economic considerations, acceptability and availability.

The second major aspect dealt in the unit is adulthood. Adulthood, you learnt, represents the stage in life (twenty years and above) when all growth in terms of body size is completed. Nutrient need is for maintenance of body functions rather than for growth. However, there are great variations in the nutrient need of adults based on their physical activity, age, sex and body weight. This aspect should be kept in mind

while planning meals for adults. The kind and amount of food included in the meals should be according to the age, activity, income and work schedule of the individual. Meals should help meet the nutrient need of adults.

7.5 GLOSSARY

Ageing : The term ageing describes the process of gradual and progressive changes which take place over the entire adult life span.

Constipation : A condition characterized by difficulty in passing stools.

Garnish : A term used in cooking which means to decorate food items/ dishes.

Perishable foods : It refers to foods that would spoil easily.

Staple foods : Foods used frequently or daily, for example, rice (in the south) or wheat (in the north).

Taste-buds : Small organs of taste on the tongue, which help to detect different taste/ flavours i.e. sweet, sour, salty, bitter.

Texture : Refer to the structure, appearance, consistency of foods, food items. Crisp, smooth, soft, hard or chewy are some of the texture of the food.

7.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) a) Seven.

b) Bed tea, Breakfast, Mid-morning meal, Lunch, Mid-afternoon meal, Dinner, Bed time.

c) Plan a menu based on the availability of foods in your region.

Check Your Progress Exercise 2

1) a) Religious consideration
b) Variety in meals
c) Food availability/acceptability
d) Balanced meals
e) Variety in meals/Economic Consideration
f) Economic/Time considerations

2) Meal planning is important as it:
- ensures balanced meals.
- makes meals look appealing and attractive.
- make best possible use of money, time, energy.
- ensure variety in meal.
- help meet nutrient needs of individual.

(List any three from above)

Check Your Progress Exercise 3

1) List any two of the following:
- Decrease in the number of the functional cells of the body organs
- Changes in the digestive tract functioning
- Changes in bone composition

2) a) False; adulthood represents the period beginning from twenty years and above.
b) False; during old age the active tissue is replaced by the inactive fatty tissues.
c) False; woman require less energy as compared to the men of the same age, activity level.
d) False; the requirement for protein remains the same as that of an younger adult, whereas the requirement for calcium possibly increases.
e) False; osteoporosis does not develop in all old men and women.
f) True

3) Sedentary adult woman required 1875 calories (100% RDIs). At 55 years the energy requirement is 90% of the reference i.e. 90 × 1875/100 =1687 Kcal

Check Your Progress Exercise 4

1) a) well-balanced; nutritionally adequate b) energy c) 2-3 d) fatty; fried e) amount, proportion

2) A coal mine worker performs heavy work. Hence his requirement for energy and other nutrients, like the B vitamins, would be much more than that of a sedentary worker. Keeping this in mind one would:

- include more of energy-rich foods like cereals (including roots and tubers), fats/oils, sugar/jaggery etc.
- decide the number of meals, based on the work timing

3) List any three of the following:

- Include only soft, well-cooked mashed foods in the meal
- Give small but frequent meals
- Provide plenty of fluids
- Include plenty of milk, green leafy vegetables, cereals and other calcium-rich foods
- Serve fibre-rich foods
- Discourage her from overeating
- Avoid spicy, fried foods.

UNIT 8 MEAL PLANNING FOR PREGNANT AND LACTATING WOMEN

Structure

8.1 INTRODUCTION

In the last unit you learnt that adulthood represents the stable state in life, that is all growth in terms of body size has been completed. The nutrient need is for maintenance rather than for growth. But in the life of an adult woman there may be two phases, namely Pregnancy and Lactation , when there are sharp increases in nutrient requirement. What are these two stages? Why does the nutrient need increase during these two stages? You shall learn about these aspects in this unit.

Pregnancy is the period in the life of an adult woman when the foetus, i.e. the unborn baby, grows inside her body. To support the growth of the foetus, certain physiological changes take place in the woman's body. These changes, along with the growth of the foetus, necessitate an increase in the nutrient requirements of the woman. *Lactation* on the other hand, is the period following the birth of the child when the mother breastfeeds her baby. The baby, for the first few months after birth, depends totally on breast milk for nourishment. Breast milk contains several nutrients which of course are supplied by the mother. Hence, more food is required by the woman during lactation to help meet the additional nutrient requirements.

As you read the unit it will become clear that there are heavy demands on the mother during pregnancy and lactation. This is the reason why a proper diet is of crucial importance during these phases. What are the foods that must be included in the diet of the pregnant/lactating woman? To what extent should the diet be modified to meet the increased need? How to plan balanced meals for a pregnant/lactating woman? We shall examine all these aspects in this unit.

Objectives

After studying this unit, you will be able to:

- describe the various physiological changes that take place in the woman's body during pregnancy and lactation
- discuss the nutrient needs of the woman during pregnancy and lactation and
- state the dietary considerations to be followed to ensure successful pregnancy and lactation

8.2 PREGNANCY

Pregnancy is a period of about 9 months. It is the period when the foetus i.e. the unborn baby grows inside the woman's body. Let us understand the process of growth.

Life for the human being begins with the meeting of two cells namely the egg (from the mother) and the sperm (from the father) inside the woman's body (Figure 8.1). The egg and the sperm unite to form a single cell. This tiny, single cell migrates to the uterus and it is there that it eventually grows to form the foetus. This single cell first divides into two cells, then four, eight and many such cells. As a result, there is a tremendous increase in cell number. Cell size also increases. But we must remember that all cells are not the same. Gradually cells become specialized in structure and

function. Cells of similar type align themselves to form tissue. Such tissues then form the organs of the body. Growth and development of these organs continues. Growth as you may already know refers to the physical increase in the size of the body and its organs. Development,on the other hand,denotes a qualitative change. It refers to an increase in complexity of body functioning. In a period of about 270 days or 40 weeks the foetus grows from being a tiny single cell to a weight of almost 2.5-3 kg.

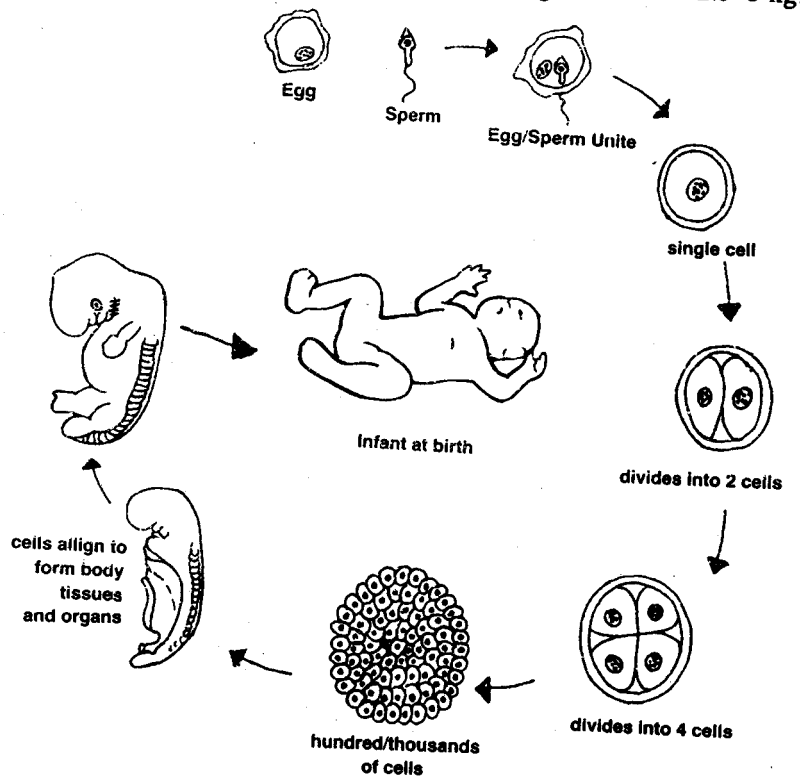

Fig. 8.1 Growth and development of the foetus

You can make out from the above mentioned sequence of events that a foetus grows and develops very rapidly. The foetus takes all the nutrients required for its growth from the mother's body. How does the foetus do that? The foetus is nourished by the placenta. What is placenta? Look at Figure 8.2. Can you spot the placenta? The placenta is the spongy tissue which develops in the uterus only during pregnancy. The foetus is attached to the mother through the umbilical cord which in turn is attached to the placenta. Within the placenta oxygen, nutrients and waste products are exchanged between the mother's blood and that of the foetus.

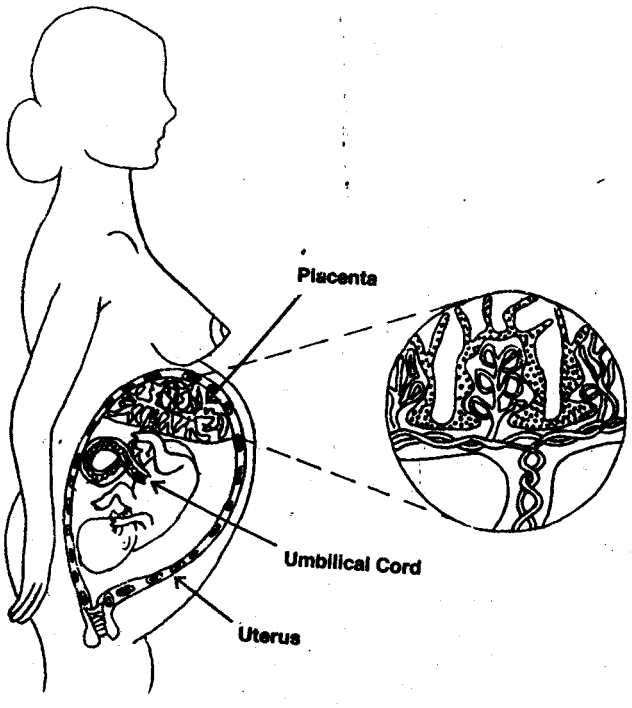

Fig. 8.2 The Placenta

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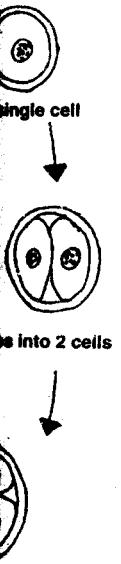

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From our discussion above you would have got an idea of how pregnancy is associated with certain physiological changes that take place in the woman's body. To facilitate the nourishment of the foetus, for example, the placenta develops. Likewise, there are few other physiological changes characteristic of pregnancy. Let us now examine these physiological changes:

a) **Changes in body organs:** Along with the development of the placenta the following changes take place in body organs:

- the uterus and its supporting muscles increase in size to accommodate the growing foetus and
- the breast grows in size and prepares to produce milk.

b) **Changes in body metabolism:** The basal metabolic rate (BMR) increases during pregnancy. Why does the body metabolism increase? You remember reading in Unit 7 that rapid growth periods are associated with increased BMR. Pregnancy is characterised by rapid growth and development of the foetus and the mother's tissues. Due to this rapid growth and development the basal metabolism increases.

c) **Changes in the body fluids:** There is a gradual increase in the total fluid (extracellular and intracellular fluid) content of the body. Blood, (the major portion of the extracellular fluid of the body) increases in volume. The increase in blood volume is as much as 50 per cent. Why does the blood volume increase? This is to facilitate the supply of nutrients to the foetus and to the newly built tissues in the mother's body. However, due to the increase in blood volume, the concentration of haemoglobin (Hb) and other constituents of blood reduces. The normal Hb level of 12 mg/100 ml of blood as seen in a healthy adult woman drops to about 10-11 mg/100 ml during pregnancy. This is a normal physiological change. Care should be taken that the Hb levels do not fall below this point.

d) **Changes in digestive functioning :** One important adaptation of the body during pregnancy, is the *increased rate of absorption of certain important nutrients like calcium and iron.* The absorption increases so as to meet the increased demands of the body. Along with the increased absorption, the following changes in the digestive functioning are also observed:

- There is less production and secretion of acid and other digestive juices by the stomach. The food, therefore, is not broken down and digested properly. It tends to stay in the stomach for a longer time and that gives a *feeling of heaviness or fullness.*
- The capacity of the stomach and the speed of digestion tend to decrease as the growing foetus exerts pressure on the stomach. The food, as well as, the stomach acid, tends to be pushed up into the food pipe which leads to *nausea, vomiting, heartburn and other such symptoms of indigestion in early pregnancy.*
- The movement of food in the digestive tract becomes slow and sluggish as the muscle activity is altered. This becomes more pronounced at the end of the pregnancy period, as a result, *constipation commonly occurs.*

e) **Changes in the body weight:** During pregnancy a woman gains weight. What do you think contributes to this weight gain? The gain in weight is due to the:

- growing foetus
- increase in the size of the uterus
- development of the placenta
- increase in breast size
- increase in blood and total body fluids and
- deposition of fat in the body (which would be needed to supply energy at the time of breast feeding the baby).

You may wonder how much weight gain is normal. You know that each individual is different. *Experts suggest that you can expect a total gain of 8-10 kg. i.e. a pregnant woman must add 8-10 kg to her pre-pregnancy weight.*

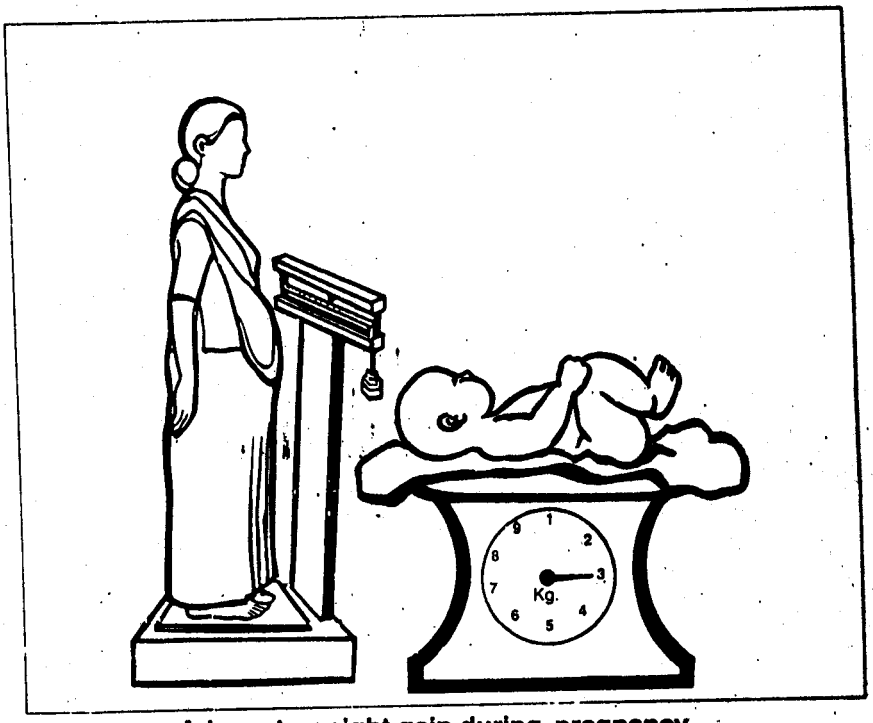
The entire period of pregnancy is actually divided into three trimesters:

- 1st trimester – 0-3 months
- 2nd trimester – 3-6 months
- 3rd trimester – 6-9 months

There is a progressive gain in weight during these three trimesters. It is, however, observed that the maximum weight gain occurs only during the second and third

trimester. Why is this so? This is because maximum growth of the foetus, as well as, the maternal tissues takes place only during this period (i.e. fourth month onwards). The gain in weight during the first three months (i.e. the first trimester) is, however, limited as the foetus is very small.

Gain in weight is, therefore, considered the best indicator of a successful pregnancy. Progressive gain in weight indicates that the foetus and the mother's tissues are growing normally. A gain in weight of less than 8 kg is indicative of the poor health of the foetus, as well as, the woman. If the woman does not have proper weight gain, she may give birth to an underweight baby who would have little or no chance of survival. The life of the woman could also be endangered. The effort should, therefore, be to achieve a satisfactory weight gain during pregnancy (Figure 8.3). Excess weight gain is also not advisable as this too adversely affects the health of the foetus and the woman.



Adequate weight gain during pregnancy ensures healthy infant at birth.

Fig 8.3 Ensure adequate weight gain during pregnancy

8.2 Recommended Dietary Intakes for the Pregnant Woman

The recommended dietary intakes for the pregnant woman are listed in Table 8.1

Tabel 8.1: Recommended Dietary Intakes for the Pregnant Woman

Nutrients	RDIs
Calories (Kcal)	+ 300
Proteins (g)	+ 15
Calcium (mg)	1000
Iron (mg)	38
Vitamin A (μg)	
Retinol	600
or	
Carotene	2400
Thiamine (mg)	+ 0.2
Riboflavin (mg)	+ 0.2
Niacin (mg)	+ 2.0
Ascorbic acid (mg)	40
Folic acid (μg)	400
Vitamin B_{12} (μg)	1.0

Source: Nutrient Requirements and Recommended Dietary Intakes for Indians, ICMR (1990)

In Table 8.1, you would have noticed that the RDIs for energy, protein and B vitamins are given in terms of additional intakes (indicated by the "+" sign) and for all other nutrients as total intake figure.

A woman during pregnancy requires 300 kcal and 15 g protein in addition to what she needs when non-pregnant. To illustrate, a sedentary woman during pregnancy would require a total of 2175 Kcal (i.e. 1875+300) and 65 g protein (i.e. 50+15). Physically active pregnant women and pregnant adolescent girls (i.e. girls between 13-18 years of age) would, however, require more as compared to sedentary pregnant woman. Pregnant adolescent girls would need more nutrients to support their own growth, as well as, the growth of the foetus. (A detailed discussion on pregnancy during adolescence is given in Highlight 6, Unit 10.) The requirement for B Vitamins— thiamine, riboflavin and niacin — is based on the energy requirement. The greater the energy need, the higher would be the B vitamin needs.

The RDIs for almost all nutrients increases during pregnancy, but the requirement for a few specific nutrients increases substantially. *These nutrients include energy, protein, calcium and iron.* Besides iron, *iodine and zinc* are the other two trace elements which are of vital importance during pregnancy. The recommended dietary intakes of these two nutrients have not been given in Table 8.1 as their requirement has not been established as yet.

The next question that might come to your mind is why is the need for these specific nutrients more during pregnancy? Let's consider. Extra energy is needed to:

- support the growth of the foetus and placenta
- add to the fat reserves of the mother and
- compensate for the increased energy expenditure as a result of higher basal metabolic rate.

The need for protein is more as this nutrient is required for the synthesis of new tissues in both the mother and the foetus. Iron is needed for the synthesis of haemoglobin in the foetal blood cells. In addition, the foetus accumulates abundant stores of iron in the body to last through the first three to six months of life after birth. This further raises the iron requirement. The need for calcium increases to support the mineralization of bones and teeth in the foetus. As for the trace elements — zinc is required for growth and protein synthesis and iodine helps to regulate the physical and mental growth of the foetus.

It must be emphasized here that the requirement for most nutrients increase only from the second trimester onwards. Why? You are already aware, that in the first trimester (0-3 months) the foetus is small and its nutritional needs are not significant. Hence, no extra amounts of nutrients are recommended for the mother.

The foetus obtains all these nutrients required for its growth from the mother's diet. If the diet is inadequate, the woman's tissues will be broken down to supply these nutrients to the foetus. Hence, though the diet during pregnancy does count, entering pregnancy in good nutritional status is also very important. A well nourished woman with adequate nutrient reserves will be better equipped for a successful pregnancy.

Check Your Progress Exercise 1

1) State whether the following statements are true or false. Correct the false statements

   a) The foetus grows in an organ called the placenta in the woman's body. (True/False)

   .....

   .....

   b) The foetus obtains all the nutrients it needs from the woman's diet (True/False)

   .....

   .....

   c) The haemoglobin level increases during pregnancy. (True/False)

   .....

   .....

   d) The probability that a woman who gains 7 kg weight during pregnancy, will give birth to a healthy baby is high . (True/False)

e) The foetus accumulates abundant stores of vitamin A during pregnancy. (True/False)

f) The requirements of energy and protein increase right from the first trimester of pregnancy (True/False)

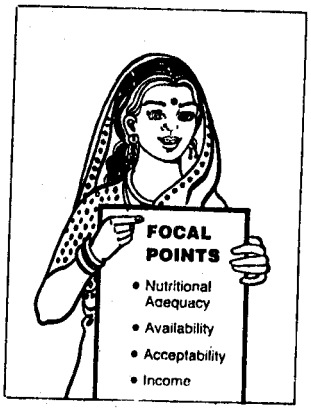
g) The requirement of B vitamins does not increase during pregnancy. (True/False)

h) The stage of pregnancy influences the nutrient requirement. (True/False)

i) Why does the need for nutrients increase during pregnancy?

8.2.2 Meal Planning for the Pregnant Woman

The stage of pregnancy is likely to cause changes in the pattern of life, as well as, eating habits of the woman. You are aware that right from the initial stages of pregnancy certain changes in the body functioning occur. These changes necessitate modification in the meal patterns. Further, the nutrient requirement also increases because of which qualitative and quantitative changes need to be made in the meals. In this section, we shall learn about the various changes and the basic factors that need to be considered while planning meals for pregnant woman.



To begin with, do you recall the basic four factors that one should keep in mind while planning meals? They are listed in the margin for your reference. In addition to these factors the other points to be considered include:

Whom are we planning for?

- Is the woman in the first trimester (0–3 months), second trimester (3–6 months) or the third trimester (6–9 months) of pregnancy?
- What is the income level of the woman—does she belong to the high income group, middle income group or the low income group?
- Which region (part of the country) does she belong to?

Information on these aspects would help you specify the kind and amount of food to be selected. The stage of pregnancy would also help you to specify the nutrient requirement. After identifying the individual you can list the RDIs accordingly.

Which nutrients are of particular importance?

You have just read that the requirement for almost all nutrients increases during pregnancy. But the requirement for a few specific nutrients is considerable. These include:

- energy-giving nutrients (carbohydrates and fats)
- proteins
- calcium and
- iron

It is however important to remember that the requirement of these nutrients *increases only from the second trimester onwards.*

Which foods to select?

Generally a mixed diet consisting of food items from each of the three major food groups (namely energy-giving, body-building, protective/regulatory) would help meet the requirement. But you are aware that the requirement for energy, protein, calcium and iron is maximum during pregnancy. Hence, from the three major food groups, include more of cereals, pulses, milk and milk products, green leafy vegetables in the diet (Figure 8.4). Meat/fish/poultry, eggs may be included if acceptable. Also, if income permits nuts/oilseeds may be considered. For your reference a list of food items rich in energy, protein, calcium and iron is given in Annexure 1 at the end of the block. You can consult it while selecting the food items.

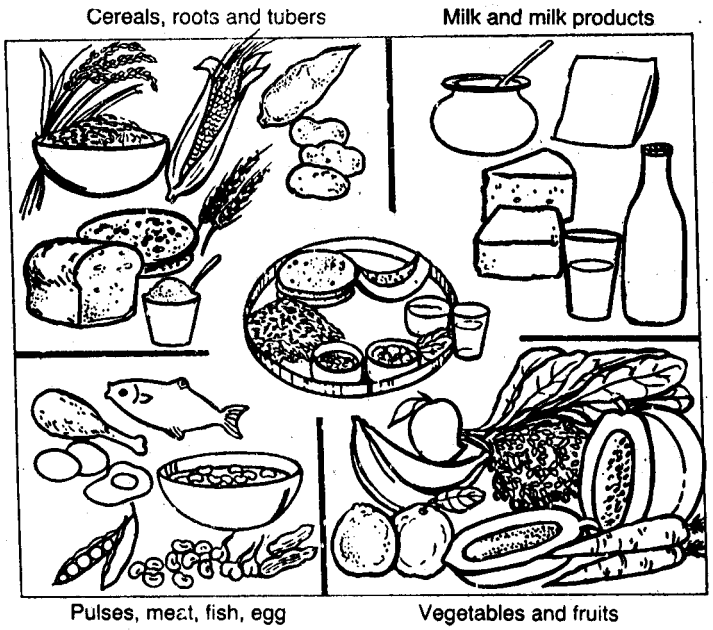


Fig. 8.4 Foods to emphasize during pregnancy

A pregnant woman from the low income group may not be able to consume much of milk, meat, nuts, fat/oils. So, then the crucial question is what food items should she select that would enable her to plan nutritious meals at low cost? Do you recall the discussion we had in Unit 7 on how to plan nutritious meals at low cost. Planning meals keeping those points in mind will ensure balanced meals for pregnant women of low income groups as well.

It is important to mention here that iron from food sources alone may not be sufficient to meet the increased needs of iron during pregnancy. Additional iron in the form of tablets usually needs to be given. It is suggested that right from the second trimester onwards a pregnant woman should take an iron tablet providing 30–60 mg

Fig. 8.5 Give iron/folic acid tablets during pregnancy

iron and 500 μg folic acid daily (Figure 8.5). From where does one get these tablets? The tablets are easily available from the primary health centres or the ICDS (Integrated Child Development Services) anganwadis where they are distributed free of cost. Alternatively, one could also buy them from the open market at a minimal cost.

Another point to remember is that one should use iodized salt for cooking. This will help meet the iodine need during pregnancy.

Are there any special food preparation for the pregnant woman?

You must have observed mothers or mothers-in-law preparing and serving special food items to their pregnant daughters/daughters-in-law. In the North, for instance, pinni/panjiri is commonly served, likewise payasam in the South, and methi-pak in the West. In most regions it is customary to serve such specific food preparations during pregnancy and lactation. What are these special food preparations? Why should they be served during pregnancy? These special food preparations are energy/protein-rich snacks made of cereals/pulses/fats/nuts/special herbs. In addition to calories and proteins they provide sufficient amounts of other essential nutrients like calcium or iron or vitamin A. Usually these food preparations are served in — between meals and together with the meals they help meet the increased needs during pregnancy. Some of the common traditional food preparations of different regions are listed for your reference in Annexure 2. You will find this discussion relevant for lactation also.

What should be the meal pattern?

To meet the increased demands of pregnancy, it is clear that the food intake increases. The question now is how to increase the daily food intake? Well, that's simple. To begin with, one can try increasing the amount of food normally eaten at each meal. For instance, in a meal (i.e. lunch) consisting of chapati/ rice/ dal/ vegetable/curd one could increase the number of chapaties or the amount of rice or increase the amount of dal/vegetables normally consumed. If possible, one could include a little more curd. But it is generally observed that pregnant women cannot eat much at one time because of the various digestive changes that occur during pregnancy. *The only alternative then is to provide small but frequent meals.* The meal frequency i.e. the number of meals consumed in a day, would increase so as to accommodate the increased food intake. In addition to the three main meals i.e. breakfast, lunch and dinner, some other foods/food preparations (like those suggested in Annexure 2) must be included in the daily diet at different times of the day — say mid-morning, mid-afternoon, tea time. The number of meals consumed would, however, depend on the income of the individual. Some alternatives are given in the following lists:

A	B	C
Breakfast	Breakfast	Bed tea
Mid-morning meal	Mid-morning meal	Breakfast
Lunch	Lunch	Mid-morning meal
Tea	Mid-afternoon meal	Lunch
Dinner	Tea	Mid-afternoon meal
	Dinner	Tea
		Dinner
		Bed time

A) 4-5 meals/day pattern is likely to be followed by a low income group pregnant woman

B) 5-6 meal/day pattern is likely to be adopted by a middle income group pregnant woman

C) 6-7 meal/day pattern is typical of the high income group.

Remember, *whatever be the income group, the idea is to provide small but frequent meals during pregnancy.*

What are the other specific considerations?

During pregnancy certain digestive changes commonly occur. You studied earlier that during the early weeks of pregnancy nausea, and/or vomiting is common, especially in the early morning. This is referred to as morning sickness. Similarly heartburn and a feeling of fullness or heaviness is common and sometimes troublesome especially in the third trimester of pregnancy. The occurrence of constipation during the second ha

of pregnancy is also common. All these changes cause a lot of stress and discomfort to the woman. How to overcome this discomfort? Certain changes in the eating habits, meal pattern and the kind and amount of foods selected need to be made. Here are simple tips on how to deal with these situations.

i) To overcome *morning sickness* one should provide carbohydrate-rich foods/food preparations like biscuits, rusks, bread etc to the woman early in the morning (preferably with bed tea). In addition, foods which have a strong odour and flavour or those which leave a taste long after being eaten should be avoided.

ii) *To overcome heartburn* or the feeling of heaviness/fullness, one should restrict eating fatty or fried foods. One would also benefit by not eating much at one time. Rather one should eat small frequent meals, as discussed earlier.

iii) To prevent constipation one should take plenty of fibre-rich foods and adequate amounts of fluid in the diet:

– Foods like vegetables (specially green leafy vegetables), whole grain cereals/pulses (like wheat, bengal gram, black gram, horse gram) are rich sources of fibre. More of these foods should be included in the diet. But at times it is observed that certain fibre-rich foods, especially whole pulses like black gram and cauliflower among vegetables, when consumed, produce a lot of gas in the body. This causes considerable discomfort. It is suggested that the use of these foods should be restricted, but, only if not tolerated.

– Water (at least four to six glasses) and other drinks/beverages such as milk, buttermilk, coconut water, lime juice etc.should be taken in-between meals so as to help in the movement of food through the digestive tract, thus preventing constipation.

Simple tips on how to ensure a safe, comfortable pregnancy are listed in points to remember.

POINTS TO REMEMBER

Pregnency

Do's	Don'ts
1. Ensure that the pregnant women attains adequate weight gain (i.e. 8-10 kg) during pregnancy	1. Avoid serving too much food at one time (one meal)
2. Include more of cereals, milk and milk. products, pulses/nuts/sprouted grains and green leafy vegetables in the diet of pregnant women	2. Avoid the consumption of foods with strong flavours
3. Give iron/folic acid tablets right from the second trimester onwards	3. Restrict the use of spicy, fried and fatty foods
4. Use idized salt for cooking	4. Discourage the pregnant woman from smoking or consuming alcoholic beverages
5. Give small but more frequent meals during the day	5. Avoid giving drugs except when prescribed by a doctor
6. Provide nutritious snacks in-between meals	6. Avoid serving too much of tea or coffee
7. Serve biscuits rusk or any other carbohydrate rich food item early in morning to prevent morning sickness.	7. Discourages the pregnant woman from doing strenuous heavy work.
8. Include fibre-rich foods and plenty of water in the diet to relieve consripation:	8. Avoid excessive weight gain during pregnency.
9. Encourage the women to drink fluid between meals rather than with them.	9. Do not curtail the diet of the pregnant woman even for a short while.
10. Encourage the women to do a few simple exercises daily.	
11. Ensure that the pregnant woman takes adequate rest after each meal.	

Check Your Progress Exercise 2

1) List any four dietary modifications that need to be made in the diet of a woman during pregnancy.

.....

.....

....

....

Fill in the blanks.

Eating .... rich foods can prevent morning sickness during pregnancy.

.... and .... combination provides protein of good quality.

A pregnant woman should have more of foods rich in .... and ....

(d) During pregnancy .... and .... meals should be given

(e) To overcome the feeling of heaviness during pregnancy avoid eating .... and .... foods.

8.3 LACTATION

Lactation is the period following pregnancy when the women nourishes a fully-developed and a rapidly growing baby with breast milk. Most of the nutrients required by the baby are supplied by the breast milk.

A lactating woman secretes about 500 ml of milk/day in the first month. This amount increases to about 1 litre/day by the fifth month. On an average, a well-nourished lactating woman *secretes about 850 ml milk/day*. But there usually are individual variations. The nutrient composition of the milk secreted is as indicated in Table 8.2.

Table 8.2: Nutrient Composition of Human Milk

NUTRIENT	Amount in human milk (per 100 ml)
Energy (Kcal)	65
Proteins (g)	1.1
Carbohydrates (g)	7.4
Fats (g)	3.4
Calcium (mg)	28
Iron (mg)	—
Carotene (μg)	137
Thiamine (mg)	.02
Riboflavin (mg)	.02
Niacin (mg)	—
Vitamin C (mg)	3

Source: *Nutritive value of Indian foods* by C. Gopalan, B.V. Rama Sastri and S.C. Balasubramanian,; revised and updated by B.S. Narasinga Rao, Y.G. Deosthale and K.C. Pant, National Institute of Nutrition (1989)

All these nutrients contained in breast milk are derived from the mother's body. Lactation, therefore, makes considerable nutritional demands on the woman. In fact, it imposes great strain on the woman, even more than in pregnancy. The mother's diet and state of nutrition influence the composition and output of milk produced. Extra nutrients should be provided during lactation so as to help the mother secrete enough milk and maintain an adequate level of nutrients. Let us now learn how much of which nutrients need to be provided during lactation.

8.3.1 Recommended Dietary Intakes for the Lactating Woman

The recommended dietary intakes for the lactating woman are listed in Table 8.3.

Table 8.3: Recommended Dietary Intakes For the Lactating Woman

Nutrient	RDIs	
	0-6 months of lactation	6-12 months of lactation
Energy (Kcal)	+ 550	+ 400
Proteins (g)	+ 25	+ 18
Calcium (mg)	1000	1000
Iron (mg)	30	30
Vitamin A (μg)		
Retinol	950	950
or		
Carotene	3800	3800
Thiamine (mg)	+ 0.3	+ 0.2
Riboflavin (mg)	+ 0.3	+ 0.2
Niacin (mg)	+ 4.0	+ 3.0
Ascorbic acid (mg)	80	80
Folic acid (μg)	150	150
Vitamin B_{12} (μg)	1.5	1.5

Source: Nutrient Requirements and Recommended Dietary Intakes for Indians, ICMR (1990)

The nutrient requirements increase considerably during lactation. In Table 8.3 you would have noticed that RDIs are given for two stages — 0-6 months and 6-12 months of lactation. The nutrient need during the first six months is much higher than the 6-12 month stage. This is so because during the first six months the amount of milk secreted is the most. By six months lactation reaches its peak and, thereafter, the milk output starts decreasing gradually and so does the nutrient need.

The RDIs for energy, protein and B vitamins are given in terms of additional allowances and for all other nutrients as total intake figure (as in the case of pregnancy). A woman during lactation requires 550 Kcal in the first six months and 400 kcal during the 6-12 months stage, in addition, to her needs prior to pregnancy and lactation. This represents 25-30 per cent increase in energy needs. Figure 8.6 illustrates the per cent increase in the nutrient need of a lactating woman as compared to a pregnant and non-pregnant woman. (In Figure 8.6 the recommended dietary

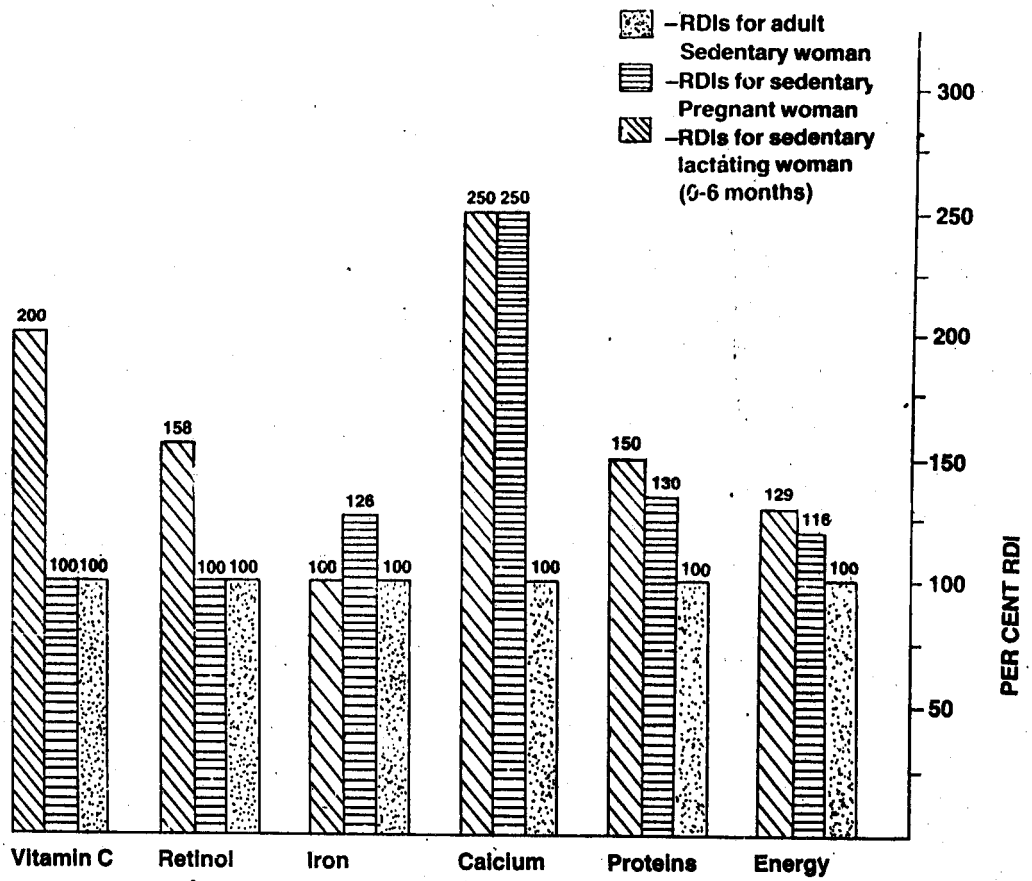


Fig. 8.6 Per cent increase in the nutrient need of pregnant and lactating women.

intake of non-pregnant/non-lactating sedentary woman is taken as 100 per cent). One important thing to keep in mind is that the activity level of the lactating woman should be considered (sedentary, moderate or heavy work) before deciding on her energy requirement.

In addition to energy, *the need for proteins, calcium, vitamin A and vitamin C* is considerably high during lactation. The growing infant needs sufficient amount of these body-building and protective nutrients for rapid growth of tissues. The infant takes all these nutrients from mother's milk. Hence, the diet of the lactating woman should contain plenty of these nutrients.

What food to include in the diet to help meet the nutrient need, is what we are going to learn in the next section.

Check Your Progress Exercise 3

1) Fill in the blanks.

a) On an average.....ml of milk is secreted per day during lactation.

b) A sedentary woman would require a total of..... Kcal during the first five months of lactations.

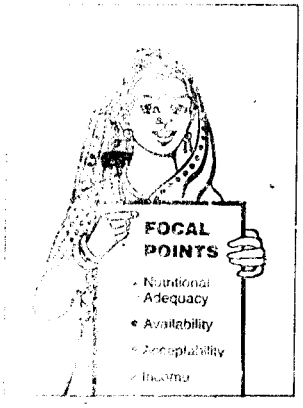
c) .....and.....are the two nutrients, the requirement for which increses during lactation.

d) Adequate amount of.....should be included in the diet so as to help maintain milk secretion.

e) The mother's diet influences the .....and ..... of milk secreted.

8.3.2 Meal Planning for the Lactating Woman

The mother's nutrition is a key to successful breastfeeding and therefore the baby's health. One should pay attention to the fact that the nutrient need increases during lactation and, therefore, the woman needs to eat more food, in fact, even more than during pregnancy. The kind of foods eaten during lactation would be similar to that consumed during pregnancy, but with additional energy and protein intake to maintain lactation.



Some general considerations we should keep in mind while planning meals for lactating women are discussed in this section.

Whom are we planning for?

- Is the woman in the first six months of lactation or is she in the 6-12 month stage?
- Does the woman belong to low income group, middle income group or the high income group?
- Where does the woman live?

Based on this information first list the nutrient requirement and then decide on the right kind of foods to be included in the meals.

Which nutrients are of particular importance?

In general, the requirement for almost all nutrients increases during lactation. But the diet should provide more of the following:

- energy-giving nutrients (carbohydrates and fats)
- proteins
- calcium
- vitamin A and
- vitamin C

The requirement for *energy and protein during the first six months of lactation is comparatively much more than the next six months.* While planning, one should take this aspect into consideration.

Which foods to select?

In general, to provide an adequate well balanced meal during lactation, include atleast one food item from each of the three food groups — energy-giving, body-building and regulatory/protective.

But you are aware that the requirement for energy, proteins, calcium, vitamin A and

vitamin C (among the protective nutrients) is particularly high during lactation. Hence provide more of the following foods (Figure 8.7):

- a mixture of *cereals* (i.e. wheat, rice, bajra, millets, jowar, ragi or any other staple commonly used)
- ***pulses*** and *meat/fish/egg,* if acceptable
- ***milk*** and *milk products* (like curd, cottage cheese, khoa etc.)
- *green leafy vegetables* (like amaranth leaves, mustard, fenugreek leaves, colocasia leaves etc.)
- *other vegetables* (especially yellow or orange coloured vegetables like carrots, pumpkin etc.)
- *seasonal fruits* (specially citrus fruits like oranges, lemons, limes, and others like guava, pineapple, mango, papaya etc.) and
- *nuts/oilseeds* (groundnuts, gingelly seeds, coconut etc.)

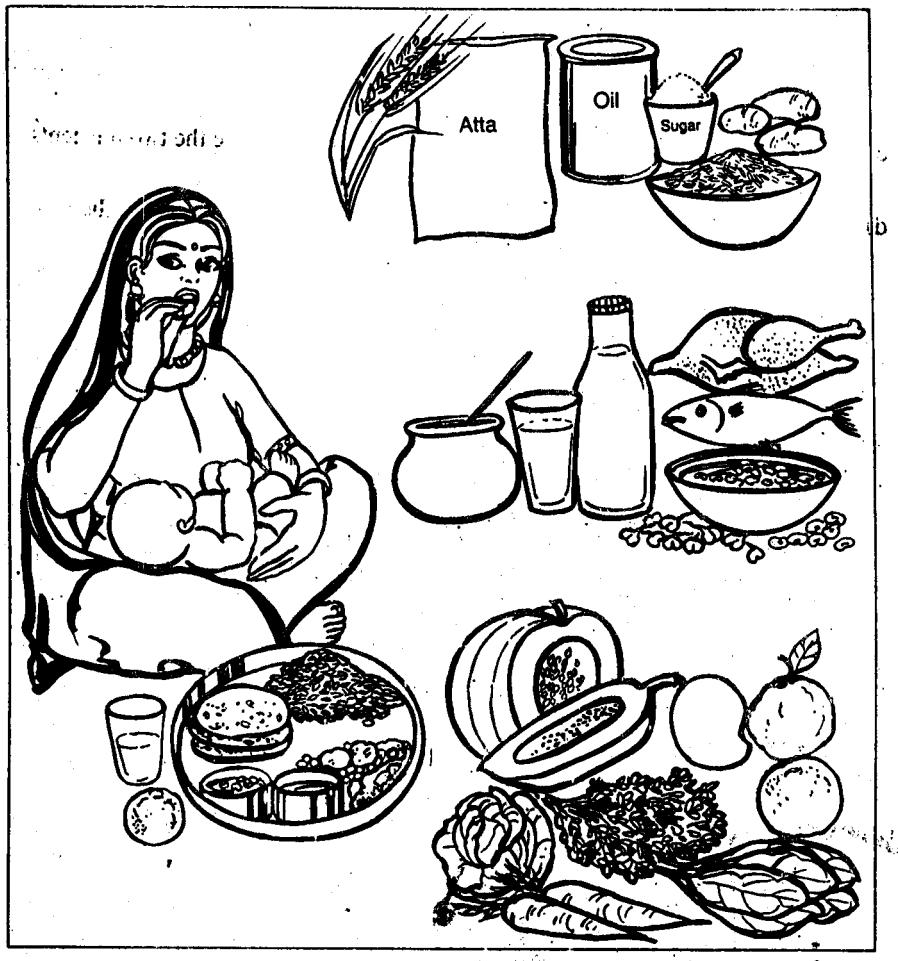


Fig. 8.7 Foods to emphasize during lactation

It is important to mention here that the kind and amount of food selected for the meals should be according to the income of the individual. How to plan nutritious meals at low cost has already been discussed earlier in Unit 7. Plan meals keeping those points in mind. A lactating woman should consume at least a minimum of 500 ml milk/day or preferably more. In case of lactating women belonging to lower income groups a minimum of 325 ml milk/day must be ensured.

What should be the meal pattern?

To help meet the increased nutrient requirements, the lactating woman needs to increase the amount of food normally eaten in a day. To begin with, she should continue to eat the same balanced diet that was eaten during pregnancy i.e. chapati/rice, dal, curd, green leafy vegetables, and other seasonal fruits, vegetables. In addition, certain snacks/food preparations (like those suggested in Annexure 2) should be served at different times of the day i.e. mid-morning, mid-afternoon, tea time. This will help meet the increased nutrient requirement. The number of meals consumed in a day should be increased during lactation. A 5-6 meal pattern could be followed such as breakfast, mid-morning meal, lunch, mid-afternoon meal, tea and dinner

What are the other specific consideration?

i) Along with the increased food intake, *the fluid intake should also increase during lactation*. Increased fluid intake is recommended so as to help in maintaining an adequate supply of breast milk. Liquids in the form of juices, tea, milk, milk-based beverages, lime juice, coconut water etc.should be provided in-between meals or whenever desired. Plenty of water (at least 4-6 glasses daily) should also be provided. All these liquids i.e. water, drinks, beverages add to the fluid intake necessary to produce milk.

ii) It is observed that during lactation no specific food needs to be omitted from the diet. A lactating mother can eat whatever nutritious food she chooses. But if she suspects a particular food of causing some discomfort to the infant she can eliminate that food from her diet. *Food with strong or specific flavour may alter the taste of breast milk. Use of such foods may, therefore, be restricted.*

iii) Some substances like alcohol, drugs etc.can enter the breast milk and interfere with infant development. *Such foods should be avoided* (Figure 8.8). Drugs, should be taken only in consultation with the doctor.

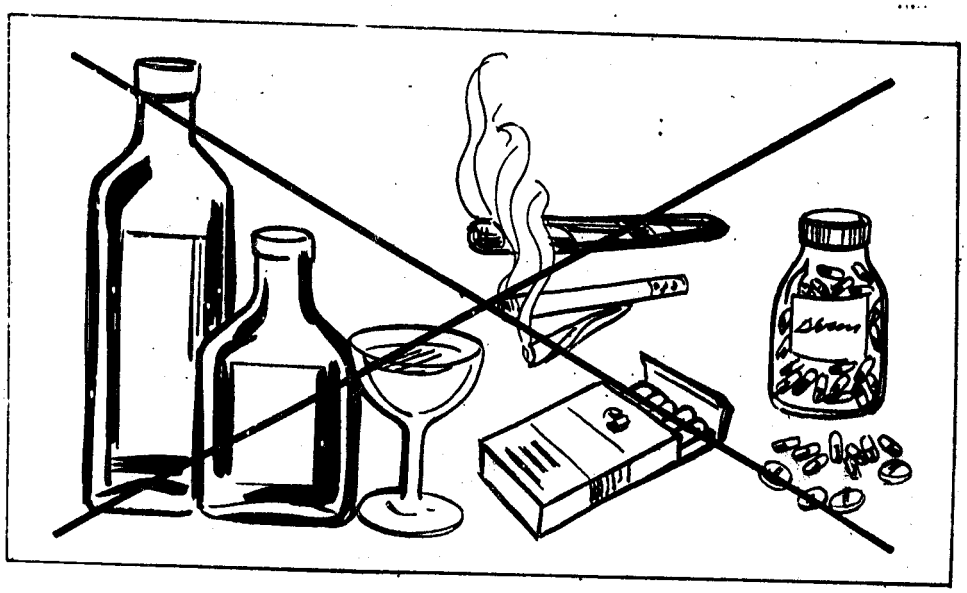


Fig. 8.8 Substances to be avoided during pregnancy/lactation

Simple tips on how to ensure successful lactation are listed under points to remember.

DO'S	DON'TS
1. Include generous serving of milk, citrus fruits, green leafy vegetables and whole grains in the diet.	1. Discourage the lactating woman from smoking or consuming alcoholic beverages.
2. Provide plenty of water and fluids (about 3 litres) to maintain adequate supply of breast milk.	2. Do not grive drugs except when prescribed by the doctor.
3. Continue iron supplementation for a few months after child birth.	3. Restrict the use of foods with strong flavour.
4. Increase the meal frequency to 5-6 meals a day	4. Avoid serving highly seasoned or spicy foods
5. Increase the quantity of food eaten at one time	5. Discourage the lactating woman from breast feeding if she is suffering from chronic illness such as cardiac disease, tuberculosis, severe anaemia, kidney disorder or mental disorder
6. Provide nutritious food preparations/snacks in-between meals.	
8. Encourage frequent sucking to produce enough milk for the baby's need	
9. Ensure that the women is not emotionally disturbed during lactation	

NOTE: LOOK UP SECTION 6 OF THE PRACTICAL MANUAL – PART I FOR DIETS FOR PREGNANT AND LACTATING WOMEN

Check Your Progress Exercise 4

1) A snack made of cereals/pulses/green leafy vegetables oil/nuts is given to a lactating woman. List the major nutrients that would be provided by this nutritious snack. Suggest any two snacks/food preparations suitable for lactating women.

.....

.....

.....

2) List any four dietary considerations that should be kept in mind while planning meals for lactating women.

.....

.....

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.....

8.4 LET US SUM UP

In this unit you studied about the period of pregnancy and lactation.

Pregnancy, you learnt, is a period of about 9 months (divided into three trimesters i.e. 0-3; 3-6; 6-9 months) during which the foetus i.e. the unborn baby, grows inside the mother's body. Rapid growth and development of the foetus takes place during this period. To support the growth of the foetus certain changes in the mother's body also take place. Due to the rapid growth of the foetus and the mother's tissues the nutrient requirement of women increases. To help meet the requirement certain quantitative and qualitative changes need to be made in the diet of the pregnant woman which include the following: a well balanced diet containing food items from the three food groups should be provided. The amount of food consumed should be increased. Plenty of energy/protein, calcium and iron-rich foods should be included in meals. Small but frequent meals should be provided. All fatty foods or strongly flavoured, spicy foods should be avoided. Plenty of water and other fluids should be consumed.

Lactation, on the other hand, is the period following pregnancy, when the mother breastfeeds her infant. On an average 850 ml of milk/day is secreted during lactation. The mother's milk is a rich source of most nutrients for the infant, and because these nutrients are supplied only by her body, her nutritional requirements are high, in fact, even higher than during pregnancy. To accommodate this increased intake certain modifications need to be made in the meals of the lactating woman: a well balanced diet including foods from the three major food groups should be provided. More of energy, protein and protective nutrients such as calcium, vitamin A/ vitamin C should be included in the diet. The food intake should be considerably increased and in addition to the three main meals some snack should be served in-between meals. Plenty of water and other fluids should be provided so as to help maintain adequate milk secretion.

8.5 GLOSSARY

Anganwadi : Anganwadi is the centre (focal point) at which the delivery of services under the Integrated Child Development Services (ICDS) takes place.

Foetus : The unborn baby growing inside the mother's body.

Heartburn : Heartburn is a burning sensation experienced in the lower area of the heart.

ICDS : Integrated Child Development Services (ICDS) is a programme

providing a package of services namely supplementary nutrition, non-formal preschool education, health check-up, immunization, referral services, nutrition and health education to children below six years and to pregnant and lactating women.

Maternal : Refers to the mother.

Meal Frequency : Refers to the number of meals consumed in a day

Physiological changes : Changes in body composition, organ function and physical performance are referred to as physiological changes.

Reserves : Refers to the nutrient stores in the body.

Trimester : A trimester is a three-month span of time

2.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) a) False; the foetus grows in an organ called the uterus.
b) True
c) False; the haemoglobin level falls during pregnancy.
d) False; a woman who gains around 8-10 kg weight during pregnancy will give birth to a healthy baby.
e) False; the foetus accumulates abundant stores of iron during pregnancy.
f) False; the requirement increases from the second trimster onwards.
g) False; the requirement for B vitamins increases based on the increase in the energy requirement.
h) True

2) Pregnancy is the period during which the foetus grows inside the mother's body. The maternal tissues are also being formed to support this foetus. These rapid changes taking place necessitate increase in food intake. Increased amounts of nutrients are required to nourish the growing foetus, as well as, to meet the needs of the mother.

Check Your Progress Exercise 2

1) List any four of the following:
- Increase the number of meals consumed in a day.
- Avoid fatty, spicy or strongly flavoured foods.
- Include adequate roughage in the diet to avoid constipation.
- Provide plenty of water.
- Include more of cereals, pulses, milk, green leafy vegetables in the diet of the pregnant women.
- Include nutritious snacks/foods preparations in-between meals.
- Serve carbohydrate-rich food items early in the morning to prevent morning sickness.

2) a) carbohydrate b) cereal, pulse c) Any two of the following—energy/ protein/ iron/calcium d) small, frequent e) fatty, fried

Check Your Progress Exercise 3

1) a) 850 b) 2425 c) Any two of the following — vitamin A/energy/protein/calcium vitamin C d) fluids e) amount, composition.

Check Your Progress Exercise 4

1) Energy, proteins, iron, calcium, vitamin A
Answer from your own experience.

2) List any four of the following:
- Small frequent meals should be provided.
- Energy/protein-rich snacks should be included in-between meals.
- Extra fluids should be given so to help maintain adequate milk secretion. Fluids like juices, coconut-water, milk etc. should be given.
- Include more of cereals, pulses, milk, citrus fruits, green leafy vegetable, orange and yellow fruits and vegetables in the meals.
- Increase the meal frequency to 5-6 meals a day
- Restrict the use of foods with strong flavour.

UNIT 9 MEAL PLANNING FOR THE INFANT AND PRESCHOOLER

Structure

9.1 INTRODUCTION

Growth and development are essential features of life. But the pattern of growth is not always uniform. In the last unit you studied how life begins with a single cell. This cell divides and multiplies into hundreds and thousands of cells to form the foetus. Imagine the rate of growth at this stage! Never again in life would the rate of growth be as rapid as it is during the foetal stage. After the foetal stage the growth continues to be rapid for the first year, but then slows down somewhat thereafter.

The present unit focuses on the pattern of growth in the first few years of life — from birth to six years. The first year of life is called the period of infancy and the period 1-6 years is referred to as the preschool years. Infancy and preschool period together are important in the child's life as they form the foundation for the future health of the child.

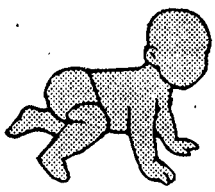
The changes in the pattern of growth influence the nutrient needs. Because the child is growing the nutrient needs are more. In addition, as the child grows, taste preferences, food advertisements, parents/friends will influence what food they consume. Feeding children, therefore, involves far more than knowing what are the nutrients required, why we need them and which foods contain them. We need to combine foods into a diet that would help meet the nutritional needs of children and at the same time be appealing and appetizing.

The unit presents a detailed discussion on how to plan/prepare balanced diets and what dietary measures are to be kept in mind while feeding infants and preschoolers. Reading through the unit you will find the answers to several questions which are often asked in connection with feeding young children — what is the right time to introduce infants to solid food? Which food other than breast milk can be given to the infant? How to provide nutritious meals to preschoolers keeping the likes/dislikes in mind? What are the best snacks/food preparations for the preschoolers?

Objectives

After studying this unit, you will be able to:

- describe the periods of infancy and preschool age
- explain why these periods are crucial for growth and development
- describe the nutritional needs of infants and preschoolers
- discuss the importance of breastfeeding and supplementary feeding (i.e. introducing foods other than breast milk) and
- state the dietary considerations to be kept in mind while planning meals for infants and preschoolers.



9.2 THE INFANT

The child in the first year is referred to as an infant. The first year of life is a period of intense growth and development. Growth, as you already know, refers to the physical increase in the size of the body. The infant at birth weighs approximately 2.5-3 kg and measures 50 cm in length. With the rapid growth taking place the infant doubles its birth weight in five months and by one year the weight is three times the birth weight

(Figure 9.1). Consider the rate of growth! Starting from 3 kg the weight increases to 9 kg in a single year. At no other time of life hereafter the rate of growth would be so rapid. The normal body length of 50 cm at birth also increases to about 75 cm by the end of the first year.

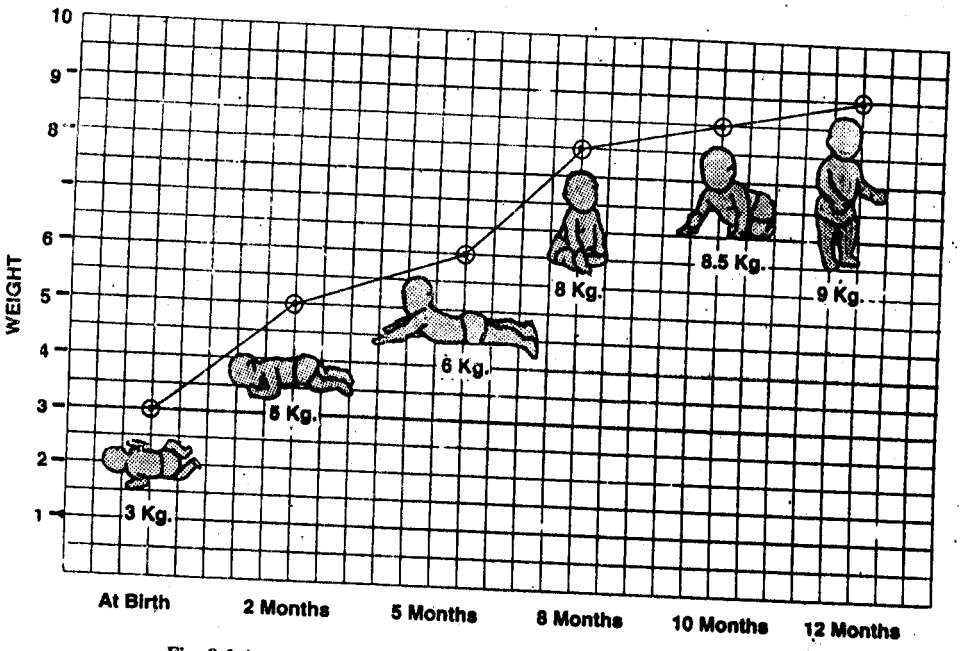


Fig. 9.1 Average body weight of infants from birth to twelve months

Gain in weight/increase in length are, therefore, the best indicators to assess the child's growth. Weighing the child every month, for the first year would give you a good idea of the pattern of growth.

The gain in height/weight are further accompanied by changes in tissues / organs/ systems of the body during the first year. The muscles grow in size and strength. The bones lengthen. The brain, kidneys, digestive system improve in their functional capacity. In other words, the body undergoes a process of development. The development of the digestive system, for example, enables the infant to handle more and more complex food items starting from breast milk at birth to solid food by the end of the first year.

Because of this extremely fast rate of growth/development infancy is a period of great stress for the baby. Obviously, diet plays an important role in promoting growth and general well-being. Can you imagine what would happen if enough food is not provided to the infant? Yes, of course, the infant would be susceptible to the effects of malnutrition. In fact, the infant would be more prone to infections and diseases resulting in ill health.

The rapid growth and development of an infant creates a high demand for nutrients. But, what nutrients are of particular importance during infancy? How much of which nutrient should be given to the infant? We shall learn about these aspects in the next subsequent section.

9.2.1 Recommended Dietary Intakes for the Infants

In Table 9.1 you would notice that the RDIs for Infants are given in two age categories — 0-6 months and 6-12 months. This is so because the age of the infant influences nutrient need. Rapid growth takes place during the first six months, which obviously necessitates a high nutrient intake..

The recommended intakes for infants during the first six months are based on the intake of normal growing infants fed on breast milk alone. What does this mean? This means that if an infant receives on an average 850 ml of breast milk daily upto six months, his requirements as given in Table 9.1 are easily met. The requirements given above are, therefore, basically guidelines for feeding infants who, for some reason, cannot receive breast milk.

Table 9.1
Recommended Dietary Intakes for an Infant

Nutrients	RDIs	
	Age group	
	0-6 months	6-12 months
Energy (Kcal)	108/kg	98/kg
Protein (g)	2.05/kg	1.65/kg
Calcium (mg)	500	500
Iron (μg)	70/kg	70/kg
Vitamin A (μg)		
Retinol	350	350
or		
Carotene	1200	1200
Thiamine (μg)	55/kg	50/kg
Riboflavin (μg)	65/kg	60/kg
Niacin (μg)	710/kg	650/kg
Ascorbic acid (mg)	25	25
Folic acid (μg)	25	25
Vitamin B_{12} (μg)	0.2	0.2

Source: Nutrient Requirements and Recommended Dietary Allowances for Indians, ICMR (1990)

Further, if you look at Table 9.1 carefully, you would notice that the RDIs for a few nutrients — energy, *protein, iron and B vitamins — are given in terms of per kg body weight and not as a total inake figure.* Can you suggest why this is so? This is because the needs for these nutrients per kg body weight are substantially different within the specific age category. The total amount of the nutrients required by the infant may seem much smaller as compared to the adult but when expressed in terms of per kg body weight, the need is over twice as much for most nutrients as can be seen in Figure 9.2. To understand this better let us compare the energy needs of a five month old infant with that of an adult. An adult sedentary man (weighing 60 kg), you know, requires a total of 2425 Kcal. This, when expressed in terms of per kg body weight works out to approximately 40 Kcal/kg body weight. (This is considered 100 per cent RDI, for energy in Figure 9.2). The requirement of the infant (per kg body weight), on the other hand, is much higher i.e. 108 Kcal/kg body weight, which you notice is

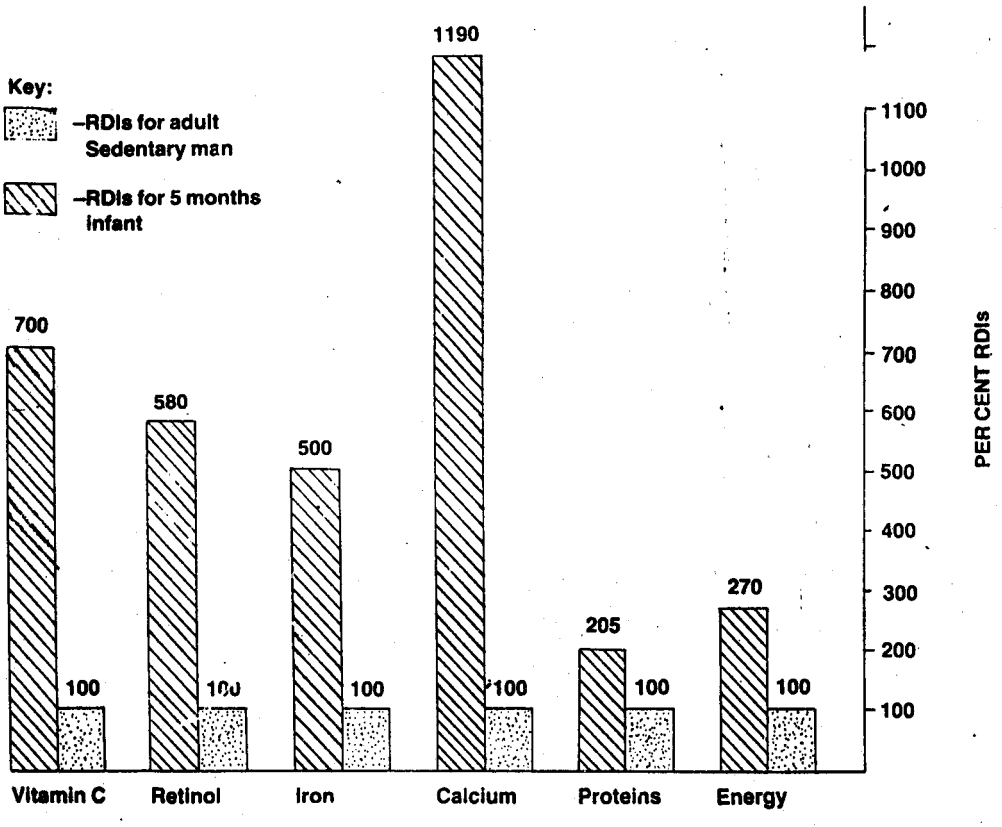


Fig. 9.2 Nutrient needs of infants as compared to those of an adult man

more than twice as much as that of an adult. The total amount of energy required, however, works out to be much lower (i.e. 108 × 5 = 540 kal) since a five-month infant weighs only about 5 kg.

The RDI for *protein and certain protective nutrients like calcium, iron, vitamin C and vitamin A* are also high. Why? You know that the tissue growth and body-building activity is considerable during the first year. This necessitates a high intake of protein and vitamin A. The bones and skeletal system develop rapidly and calcium is deposited in them, hence the requirement for calcium is high. The blood volume increases and therefore, iron is required for the synthesis of haemoglobin in the blood cells.

Check Your Progress Exercise 1

1) Fill in the blanks.

a) Infancy is the period in the life of an individual from ..... to ..... year.

b) The infant ..... his birth weight in five months.

c) The growth of the infant can be assessed by measuring ..... and .....

d) The RDIs for ..... and ..... per kg body weight are considerably high during infancy.

e) By growth we mean an increase in body size as a result of an increase in cell ..... and .....

2) State whether the following statements are true or false. Give reasons for your answers.

a) RDIs for certain nutrients are expressed per unit body weight in the case of infants. (True/False)

.....

.....

b) The requirement for iron (per kg body weight) is the least during infancy? (True/False)

.....

.....

c) The infant should be weighed once in six months during the first year of life. (True/False)

.....

.....

d) The infant increases comparatively more in length than in weight during the first year. (True/False)

.....

.....

e) RDIs for infants during the first six months are guidelines for feeding infants who for some reason cannot receive breast milk. (True/False)

.....

.....

.....

.....

9.2.2 Meal Planning for the Infant

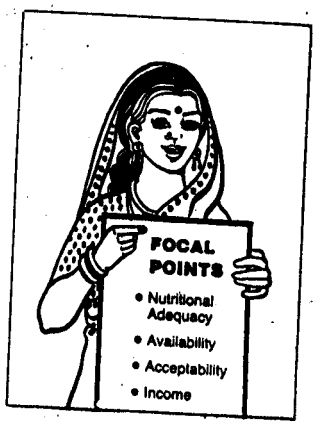
It is clear that the nutrient requirement is considerably high during infancy. The crucial aspect to consider then is how to meet these requirements. What are the foods that should be given to the infant that would help meet the requirement? This section presents a detailed discussion on these aspects.

You know that the first food normally given to the infant is breast milk. Breast milk supplies all the nutrients needed by the baby for the first few months. It is the best food for the baby. But after four to six months, breast milk alone is not sufficient to

meet the growing needs of the infant. Certain other foods need to be provided along with breast milk so as to supplement the shortfall in the nutrients. *This process of introducing foods other than breast milk in the diet of the infant is called supplementary feeding. It is also referred to as weaning.*

Supplementary feeding is a gradual process which begins from the moment other foods (liquid food preparations and solid food preparations) are started and continues till the time the child is completely taken off the breast. Any food other than breast milk given to the infant is referred to as a *supplement* or *supplementary* food. But what are supplementary foods that can be given to the infant? What is the right age to introduce these supplementary foods? Which food would be easily accepted and tolerated by the infant? How much of these foods should be given? You will find the answer to these questions in this section.

The specific considerations one should keep in mind in addition to those mentioned in the margin are discussed below:



Whom are we planning for?

- What is the stage of infancy — 0-4 months, 4-6 months, 6-8 months or 9-12 months?
- What is the expected body weight of the infant at that particular age?
- What is the income level of the family to which the infant belongs?
- Where does the infant live (region)?

Information on these aspects will help you decide on the RDIs and kind and amount of food to be served to the infant. Based on the information first list the RDIs for the infant.

Which are the nutrients of particular importance?

The need for the following nutrients is considerable during infancy:

- energy-giving nutrients (carbohydrates and fats)
- protein
- calcium
- iron
- vitamin A and
- vitamin C

Which foods to select?

During the first few months after birth, breast milk alone provides most of the nutrients required by the baby. Thereafter, in addition to breast milk, one should introduce supplementary foods. What are the supplementary foods that can be given? Before we go on to discuss this, let us first learn about the importance of breast milk. For your convenience the discussion in this subsection is given under three headings.

- Importance of breast milk
- When to introduce supplementary foods?
- What kind of supplementary foods should be given?

Importance of breast milk: Breast milk is the best and the only food for the infant for the first few months after birth. It contains most of the nutrients the baby needs. As soon as possible after birth, the infant should be put to the breast, since sucking stimulates milk production. But before milk is secreted colostrum is produced by the breast. Colostrum should be fed to the baby as it is good for growth and general well-being. What is colostrum? Why is it important to feed colostrum to the baby. You will find the answer to these questions in Highlight 2.

HIGHLIGHT 2
Importance of Colostrum

During the first few days after child birth a thick, sticky yellowish fluid is secreted from the breast. This fluid is called colostrum. Colostrum is very beneficial for the infant, as it has life-saving properties. Colostrum has an especially high concentration of antibodies and white blood cells which protect the newborn from infections. It also contains certain growth promoting substances. The infant's body does not contain these subtances nor does the body have the capacity to make them. These substances must be obtained from colostrum. Hence it is essential that the infant is breast-feed right from day one.

Breast milk is secreted from the third or fourth day onwards. It is the most nutritious and balanced food. It supplies most of the nutrients needed by the infant, in the

correct amounts and proportions. Table 9.2 gives a comparative list of nutrients present in various milks/100 ml.

Table 9.2: Comparison of Nutrient Composition in Various Milks/100 ml

Milk	Energy (Kcal)	Protein (g)	Fat (g)	Carbohydrate (g)	Calcium (mg)
Human	65	1.1	3.4	7.4	28
Cow's	67	3.2	4.1	4.4	120
Ass's	48	2.1	1.5	6.5	80
Buffalo's	117	4.3	6.5	5.0	210
Goat's	72	3.3	4.5	4.6	170

Source: *Nutritive Value of Indian foods* by C.Gopalan, B.V.Rama Shastri and S.C.Balasubramanian; revised and updated by B.S.Narasinga Rao, Y.G.Deosthale and K.C.Pant, National Institute of Nutrition (1989)

Compare the nutrient composition of human milk with that of other milk given in Table 9.2. What do you notice ? Yes; breast milk does have a low concentration of certain nutrients as compared to other animal milks (i.e. cow's, buffalo's, goat's). So, how do we say that breast milk is nutritionally adequate? We say so because the amount and proportion of nutrients present in breast milk is ideal for supporting the growth of the infant. All nutrients are present in just the amounts required by the baby. A high protein and mineral content as seen in buffalo's, cow's milk is not good for the baby as it imposes a great strain on the excretory capacity of the infants immature kidneys. Breast milk, on the other hand, suits the baby's tender digestive system and it gets easily assimilated in the body. Breast milk, however, has a high content of carbohydrates (specially lactose), essential fatty acids and certain protective nutrients like vitamin A, and vitamin E which are beneficial for the infant.

Besides nutritional adequacy, breast milk has other advantages as well which are listed in Figure 9.3.

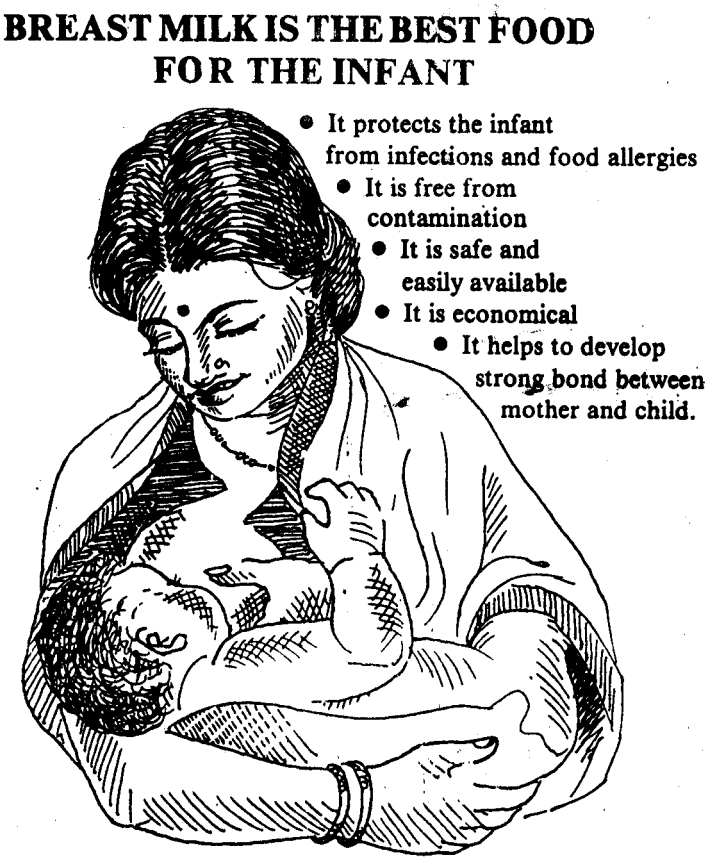


Fig. 9.3 Importance of breast milk

Check Your Progress Exercise 2

1) Explain the following statements in two to three lines.

a) Breast milk is nutritionally adequate.

c) Colostrum has life-saving properties.

When to introduce supplementary foods: In many families you would have noticed that the introduction of solid food is associated with a religious ceremony commonly known as 'Anna Prashna'. This ceremony takes place at around 6 months in some communities and in some as late as one year. But, what is the right time for supplementary feeding? The right time to start with supplements is between four to six months. If you start too early you risk diarrhoea and if you start too late you risk malnutrition. *Hence introduce supplementary foods only around 4-6 months.* But continue breastfeeding.

What kind of supplementary foods should be given: In general, based on the age of the infant, one could vary the texture and consistency of the supplements as follows:

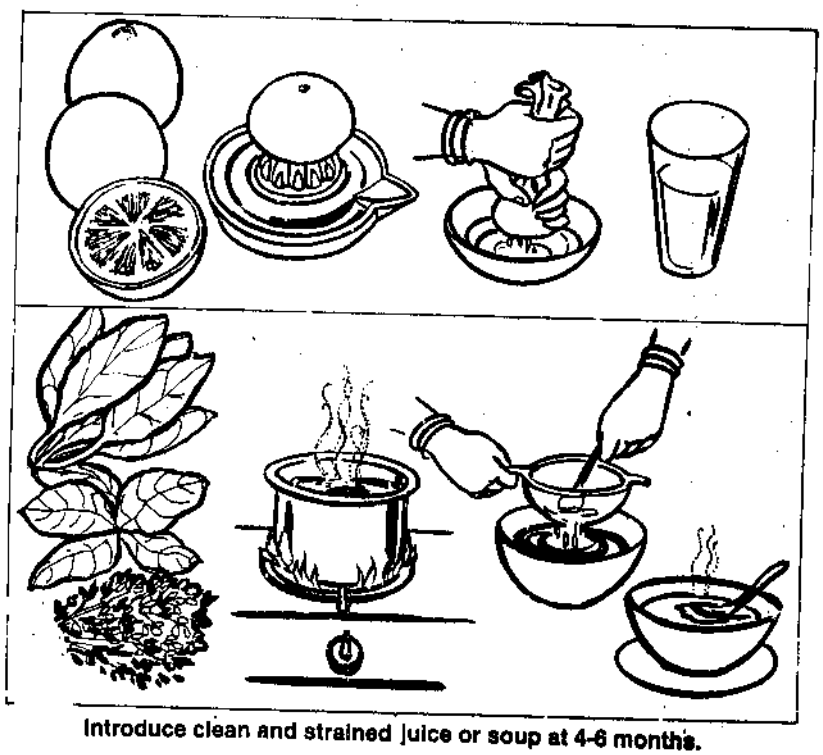
(a) Liquid Supplements at — 4-6 months

(b) Semisolid to solid supplements — well cooked and mashed between 6 - 8 months

(c) solid supplements — chopped or lumpy between 8-12 months

Let us learn what liquid and solid supplements can be given.

a) **Liquid Supplements:** To begin with, at about 4 months, along with breast milk, certain liquid supplements like *juices, soups* or *other milk substitutes* (like animal milk) can be given (Figure 9.4). Juices of seasonal fruits such as oranges, musambi and grapes provide protective nutrients (likely vitamin C) which are not present in



Introduce clean and strained juice or soup at 4-6 months.

Fig. 9.4 Liquid supplements for infants

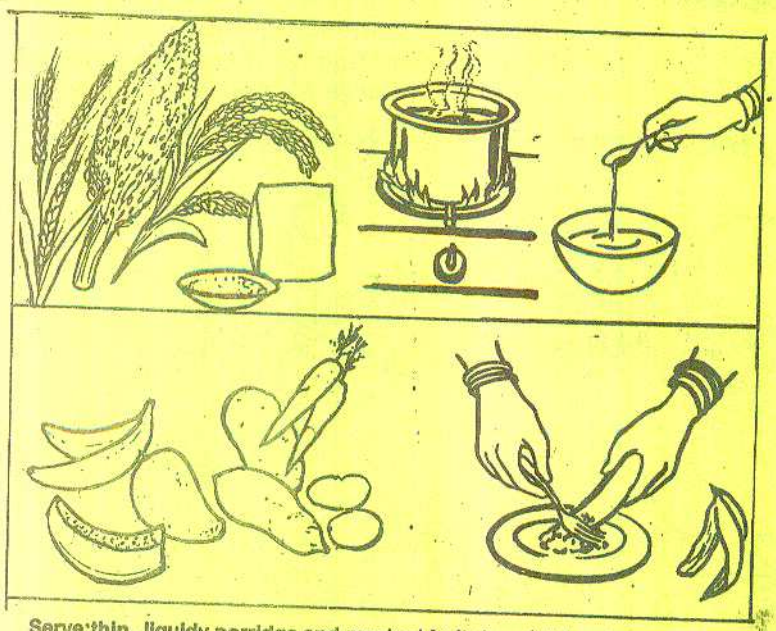
sufficient amounts in breast milk. Alongwith fruit juice, soups of green leafy vegetables may be given. The soup can be prepared by boiling the vegetable in minimum water and a little salt and then straining it through a sieve. The liquid obtained may then be fed to the baby. In addition, thin dal soup can also be given.

Now, what we need to know is how much of these liquid supplements should we give to the infants? In the early stages fruit juices can be diluted with equal amounts of boiled water and only a couple of teaspoons can be fed. Thereafter, the amount can be gradually increased and at the same time the dilution can be cut down. In a few weeks the baby can be given 3 ounces or 85 ml (a little less than half glass) of orange juice or the soup.

A word of Caution: Juices, soups when diluted with excess water and strained may not be able to provide adequate nutrients. Hence, it is advised to use minimum of water for dilution. Similarly mash the dal with the water used for cooking and feed it to the infant instead of serving 'dal ka pani'.

b) **Semisolid and Solid Supplements:** As the child grows, the kind and quality of food given changes. From liquid supplements there is a gradual transition to semisolid/solid foods (Figure 9.5). The first solid food commonly offered at 5-6 months is *a soft thin, liquidy porridge made from the staple food of the community.* The porridge can be prepared by cooking the cereals (i.e. wheat, rice, semolina etc.) with milk and sugar. Such a preparation is called the *basic mix i.e. when the staple (cereal) has one food (usually a protein source) added to it.* A common basic mix served to the infants in the south is 'ragi kanjee' and in the north 'suji kheer'. A few other common examples of basic mix with the method of preparation is given in Annexure 3 at the end of the block.

A staple porridge can be made with any cereal flour — maize, jowar, sago, semolina etc. The addition of just one-fourth to half a teaspoon of germinated wheat flour to the porridge will ensure that it does not thicken at all and will be in a form that the baby can swallow easily. What is this 'germinated wheat flour'? Why are we suggesting the use of this in the porridge? What is its role in making thick porridges thin? Information on this new interesting concept is given in Highlight 3.



Serve thin, liquidy porridge and mashed fruits/vegetables at six months.

Fig. 9.5 Semisolid supplements for infants

Other than the porridge, *starchy fruits and vegetables which are cooked well and mashed* can be given round 5-6 months. Roots and tubers, vegetables that can be given in the mashed state include potatoes, sweet potatoes, yam, carrots, green leafy vegetables. It is advisable to boil these vegetables in minimum water till tender and then to mash them properly. The mashed vegetable can be fed as such or with a little salt or/and ghee/butter could be added to provide more energy. Remember, only the pulp of vegetables is to be given. The skin and seeds, if any, and other fibrous matter is to be discarded.

Among the fruits — bananas, papaya, mangoes or any other seasonal fruit could be mashed and given as such, whereas, other fruits like pineapple, peaches etc.need to be first stewed (i.e. boiled in a little water and sugar till tender) and mashed before being served. Remember to discard skin, seeds of the fruits before serving.

Other supplements which could be given include yolk of a hard- boiled egg, finely minced and cooked meat, mashed fish (without bone), well cooked and mashed dals. NOTE: Salt, can be added to taste. Small amount of fat (i.e. butter) can also be added to provide more energy.

Along with all these supplementary food *remember breastfeeding should be continued.*

HIGHLIGHT 3
Reducing the bulk of thick staple porridges

Staple porridges especially cereal based porridges have the disadvantage of being bulky. Rice, for example, absorbs more than twice its own volume of water before it becomes soft enough. Even small amounts of rice when cooked become bulky. It is, therefore, very difficult for the infant to eat this at one time. His stomach is also too small to take all this bulk. So what does one do? One could quite simply dilute the preparation with water and serve. But by diluting with water the nutrient content of the preparation will be lowered. We need to avoid this. Instead one other simple way of making thick/bulky porridges thin would be to add a few grams of Amylase-Rich-Food (ARF) to the porridge. What is ARF? ARF is nothing but flour obtained from germinated grain. Germinated grain flour contains a lot of amylase (an enzyme) which makes the porridge soft, thin and easy to eat, without taking away any of its nutritive value. (Amylases as you studied in Unit 2, Block 1 are enzymes which aid in splitting starches).

All that a mother has to do is to *germinate* 200 g of wheat grain (by soaking them in triple volume of water for 12 hours and then wrap it in a wet cloth for 48 hours), *sun dry* (6-8 hours) them, *remove the sprout* and then make a powder of the remaining grains (Figure 9.6).

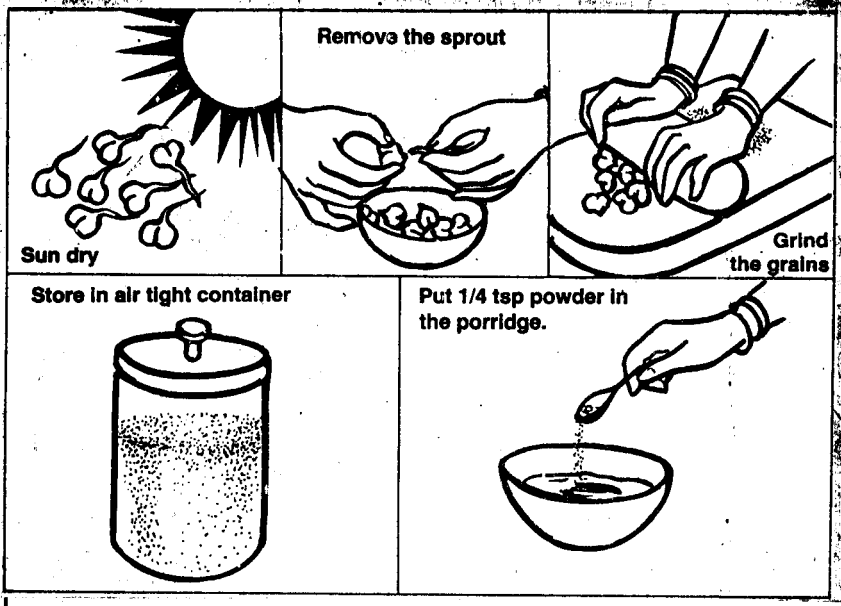


Fig. 9.6 Preparation of ARF powder

Cereal grains like bajra, jowar, maize may also be used to make the powder. This powder can be stored in an air-tight container for one month. It will suffice for one child's porridge for 30 days. Use only few grams i.e. 1-2g. (not more than one-fourth of a teaspoon) of this powder in the porridge. You would notice that the porride becomes thin and can be easily swallowed.

c) Solid Supplements: By eight months. you would notice that the baby starts teething. This is the right time to change him over to chopped and lumpy (thick) foods. The foods which were boiled and mashed earlier should be now just boiled and *cut into*

small pieces before being served. For instance, vegetables like potato and carrots could be boiled and cut into small pieces. Minced meat and fish could be boiled and served as such instead of mashing. Soft cooked rice or small pieces of chapaties may also be introduced at this stage.

As the infant is teething, it is beneficial *to give more of crunchy foods like a hard biscuit* or a piece of toast/rusk or a slice of raw carrot or a fruit segment (seeds and skin removed) which would be ideal for the child to chew. These foods would aid in teething and provide exercise to the gums.

In addition to this, *thick porridges* can be prepared and served to the infant. Earlier you studied about the basic mix i.e. cereal porridges prepared by adding milk and sugar. Now other than milk, foods like pulses, animal foods, green leafy vegetables, other vegetables can also be added to the staple to *form a multimix* (Figure 9.7). When the staple i.e. the cereal *has more foods added to it,* (protein source plus vitamin/mineral source) we call it a multimix. A commonly used multimix in the north is 'khichri' and 'pongal' in the south. Multimixes can be prepared by mixing the following food items:

(a) Cereal + pulse + green leafy vegetable
or
(b) Cereal + pulse + milk
or
(c) Cereal + pulse + vegetable + curd
or
(d) Cereal + animal food + green leafy vegetable
or
(e) Cereal + milk + fruit + nuts (finely ground)
or
(f) Cereal + animal food + green leafy vegetable
or
(g) Cereal + animal food + orange yellow vegetable (carrot, pumpkin etc.)

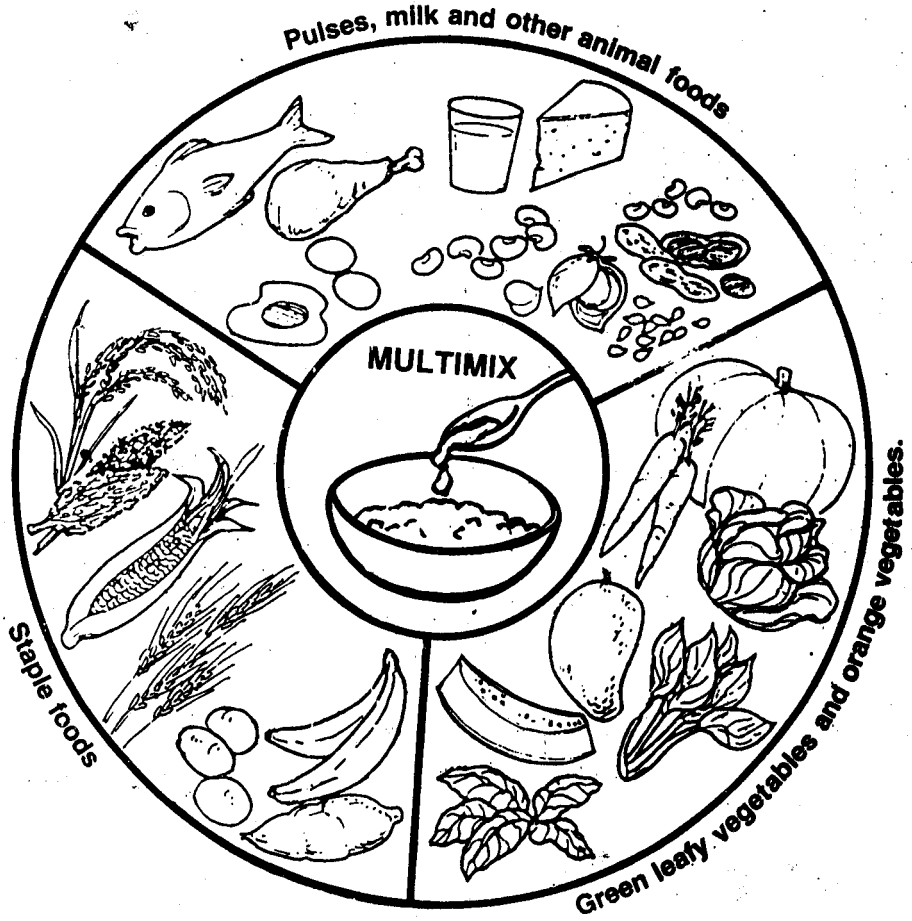


Fig. 9.7 Solid supplements (multimixes) for infants

Multimixes can be introduced as early as 6-7 months of age. You could add one-fourth of a teaspoon of ARF powder to the multimix to make it thin and easy to swallow. Some of the multimixes or infant foods that can be prepared daily for the infants are given in Annexure 4 at the end of the block.

What foods to give at 12 months i.e. one year? By the age of one year (i.e. 12 months) the baby can take all solid foods. In fact, the infant should be *eating foods prepared for the family,* for example rice/dal; chapati/dal; rice/fish; chapati/subji. A chapati can be crumpled into small pieces and softened with milk, dal or curd and salted or sweetened according to the baby's taste and served. Rice can be served with dal and vegetable all mixed well. Attempts should be made to get the infant slowly on to the family meal pattern. Along with these foods breastfeeding should be continued. But if breast milk has ceased, then the child can be given half a litre of animal milk per day either a; such or as curd, cottage cheese or milk pudding or porridge.

Along with the supplementary foods, one should *provide plenty of water/fluids to the infants.* Small amounts of boiled and cooled water should be given 2 to 3 times a day or more often, depending on the need. More water needs to be given during hot seasons and especially if the baby has diarrhoea.

What should be meal pattern?

The type and quality of food given would depend on the age of the infant. Consider the meal patterns A, B, C and D.

Meal Pattern A **0-4 months**	**Meal Pattern B** **4-6 months**	**Meal Pattern C** **6-8 months**	**Meal Pattern D** **8-12 months**
Birth-2m: Breast milk 7-8 times a day	On waking- Breast milk 8 AM-Fruit juice	On waking- Breast milk 9 AM-Mashed fruit/vegetable	On waking- Breast milk 9 Am-Multimix 11 AM-Fruit cut into pieces
From 2m-4m: Breast milk 6-7 times a day	10 Am-Mashed banana 12 PM-Breast milk 2 PM-Dal soup 4 PM-Breast milk 6 PM-Vegetable soup 8 PM-Breast milk 10 PM-Breast milk	11 Am-Breast milk 1 PM-Porridge 4 PM-Breast milk 6 PM-Porridge 8 PM-Breast milk 10 PM-Breast milk	1 PM- Multimix 4 PM- Breast milk/ other milk 6 PM- Rusk/Biscuit/ a slice of bread 8 PM-Multimix 10 PM-Breast milk

From birth to four month only breast milk is to be given. There is no rigid rule for the number of times the infant should be fed each day. Feeding on a self-demand schedule is recommended. However, roughly *6-8 feeds can be* given during the first few months which can be reduced slowly. By the age *of 6 months* babies should be given some staple based porridge about twice a day. One to two teaspoonfuls are enough to start with, followed by about 3-6 large spoonfuls at each feed subsequently. *By 9 months,* however, atleast *4-5 supplements* in addition to regular breastfeeding should be given.

The frequency of breastfeeding should be gradually reduced. In fact, *by the time the child is 12-18 months, attempts should be made to take the baby off the breast. By one year,* the child is capable of eating and digesting a variety of foods. The child is ready to eat the family food i.e. chapati, dal, rice, vegetables etc. But the child may not be able to eat much at one time. On the other hand, the child's energy needs, are greater than is indicated by its size. So the problem is how to provide enough energy food to the child. The answer is:

- feed the child frequently – *five to six times* a day in addition to breast milk/and
- enrich the child's food with a little oil or fat.

Simple tips on infant feeding are listed in points to remember.

POINTS TO REMEBER

Infants

Breastfeeding:

1) Breastfeed the baby soon after birth and feed frequently on demand.
2) Breastfeed for as long as possible (atleast one to one and a half years).

Supplementary feeding :

1) Start supplementary feeding when a child is between 4 to 6 months of age
2) Introduce clean and strained liquid supplements like juice or soup at 4-6 months
3) Give well cooked and mashed supplements at 6-8 months
4) Give to the infants aged 9-11 months rusk, biscuits, pieces of carrot, cucumber to chew
5) Start giving the infant whatever is cooked for the family by the age of one year
6) Feed infants (at 10 months to 1 year) solid foods 5-6 times a day
7) Give such foods to the infant which are seasoned lightly (preferably only with salt); all other spices should be avoided
8) Offer a balanced diet; prepare nutritious mixes, using combination of foods

How to feed the infant :

1) Introduce only one food at a time; give enough time to the infant to get familiar with each food, before introducing another one
2) Give as much as the baby wants at a time; refrain from forcing the infant to eat
3) Try any new food a number of times; don't give up if the infant refuses it initially; continue giving the food; the infant will slowly develop a taste for it
4) If a baby does not like a particular item, change it or give it in a different from e.g. if milk is disliked-give 'dahi' (curd), it is as good as milk.
5) Introduce a variety of foods to the infant so that in time he learns to accept various foods

Cleanliness and hygienes :

1) Wash hands before cooking and giving food
2) Make sure all foods and the utensils used to prepare and serve the food are clean
3) Water used for any preparation should be clean and boiled.

From our discussion so far you would have got an idea about infant feeding. Now consider the case of Lata. Lata had a baby two weeks back. Like most mothers she started breastfeeding her baby right from day one. But to her dismay, she found she was unable to feed her baby because of the inability to secrete adequate breast milk. Lata was very worried. She consulted her doctor. The doctor diagnosed her condition as *Lactation Failure*. Lactation failure refers to the inability of the mother to secrete breast milk. There is either a deficient supply of milk or at times there is no milk secretion. Under such circumstances what should Lata do. We are already aware about the high nutrient need during infancy. How should Lata meet the needs of her growing baby? She need not worry. For her and for many women like her here is a detailed discussion on Infant feeding in lactation failure in Highlight 4.

HIGHLIGHT 4
Infant Feeding in Lactation Failure

If a mother is unable to breastfeed, there are other substitutes available to feed the baby. One such substitute is animal milk i.e. cows, buffalo's, goat's milk.

From the different animal milks available, *cow's milk is best suited for the infant*, since its nutrient composition is somewhat similar to that of breast milk (Table 9.2). But cow's milk like the other animal milk, contain more protein as compared to human milk. So in order to make it comparable to breast milk, it needs to be suitably diluted with clean boiled water to lower the protein content and bring it closer to the level of protein as present in breast milk. But how much of water should be added? *During the first few weeeks* the dilution for cow's milk should be in the proportion of 2:1 i.e. 2 parts of water to one part of milk. This proportion of water is subsequently reduced so that by 2-3 months the milk is diluted in the proportion 3:1 i.e. 3 parts milk to one part water. *By six months* the infant can be given whole cow's milk, without dilution. In case of buffalo's milk, which is very rich in fat (hence difficult to digest), one could first boil the whole milk and allow it to stand for some time. The thick cream formed on top can be removed. This will reduce the fat content, as well as, some protein from the milk. The milk (an then be diluted in the proportion of 3:1 (i.e. 3 part of milk to one part of water) for the first 2-3 months only and then served to the infant. Later, after 2-3 months it can be given without dilution.

Another point needs to be considered is that human milk contains more sugar, as compared to other animal milk. Now, when animal milk is diluted, the sugar content falls far below that of human milk. Thus to improve this milk, one

would need to add a little sugar. About one level teaspoonful, i.e. 5 g. can be added into 75-100 ml of milk.

Now the question that needs to be answered is how, much of this milk should be given to the baby? Well, the quantity of feed will vary, to a certain extent, with each baby. However, Table 9.3 gives an approximate idea about the quantity to be served.

Table 9.3 : Approximate amounts of other milk served to the infants

Age of infant	Approximate amount and number of feed	
	Amount of feed	Number of feed/day
Birth to 1 month	50-75 ml,	6-8 times a day
1 month to 2 month	75-100 ml,	6-8 times a day
2 month to 4 month	100-125 ml,	5-6 times a day
4 month to 6 month	150-175 ml,	5-6 times a day
Beyond 6 months	175-200 ml,	4-5 times a day

Along with this milk, other supplementary foods should be introduced at about 4-6 months of age.

One should also remember that *the milk given to the infant should be boiled. All the utensils used for cooking /feeding should be washed in clean water and steamed or boiled to kill the germs.*

Check Your Progress Exercise 3

1) What do you understand by supplementary feeding?

.....

.....

.....

.....

.....

2) Fill in the blanks.

a) Supplementary feeding should begain around.....months.

b) .....and.....foods should be given at 6 months.

c) When he child starts teething.....and.....foods should be given.

d) Infants cannot eat much at one time. They need.....and .....feeding.

e) Along with supplementary feeding.....should be continued.

f) In case of lactation failure.....milk is best suited for the baby.

3) Note down some of the staple porridges or multimixes used in your community.

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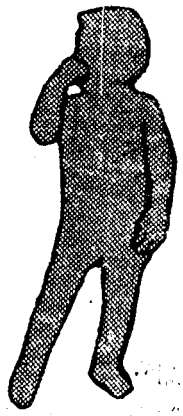


9.3 THE PRESCHOOL CHILD

Who is a preschool child? Here we will consider a child in the age group 1-6 years as a preschool child.

From the growth and development standpoint,the preschool child, like the infant is extremely vulnerable. A preschooler grows rapidly, but when compared to infancy, the rate of growth is somewhat slower and more gradual. The average gain in weight during the preschool age is only about 2-2.5 kg each year as can be seen from Figure 9.8. It is, however, interesting to note that the preschool child gains

comparatively more in height than in weight. By three years the child is about 93 cm tall and by four years about 100 cm tall. Because of this the child gives an appearance of being tall and thin as compared to the round and chubby appearance characteristic of infancy. Another characteristic feature of the preschool child is the increased physical activity. The infant from being dependent on the mother moves on to becoming independent especially in terms of gaining control over the body. The increased physical activity and the growth taking place during the preschool stage necessitates a higher intake of nutrients.

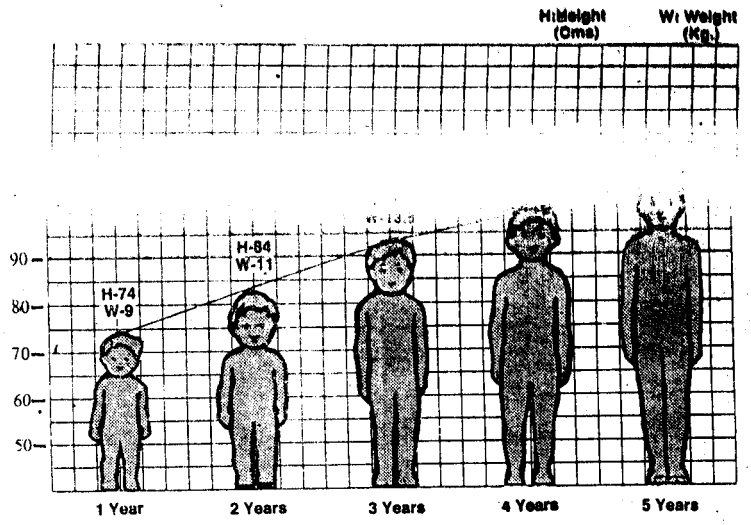


Fig. 9.8 Average height/weight of preschool children

Regular weight gain is the most important sign of the child's overall health and nutritional status. Weighing the *child once every three months during the second year, and subsequently once a year, till the child goes to school,* would give a good indication of the child's growth. Any subnormal growth or growth failure can be easily detected and corrected. It is important to mention here that it is during the early years of childhood i.e.0-6 years, that "catch-up" growth is possible. What do you mean by "catch-up" growth? To understand this, consider a case of growth failure i.e. a child, whose height/weight is considerably lower as compared to other children of his age. Now, if during infancy and preschool years right inputs i.e. good diet and clean, safe hygienic living conditions are provided, it will be possible for the child to make up for the earlier deficit in growth and development. From this standpoint, therefore, preschool period is very crucial. Diet plays an important role in promoting good health. Let us now study the influence of above mentioned factors on the nutrient needs of a preschool child.

9.3.1 Recommended Dietary Intakes for the Preschool Child

The recommended dietary intake that would support optimum growth and development of the preschool child is given in Table 9.4.

Table 9.4: Recommended Dietary Intakes for the Preschool child

Nutrients	RDIs Age group	
	1-3 years	4-6 years
Energy (Kcal)	1240	1690
Protein (g)	22	30
Calcium (mg)	400	400
Iron (mg)	12	18
Vitamin A (μg) Retinol	400	400
or Carotene	1600	1600
Thiamine (mg)	0.6	0.9
Riboflavin (mg)	0.7	1.0
Niacin (mg)	8.0	11.0
Ascorbic acid (mg)	40	40
Folic acid (μg)	30	40
Vitamin B_{12} (μg)	0.2-1.0	0.2-1.0

Source: Nutrient requirements and Recommended Dietary Allowances for Indians, ICMR (1990)

The preschool years represent the age from approximately 1 year to 6 years. It is obvious that at any given age the nutrient need would vary depending on the level of growth and physical activity. This is the reason why the nutrient need of the preschool child is given under two categories — 1-3 years and 4-6 years in Table 9.3.

The total energy requirement of the preschooler increases with age, but if you were to calculate per kg intake you would notice that in comparison to early infancy (0-6 months), the requirement is markedly less. This of course is attributed to the gradual and slower rate of growth typical of preschool years.

The requirement for other nutrients (in proportion to body size) is also high *but the need for a few nutrients like protein, calcium, vitamin A and iron is the most.* This is so because these nutrients support the growth and development of the body. A preschool child is more prone to infections and diseases hence protective nutrients, especially vitamin A and iron are particularly important. The diet of the preschool child must provide sufficient amount of these nutrients.

Check Your Progress Exercise 4

Fill in the blanks.

a) The preschool stage is the period from.....to .....years.

b) As compared to infancy, growth during the preschool stage is ..... and more .....

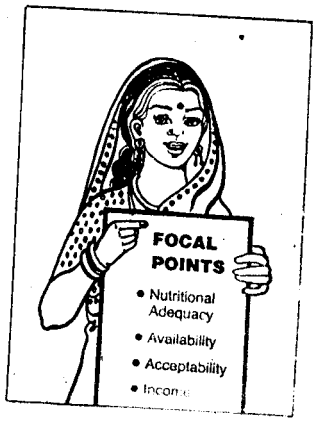
c) The preschool stage is characterized by increased .....activity.

d) The dietary requirement for ..... and .....is high in the case of the preschooler.

e) A preschooler increase more in ..... than in .....

f) The gain in weight during the preschool years is only ..... kg each year

9.3.2 Meal Planning for the Preschool Child



The preschool years are the time to establish good eating habits in children. At the same time the influence of parents, friends, television, activities associated with food, help to shape the child's food habits. Providing an adequate diet for the child is, therefore, a challenging task. What dietary measures should one keep in mind while planning/preparing a diet for children? How to plan balanced meals keeping the likes/dislikes in mind? How much of which food item should be included? These are some of the questions which are often asked in the context of feeding preschoolers. In this subsection, you will find the answer to these questions.

We begin meal planning for the preschool child by taking into consideration the basic four factors listed in the margin. The other considerations include:

Whom are we planning for?

- Is the child in the 1-3 year age group or in the 4-6 year age group?
- What is the income of the family to which the child belongs?
- Which region does this child belong to?

Information on these aspects would help us select the right kinds of foods (in the right amounts and proportions) that would be included in the day's diet. Based on the information the RDIs can be listed.

Which are the nutrients of particular importance?

Some of the nutrients which are crucial for the growth and development of a preschool child include:

- Energy-giving nutrients (carbohydrates and fats)
- Protein
- Calcium
- Iron and
- Vitamin A

Which foods to select?

The diet of the preschool child must include at least one food item from each of the three major food groups namely energy-giving, body-building and protective / regulatory. But you are also aware that the need for energy, protein, calcium, iron and vitamin A is considerable during the preschool age. Hence, include more of

energy-rich foods, specially cereals; protein-rich foods such as pulses, meat, egg; calcium-rich foods particularly milk and milk products and iron-rich foods such as meat (particularly liver) pulses and green leafy vegetables in the diet. A list of food items rich in energy, protein, calcium and iron is given in Annexure 1. You could consult it and select food items according to the likes/dislikes of the child and availablity of the food item. As for the vitamin A-rich food sources one can select one or two of the following foods as indicated in Figure 9.9.

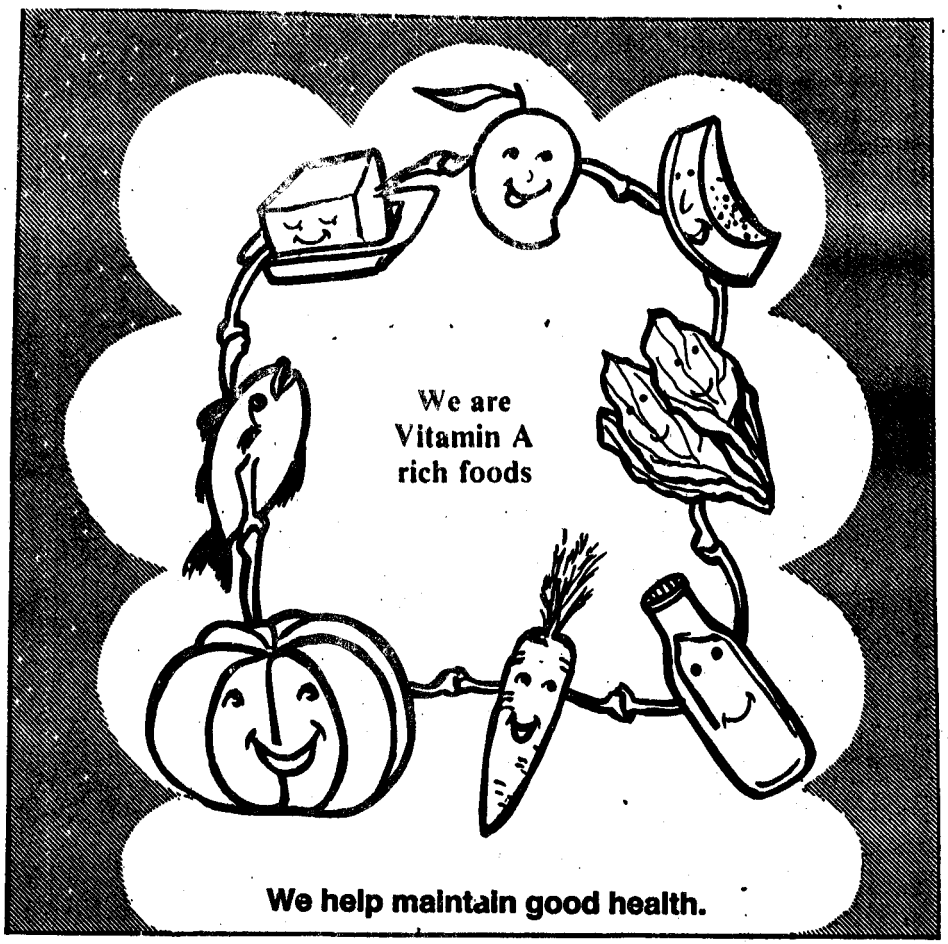


Fig. 9.9 Preschoolers need foods rich in Vitamin A

What should be the meal pattern?

Always remember that a regular meal pattern should be maintained. Too long or too short an interval between successive meals should be avoided. The preschool child may not be able to eat much at one meal. *Hence, small frequent meals need to be given. A preschool child would benefit from three small meals plus 2 to 3 snacks in-between meals per day.* The meal pattern adopted would actually depend on the age of the preschool child. Consider the list of meals given under A and B.

A	B
Early Morning	Early morning
Breakfast	Breakfast
Mid-morning meal	Mid-morning meal
Lunch	Lunch
Mid-afternoon meal	Tea
Tea	Din
Dinner	Bed Time
Bed Time	

A) is likely to be adopted for a *1½ year* old child. The child needs to be given food every 3-4 hours. Alteast 2-3 milk feeds (early morning, tea, bed time) should be given. In addition foods of high protein and energy content should be given 4-5 times a day.

B) is likely to be adopted for a *3-5 year old* child. In addition to 2 milk feeds, and three main meals (breakfast, lunch, dinner) other nutritious foods, snacks and food preparations should be served in-between meals.

What are the food preparations/snacks suitable for the preschool child?

Any snack/food preparations based on the common locally available cereals and pulses can be prepared. The snack should provide on an average 300-400 kcals. But, ensure that the bulk of the preparation fed to the child is not very large. A child will remain healthy and well nourished provided food/snacks of high energy / protein / calcium / vitamin A content are given (without increasing the bulk/volume). Snacks should supplement not substitute the main meals. Snacks should be such that are easy to prepare and should be in a form easily handled by the child. A few ideas for snacks for preschool children are given in Annexure 5.

What are the other specific considerations?

i) Mealtime for children should be relaxing and enjoyable. Children learn to enjoy food when they are allowed to feed themselves. It is easier for the child to feed on his own if food is cut into bite-sized pieces that can be readily handed and lifted to the mouth. Children like foods that can be eaten with the fingers (Fig 9.10).

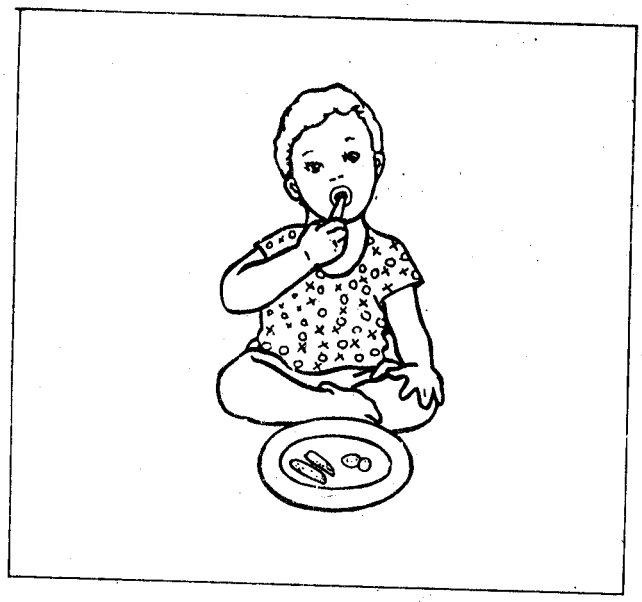


Fig. 9.10 Children enjoy finger foods

ii) When introducing new foods to the child, offer one at a time. Give only small amounts at first. Let the child make the decision of liking or disliking the food. Never make an issue of food acceptance. Forcing the child to eat a particular food may establish an unfavourable attitude towards that food. If the food is rejected, wait for a few weeks and then try again.

iii) Children of preschool age develop very strong likes and dislikes for certain foods. They might avoid eating one or more essential foods. For example, green leafy vegetables, milk are usually disliked by children. In such situations, therefore, it is advisable to change the form of the food and then serve it to the child rather than totally omit it from the diet. Fewer difficulties are likely to be encountered if foods which are disliked by children are given when the child is hungry.

iv) Children are easily influenced by the parents attitudes towards food. Parents should, therefore, be extra careful of not to express their likes and dislikes in front of children (Figure 9.11). Rather they should eat a variety of food and encourage the child to do the same.

v) Foods served to children should be warm and not too hot or too cold.

vi) Children usually have a very high taste sensitivity. They do not enjoy highly flavoured foods. Only mildly flavoured foods should be included in the diet.

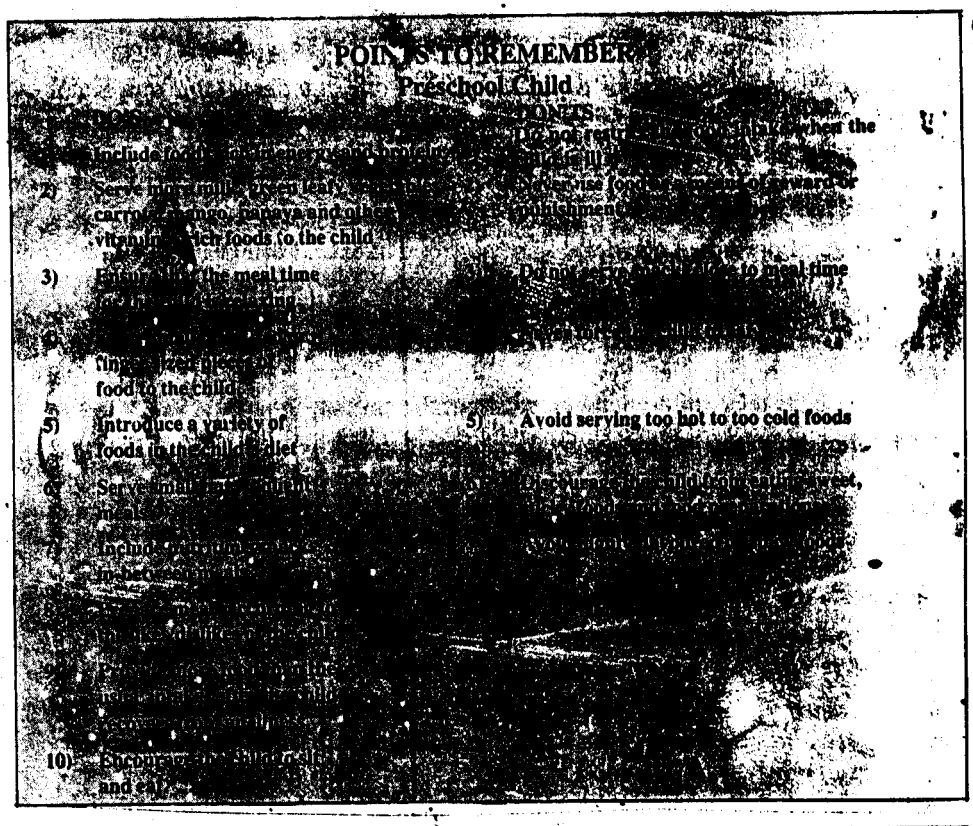
vii) The digestive tract of the preschool child is easily irritated by spicy food, very sweet or fried foods. Hence, such foods should be avoided. Further consuming excessive amounts of fibrous food also irritates the tender digestive tract. It is, therefore, advisable to use a minimum of fibre-rich foods for preschool children.

viii) Preschool children are almost constantly active. Their interest is readily diverted from food. Hence, it is essential to prepare meals that look colourful, attractive and catch the attention of the child and motivate them to eat.

Fig. 9.11 Parents attitudes influence children's food habits

ix) It is important that the child eats a good breakfast. **Breakfast should supply upto** one-third of the day's energy reqirement. A good nutritious breakfast served in the morning would help increase physical and mental efficiency of the child.

Simple tips on how to provide adequate and satisfying meals for preschoolers are listed below n points to remember.



NOTE: REFER TO THE PRACTICAL MANUAL — PART I (SECTION 6) FOR DIETS FOR INFANTS AND PRESCHOOLERS.

Check Your Progress Excercise 5

1) State whether the following statements are true or false. Give reasons for your answers.

   a) When supplementary feeding has been delayed, the child does not accept food easily at one year of age. (True/False)

   b) Small frequent meals should not be given to the preschooler. (True/False)

   c) Fibre rich food like whole grain cereals, whole pulses should be totally avoided for older preschool children. (True/False)

   d) Foods disliked by preschoolers should be avoided. (True/False)

   e) At each meal, large helpings of food should be given. (True/False)

2) State any three specific considerations that should be kept in mind while feeeding preschoolers.

9.4 LET US SUM UP

In this unit you studied about infancy and the preschool stages.

Infancy refers to the first year of life after birth. Infancy is a period of rapid growth and development. To support the growth and development the nutritional needs are considerable. The RDI for energy, protein, calcium and iron are particulary high. The nutrient requirement of the infant for the first six months can be easily met by breast milk. After six months, however, breast milk alone is not sufficient to meet the growing needs of the infant. Along with breast milk other food supplements (liquid, semi-solid, solid) need to be given according to the age of the infant. By the age of one year the infant should be ready to eat the family food.

Preschool stage i.e. 1-6 years, is also a rapid growth period. But compared to infancy the growth is gradual and slow. The most characteristic feature of the preschool age, however, is the increase in physical activity of the child. Because of the rapid growth and increased physical activity, the nutrient requirement is high. To meet the nutrient requirement of preschoolers, certain dietary considerations should be kept in mind. First, the meal should be balanced and nutritionally adequate. Regularity in the feeding schedule should be maintained. Since the child cannot eat much at a time, small but frequent meals should be given. Substantial snacks should be offered in between the main meals — mid-morning or in the evening. Strongly flavoured or fatty foods should be avoided. Meals served should be attractive and appealing to the eye so that the child is motivated to eat

9.5 GLOSSARY

Food Allergy : It is the condition when the body reacts unfavourably to milk or other food substances. Allergy might manifest itself in the form of diarrhoea, skin rash or any other such problems.

Malnutrition : It can be defined as a pathological state resulting from relative or absolute deficiency or excess of one or more essential nutrient, which can manifest into overnutrition or undernutrition.

Staple foods : The foods used frequently or daily in meal preparation. For example rice is the staple food in south, and wheat is the staple food in north.

Subnormal growth : It refers to below normal growth, for example when the height/weight of an individual is considerably lower as compared to other individual of the same age it is referred to as subnormal growth.

Vulnerable : Refer to someone capable of being physically/emotionally hurt; Susceptible to infections/diseases.

Weaning : The gradual change in the infants diet pattern from breast milk to other liquid food preparation and cooked solid food preparation is referred to as weaning.

9.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) a) birth; one b) doubles c) weight, height
   d) any two of the following — energy/protein/calcium/vitamin A e) size; number

2) a) True; the RDIs for some nutrients are expressed per kg body weight because their requirement is substantially different within the specific age category.
   b) False; the requirement for iron is high during infancy because the blood volume increases and, therefore, iron is required for the synthesis of haemoglobin in the blood cells.
   c) False; an infant should be weighed every month during the first year, to assess the pattern of growth.
   d) False; an infant gains comparatively more in weight than in height.
   e) True; the RDIs for the first six months are only guidelines for feeding infants who cannot receive breast milk. If an infant who is breast fed, on an average, receives 850 ml milk/day his RDIs are easily met.

Check Your Progress Exercise 2

1) a) Breast milk is nutritionally adequate as it contains all nutrients in the right amount and proportion. The protein content of breast milk, as compared to other milks, is low, but it is the right amount for the infants growth. The carbohydrates and the essential fatty acids content of breast milk is high which is beneficial for the child.
   b) Breast milk contains certain substances which are protein in nature and protect the infant's body from infections and diseases. These substances thus prolong the body immunity.
   c) Colostrum is life-saving as it has protective functions. It contains high concentration of antibodies and white blood cells which protects the child from infections.

Check Your Progress Exercise 3

1) The process of introducing foods other than breast milk (liquid foods, other substitute milk preparation, cooked solid food) in the diet of the infant is called supplementary feeding.

2) (a) 4-6 (b) Well cooked; mashed (c) crunchy; lumpy (d) small, frequent (e) breastfeeding (f) cow's

3) Answer on your own.

Check Your Progress Exercise 4

1) (a) one: six (b) slow, gradual (c) physical (d) any two of the following — energy/ protein/ vitamin A/ calcium (e) length; weight (f) 2-2.5

Check Your Progress Exercise 5

1) a) True; because the child is not familiar with the food and has not developed a taste for it.

b) False; small frequent meals should be given to the preschoolers since, the child may not be able to eat much at one time.

c) False; fiber-rich foods should be served judiciously since high fibre diet would irritate the digestive system of the child.

d) False; foods disliked by the children should not be avoided infact they could be served by changing the form of food.

e) False; small amounts of food should be served at each meal since the capacity of the childs stomach is small and he cannot eat much at one time.

2) List any three of the following:

- Regularity in the feeding schedule should be maintained.
- Small frequent feeding should be given.
- All fried, spicy and strongly flavoured foods should be avoided, whilst the fibrous food should be reduced.
- Serve more milk, green leafy vegetables, yellow and orange fruits and vegetables and other vitamin A rich foods to the child.
- Include nutritious snacks in-between meals.

UNIT 10 MEAL PLANNING FOR THE SCHOOL CHILD AND ADOLESCENT

Structure

10.1 INTRODUCTION

The astonishing processes of growth and development have unfolded before you in this block. We took you through the dramatic phase of foetal growth and the rapid development of infants and preschoolers. Our journey through the lifespan continues in this unit with the school years and adolescence.

As you read the following pages, you will learn that the rate of growth characteristic of infants and preschoolers does not continue during the school years. It slows down before increasing again as the child enters the period of adolescence.

The pattern of growth and development changes as an individual grows from infancy to adulthood as you would have realized by now. Here we are using the term "pattern" to mean the ways in which specific tissues, organs and body parts grow and develop. Particular times in the lifespan are associated with a particular growth pattern. For example, brain development is rapid during foetal life whereas development of sex organs takes place during the adolescent years.

These changes in rate and pattern of growth have a significant influence on the need for nutrients. This is why the recommended dietary intakes of a school child or adolescent differ from those of an infant or preschooler.

Besides the influence of age on requirements, you will also notice the influence of sex in determining nutrient needs. The needs of certain nutrients become different for boys and girls during the school years. Further, this difference persists later in life.

In this unit you will also study how important it is to develop good food habits. School children and adolescents enjoy a sense of independence. They like to make their own decisions about what they should eat and how much to eat. It is important, therefore, to give them the knowledge they need to make wise food choices. As you read on, you will came across several points related to encouraging good food habits, ensuring adequate food intake and planning meals and diets for school children and adolescents.

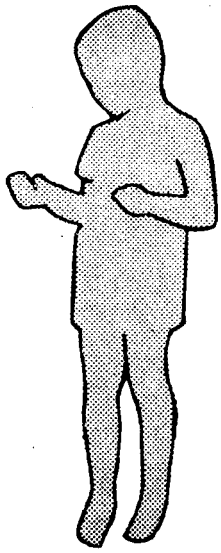
Objectives

After studying this unit, you will be able to:

- describe the characteristics of the school years and adolescence
- list the recommended dietary intakes for the school child and the adolescent and
- discuss the important factors in planning meals and diets for school children and adolescents.

10.2 THE SCHOOL CHILD

In this unit the term "school child" refers to children from the age of 7 years to 12 years. You would remember that we had said earlier, in Unit 9, that the preschooler grows at a slower rate as compared to the infant. During the school years the rate of



growth further slows down. This, however, does not mean that no significant growth occurs. In fact, *growth continues at a steady pace.* Further, the school years are characterized by an *improvement of the functioning of most tissues and organ systems.* It is important to emphasize that considerable growth and development of both muscles and bones takes place. This influences nutrient needs as you will study in the subsection on recommended dietary intakes.

The school years precede adolescence and are, in fact, spent in preparation for it. We mentioned adolescence earlier as a period of very rapid growth. It is important, therefore, that a good foundation is laid during the school years. One way in which we can do this is to provide good food. A satisfactory diet is, as you know, crucial in fostering the optimum growth and development of the child. This aspect has been stressed in every unit of this block because of its great importance.

Sex differences in growth and development first make their appearance at around the age of 10 years. You already know that weight is a good indicator of growth. So let us study the pattern of weight gain of school boys and girls from the age of 7+ to the age of 12+. This is illustrated in Table 10.1.

Table 10.1: Weights of Well-to-do* Indian Boys and Girls (7- 12 years)

Age (years)	Average Weight(kg)	
	Boys	Girls
7+	24.46	24.45
8+	26.42	25.97
9+	30.00	29.82
10+	32.29	33.58
11+	35.26	37.17
12+	38.78	42.97

Source: Nutrient Requirements and Recommended Dietary Allowances for Indians, ICMR (1990)

* This refers to affluent boys and girls. The assumption is that these children would be attaining their maximum potential for growth since they can be expected to be well nourished.

Girls, as you would notice, start weighing more than boys at the end of 10 years and they continue to be heavier than them till the early years of adolescence i.e. about the age of 14. The rate of growth in the case of boys is initially slower but picks up later and overtakes that of girls. If we plot weight against age on a graph these differences in growth become clearer (Figure 10.1).

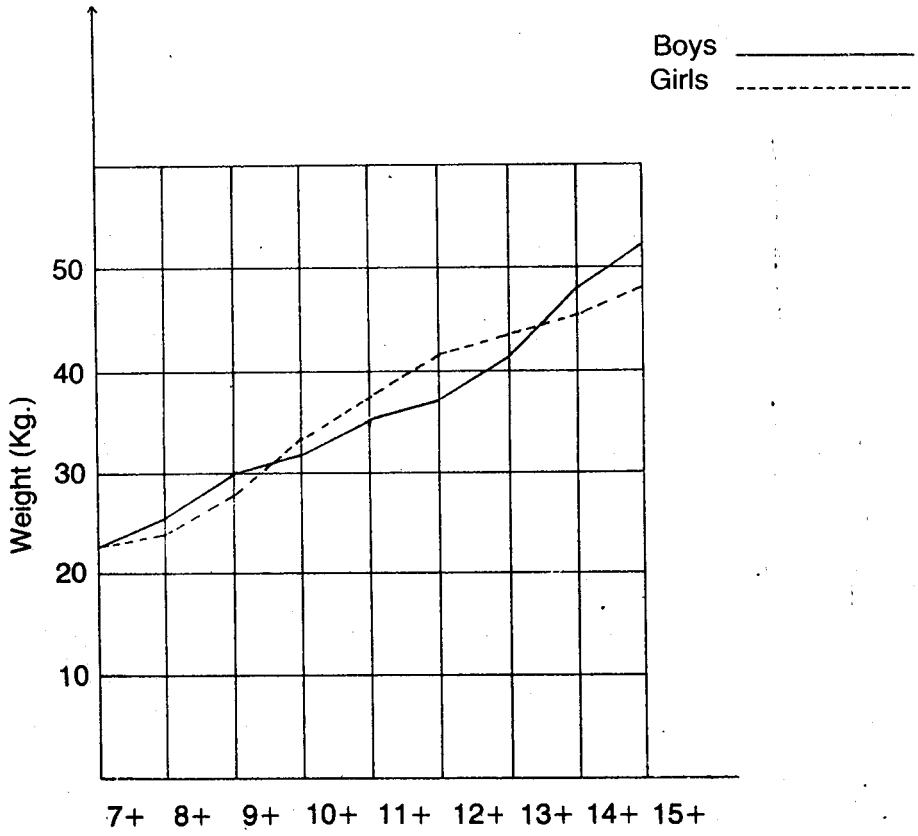


Fig. 10.1 Sex differences in growth during the school years

Further, as growth proceeds, there is a gradual tendency for boys to add relatively more muscle tissue and less adipose tissue than girls. In other words, *sex influences not just rate of growth but also body composition.* It is important to realize that once these sex differences appear, they persist into adulthood as you learnt in Unit 7 of this block.

Besides these features of the school years, one of the most obvious physical occurrences is the *shedding of the 'baby' or deciduous teeth and the erupting of permanent teeth.* This, is addition to the considerable calcium deposition in the skeleton, would have obvious effects on nutrient needs, as you will see in subsection 10.2.1.

In addition to the need for providing sufficient nutrients to support growth and development, the *vigorous physical activity* usually characteristic of the school years makes its own demands on the body. Physical activity, as you know, influences energy needs. The child who participates in vigorous sports would obviously need more energy. Attention has also to be paid to the need for increasing fluid intake. Heavy activity means more perspiration and therefore more losses of water and minerals like sodium and potassium.

There is no doubt, therefore, that a satisfactory dietary pattern and food habits help to ensure that the child remains healthy and grows normally.

10.2.1 Recommended Dietary Intakes for the School Child

We have so far noted several characteristics of the school years. Some of the features which would obviously influence nutrient needs are:

a) Differences in rate of growth between boys and girls
b) Differences in body composition of boys and girls
c) Growth and development of muscles, expansion of blood volume and increase in size of various body organs
d) Considerable mineralization of bones and formation of permanent teeth

Which nutrient requirements do you think would be influenced? Let us consider each of the above characteristics one by one.

a) **Differences in rate of growth would influence both energy and protein needs:** You are familiar with the fact that protein is needed to support growth. You also know that protein in the diet will be properly utilized only if it also provides enough energy. In other words both protein and energy needs would be influenced by the rate of growth. The needs for several other nutrients also change.

b) **Differences in body composition would influence energy needs in particular:** Body composition influences energy needs. We mentioned that boys have more muscle tissue and less adipose tissue compared to girls. Since muscle tissue is more active metabolically speaking, it requires more energy to sustain its activity. This means that more muscle tissue in the body would mean more energy needs.

c) **Expansion of blood volume pushes up iron needs:** Blood volume increases keeping pace with the growth of the rest of the body. As blood volume increases, the number of blood cells also goes up and therefore the amount of haemoglobin required also increases. You know, of course, that haemoglobin is an iron-containing compound.

d) **Mineralization of bones and formation of teeth influence calcium needs:** As the skeleton grows, more calcium is constantly deposited so as to add strength and rigidity to the bones. Similarly, calcium is also being deposited in the permanent teeth. This is why a liberal intake of calcium becomes necessary.

Now that we have understood some of the important factors influencing nutrient needs, let us study Table 10.2. The table summarizes the recommended dietary intakes for school children.

If you look at the table carefully, you would notice that the *age of the child influences requirements.* There is an increase in the RDIs for energy, protein, calcium, thiamine (B_1), riboflavin (B_2) and niacin as age increases. The RDIs for vitamin C, folic acid, vitamin B_{12} , and vitamin A remain unchanged from the age of 7 to the age of 12. *The influence of sex becomes evident after the age of 10 years.* This is the reason why RDIs are specified separately for boys and girls in the 10-12 years category. The RDI for iron is a case in point. There are sharp sex differences in iron needs. Why is this so?

Table 10.2 : Recommended Dietary Intakes for School Children

Nutrient	Age Group (Years) 7-9 (Boys & Girls)	10-12 (Boys)	10-12 (Girls)
Energy (Kcal)	1950	2190	1970
Protein (g)	41	54	57
Calcium(mg)	400	600	600
Iron (mg)	26	34	19
VitaminA (μg)			
Retinol or	600	600	600
Carotene	2400	2400	2400
Thiamine(mg)	1.0	1.1	1.0
Riboflavin(mg)	1.2	1.3	1.2
Niacin (mg)	13	15	13
Vitamin C (mg)	40	40	40
Folic acid (μg)	60	70	70
Vitamin B_{12} (μg)	0.2 to 1.0	0.2 to 1.0	0.2 to 1.0

Source: Nutrient Requirements and Recommended Dietary Allowances for Indians, ICMR (1990)

Highlight 5 gives you a part of the story. A full discussion would be too technical and therefore is beyond the scope of this unit.

You may also have noticed that by the age of 10-12 years, the child requires almost as much protein as the adult and more energy than the adult woman. Calcium and iron requirements are also considerable. This supports the conclusions we reached earlier in this discussion.

HIGHLIGHTS
Working out Iron Needs

Working out iron requirements means a lot of artithmetic. It is, in fact, a matter of addition. You have studie in Unit 5 of Block 2 that iron is lost from the body through urine, sweat and faeces. These losses are, in fact, unavoidable and are called *basal losses*. Basal losses always occur whatever the circumstances. This is why we have called them unaboidable. You are also familiar with menstrual losses. In the case of girls dietary iron is needed to replace these losses. Iron is also needed to support growth, especially increases in blood volume. Over and above all this, we need extra iron so that the body can store enough for times of emergency. In other words, iron requirements for boys and girls can be expressed thus :

Iron reuirements of the boy

Needs for replacement losses	+	Growth needs	+	Needs for improvement of body of basal stores of iron

Iron requirements of the girl

Needs for replacement of basal losses	+	Growth needs	+	Needs for improvement of body stores of iron	+	Needs for replace-ment of menstrual losses

From this it appears logical to assume that girls would require more iron. But the reverse is the case in the RDIs listed in Table 10.2. It doen't make sense, does it? It's almost as if 2+2 suddenly has become 5! Why is this so?

The answer lies partly in differences in absorpotion of iron.

After the age of 10 years *boys absorb less iron* (about 3 %) as compared to girls (about 5 %). This means that they must take in more iron in their diet to meet their needs in order to compensate for the lower absorption. Therefore RDIs for iron are fixed higher for boys.

Check Your Progress Exercise 1

1) List two major characteristics of the school years that influence nutrient requirement.

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.....

2) i) List all those nutrients whose RDIs change, based on sex, in the 10 to 12 years category.

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.....

ii) Look at Figure 10.2. It shows the 10-12 year old school girl's RDIs for all nutrients as 100%. The school boy's RDIs would be higher or lower i.e. above or below 100. Now can you identify which nutrient needs are being illustrated ? Label the figure appropriately as indicated in the case of B. You would notice that RDIs for girls are evenly mentioned as 100 per cent. For calculation use the following formula to work out the RDI as a percentage in the case of boys:

$$\frac{\text{RDI for boys}}{\text{RDI for girls}} \times 100 = - - - \text{ Per cent}$$

Then compare this with the figure mentioned in the graph for boys. This should help you identify the nutrients in the case of A and C.

(e.g. In the case of B the RDI for iron for boys = 34 and the RDI for girls = 19 so the per cent RDI in the case of boys = 34/19 × 100 = 179)

This is the same as the number indicated for boys in B. Hence we can conclude that this is a representation of RDIs for iron).

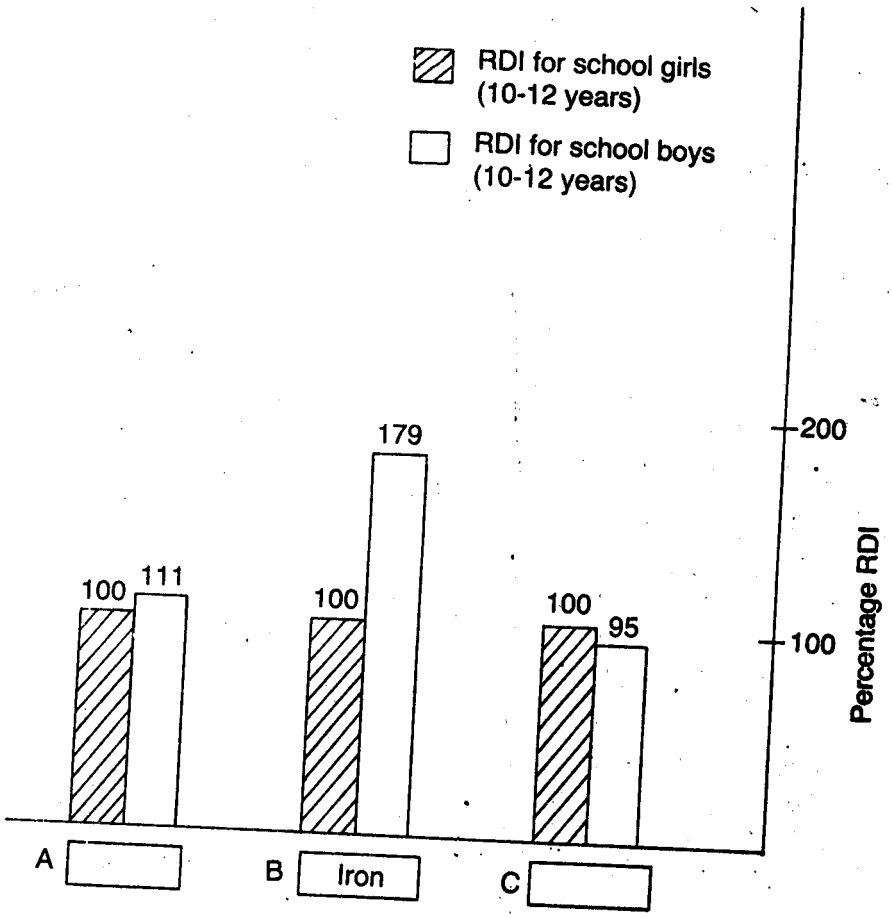
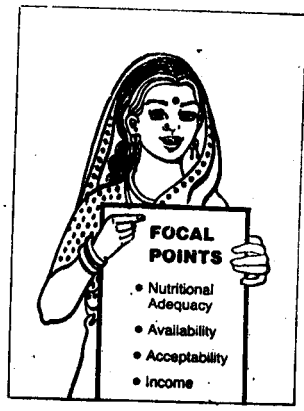


Fig. 10.2 Comparison between RDIs for school girls and boys (10- 12 years)

10.2.2 Meal Planning for the School Child

We have so far studied about growth and development in the school years. We have also gone through the recommended dietary intakes for this age group. Now let us learn how to plan meals and diets for the school child.

Do you recollect the main factors that need to be considered in meal planning ? If you want to remind yourself once again look at the figure in the margin. These factors are, of course, applicable to planning diets for any individual.



The major specific considerations involved in planning balanced meals and diets for school children are listed in the subsequent discussion. We begin by first identifying the person for whom we are planning the diet.

Whom are we planning for ?

- Is the child in the 7-9 years/10-12 years category ?
- If the child is between 10 and 12 years of age, is the child a girl or a boy?
- What income group does the child belong to?
- What is the religious and cultural background?
- In which region does the child stay?

Once you have listed the characteristics of the individual, look up the RDIs for energy and protein.

Which nutrients are of particular importance ?

Nutrients of particular importance in the school years are :

- energy - giving nutrients (carbohydrates and fats)
- protein
- iron and
- calcium

Which foods to select ?

When we plan diets we have to decide on which foods to select and how much to give of these foods. The points to keep in mind are:

- Include items from each of the three food groups (energy-giving, body-building and protective/regulatory)in each meal.
- Include an animal protein source in each meal if possible and if income permits; use cereal-pulse combinations to improve protein quality.
- Include foods rich in calcium and iron; you are already familiar with the food sources of these nutrients . You can look up Annexure 1 to refresh your memory.

What should be the meal pattern ?

The number of meals to be consumed would depend on the income of the family and the daily routine of the child. Here we must remember that the school timings are important. Some schools function from 7.30 or 8.00 a.m. to 1.30 p.m.; others function from 9.30 a.m. to 3.30 or 4.00 p.m. The meal timings, the number and even the nature of meals would vary accordingly. The meals consumed by the school child could follow any of the following patterns:

(A)	(B)	(C)	(D)
Breakfast	Breakfast	Breakfast	Breakfast
Packed lunch	Packed lunch	Packed lunch	Packed lunch
Tea	Late lunch	Late lunch	Late lunch
Dinner	Dinner	Tea	Tea
		Dinner	Dinner
			Bed time

(A) would be fairly common in the low income group. (B) and (C) are common in the middle income group and (D) could be a meal pattern followed by the high income group. However, the meal pattern selected would depend on the convenience of the child and his/her preferences. Generally meal frequency increases with increasing income.

If you look at the RDIs you would notice that school children have high energy requirements. This means that the total amount of food the child has to eat is

considerable. A four meal pattern could pose problems for some children. Increasing meal frequency (if possible) would, therefore, help the child eat smaller quantities at a time while taking in more food in the whole day.

Check Your Progress Exercise 2

1) Look at Figure 10.3 (a) Neerja has a specific problem. How would you solve it? Answer in brief (not more than one or two sentences) in the space indicated in the figure. Before you start, here's a hint. Neerja's problem is related to meal frequency.

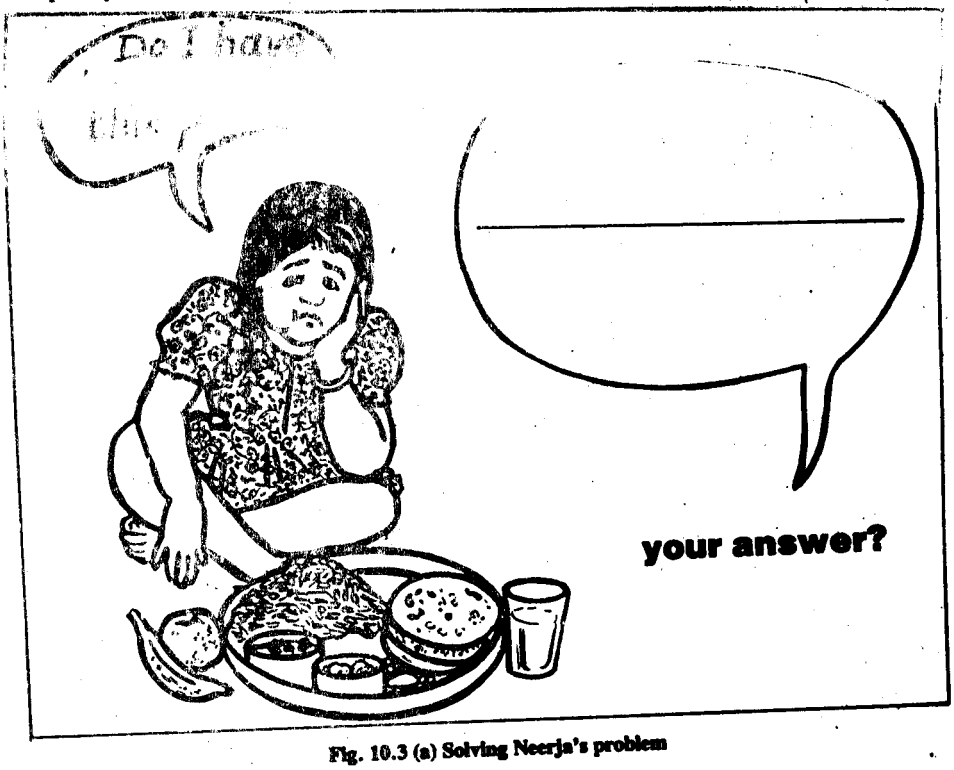


Fig. 10.3 (a) Solving Neerja's problem

2) Shyam in Figure 10.3 (b) has a different broblem. What would you tell him? Answer in one or two sentences in the space indicated in the figure. We can give you a hint. Shyam's problem is related to irregular meals.

Fig. 10.3 (b) Solving Shyam's problem

What are the other specific considerations?

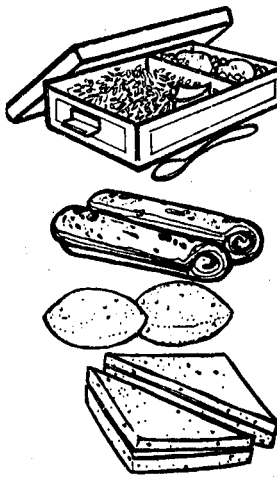
The school child, unlike the preschooler, spends a great deal of time away from home. He is exposed to various influences as a result of which he picks up new food habits. He tends to miss breakfast and munches snacks in between meals. He seldom bothers about packed lunches. The following section gives you ideas on how to overcome these difficulties and ensure satisfactory diets. Let us start with points about the main meals.

1) MAIN MEALS

- *Breakfast* should be substantial and should be planned around a cereal-based preparation. Milk/egg/pulse and a fruit should be included. Choice of items would be dependent on the money available.
- *Dinners and lunches* must be balanced meals based on items rich in protein, vitamins and minerals. They are the most substantial meals in the day. With the kind of meal pattern we adopt, we would give a packed lunch for the child to eat at school. In addition, a "late lunch" could be given at home when the child returns from school, as you have noticed in the earlier discussion on meal patterns. In such a case the late lunch would be lighter. Generally dinner can be a more elaborate meal because the child can eat at leisure, but this does not mean it should be a heavy meal. Here, of course, the terms, "heavy" and "light" refer to contribution to total energy provided by the day's diet. One must remember that the heavier meals such as lunch and dinner should also contribute more protein, vitamins and minerals as compared to meals such as tea-time or even breakfast.

  In addition to these we must also be aware of the possibility of the child receiving a mid-day meal or snack as part of a nutrition programme in schools. We will learn more about this programme in Block 6. Some schools offer a complete meal whereas others offer a ready-to-eat snack. There is considerable variation from one State to another. According to the recommendations, mid-day meals should provide at least one-third of the daily energy RDI and about half of the daily protein need.

- *Packed lunches* should be easy to carry and handle, require minimum preparation time and should be balanced. The lunch must include sources of protein, vitamins and minerals in addition to energy. Dry preparations such as a dry pulse or cottage cheese (paneer) and vegetable or meat-vegetable preparations can be offered. Items like sandwiches and pizzas are common in the high income group. Lower and middle income groups usually serve items like paranthas/rotis/rice and dal or vegetable; idlis and sambar ; curd rice/tamarind rice and similar preparations. Think for a minute or two about common packed lunches in your region. Are they balanced?



If they are not balanced, any of the following suggestions might help depending on which food group is missing or inadequate.

The body-building group

i) Add a pulse in suitable form
ii) Add cottage cheese (paneer) or milk-based dessert
iii) Add meat in suitable form
iv) Include egg in suitable form

The protective-regulatory group

i) Add a fruit or fruit-based preparation
ii) Add a vegetable preparation

Usually the energy-giving group does find a place in a packed lunch so we have left that out in the list.

Some good ideas on packed lunches are given in Annexure 6 at the end of this block. You might be tempted to try some of those and even make your own modifications. Annexure 6 also gives practical tips on how to pack lunches for children.

2) SNACKS

Snacks selected should be balanced rather than just calorie-rich and should supply substantial amounts of nutrients particularly energy, protein, calcium and iron. Snacks can be offered mid- morning and at tea-time. The packed lunch can also take the form of a snack. School children, in fact, are very fond of eating snacks in between

meals and during meal times. So you will have no problem in encouraging them to eat snacks. However, care has to be taken to select the right kind of snacks. Snacks, of course, should not be given close to the main meals or instead of the main meals. Too many sweet, sticky foods should not be consumed in between meals. This predisposes the child to tooth decay. Foods such as chips, wafers, soft drinks should not be consumed in excess since they contribute chiefly energy because of their fat and sugar content and little else. Such foods are in fact referred to as junk food. We will talk more about junk foods in Section 10.3.2.

3) SERVING SIZE AND MEAL FREQUENCY

Serving size (the amount served at a time) should be planned keeping the child's capacity to eat in mind; this is where increasing meal frequency helps.

4) FOOD PREFERENCES

Variety must be in food ... in colour, flavour, texture, form and shape. The child enjoys foods prepared using different cooking methods and food combinations.

Sufficient attention must be given to the child's *likes* and *dislikes*. Items disliked should be included in a form readily accepted by the child e.g. if a child does not like a particular vegetable it could be boiled and mashed and mixed with other foods to make cutlets which the child might like. Similarly, if a child does not like milk it could be offered as curd, custard or paneer (cottage cheese) preparations.

You have so far studied the major considerations relevant to meal planning for the school child. This should lead you to some conclusions about the type of meals, meal frequency, serving size and suitable snacks for the child.

We mentioned earlier that it is during the school years that food habits become well established. In this sense, it is a crucial phase. It is a fact that *poor dietary habits can lead to chronic diseases such as obesity and heart disease later in life*. Eating too much fat and sugar can made the child put on weight and become obese. This can also lead to the deposition of fatty substances in certain blood vessels particularly those of the heart ultimately resulting in heart disease. You will learn more about this in Block 5.

Check Your Progress Exercise 3

1) Mala is preparing a packed lunch for Rohit, her 10 year old son. He dislikes green leafy vegetables but Mala knows they are good for his health.

a) Which of the following alternatives would you recommend to Mala for ensuring that Rohit will consume the green leafy vegetables (GLV) as part of a balanced, packed meal ? You can select more than one alternative. Give reasons for your selection.

i) preparation made of GLV and potatoes.

ii) incorporating GLV in the dough for rotis or poories or any similar preparation/stuffing GLV in idlis or dosas along with potatoes.

iii) biscuits using dough in which GLV is incorporated and plain dough (to give biscuits in two colours).

iv) mixing milk, khoa, sugar and GLV paste and cooking to give a halwa-like preparation

v) preparation of cutlets/tikkis using GLV to be consumed with bread or rotis or rice

vi) preparation of pakodas/bondas with GLV and besan (bengal gram flour)

.....

.....

.....

b) From the alternatives (i)- (vi) given earlier select two which could be interesting tea-time snacks but would not be suitable by themselves for a packed lunch.

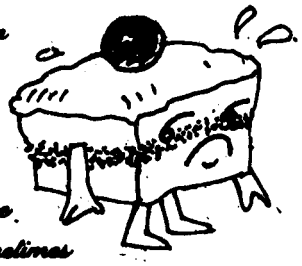
.....

Children must be encouraged to adopt healthy eating practices. It is often very effective to tell children about these aspects in an enjoyable, constructive way as illustrated in the following rhyme (Figure 10.4).

Do you think the message will get across? You may be able to think of several other ways to communicate such messages to children.

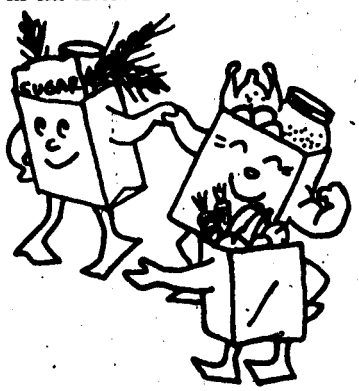
Sugar and spice
are not always nice,
too much can spoil your teeth.
Fat and oil, cream and chips
can really put you in a fix.
Eating more than you actually need
will make you fat and sick.

Soft drinks may be fun
When you're out in the sun
No protein, no vitamins
Just calories and water
No point drinking them
with each platter.



If you want to be
healthy, wealthy and wise
without paying a heavy price
Eat your favourites only sometimes
Remember your friendly foods at all times

The energy-givers,
The body-builders and
The protectors too!



Have each of them
in each of your meals
And soon you'll be healthier
than you ever knew!
Tell this here ...
Tell this there ...
Tell it everywhere
Because it's absolutely true!

Fig. 10.4 A rhyme with a message

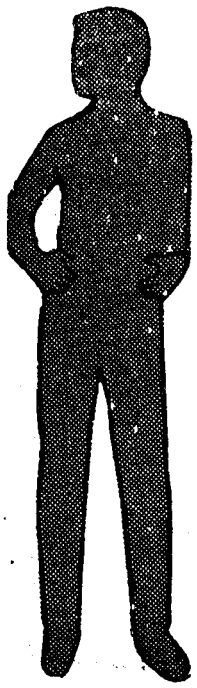
You have now gone through a number of facts, principles and ideas related to the school years and meal planning for the school child. To help you along here is a list of points to remember in planning and serving meals for school children.

POINTS TO REMEMBER

The school child

DO'S	DON'TS
1. Do include foods rich in energy and protein	1. Avoid serving too many processed foods
2. Include rich sources of vitamins and minerals, particularly iron and calcium	2. Ensure that the child does not include junk foods in the diet
3. Give about 2 glasses milk in a day if income permits	3. Do not let the child miss main meals like breakfast
4. Use cereal-pulse combinations as often as possible.	4. Make sure that children do not try to modify their own diets based on food fads or advertisements.
5. Offer substantial, balanced snack midmorning and at tea-time.	5. Do not allow the child to eat sweet, sticky foods in between meals
6. Modify popular snacks to make them more nutritious	6. Ensure that the child does not eat too many sugar-rich or fat-rich foods
7. Adopt a 5 meal pattern, if possible, to help the child to eat the relatevely large amounts of food he needs	7. Never force the child to eat
8. Give balanced and filling packed lunches which are easy to handle	8. Don't let the child overeat
9. Serve only as much as the child can comfortably eat	

10.3 THE ADOLESCENT



The individual between 13 and 18 years of age is called an adolescent. The period of *adolescence heralds major physical, mental and emotional changes.* You have learnt earlier that infancy and the preschool years are periods of rapid growth. So is adolescence. In fact, the rate of growth in adolescence is second only to infancy. This period witnesses sharp increases in height and weight which, as you are aware, are indicators of growth. Do you know that body weight almost doubles during the period from 10 years to 18 years? The boy who weighs about 32 kg after crossing the age of 10, weighs almost 59 kg by the time he has crossed the age of 18. Further, there is substantial growth and development of many specific body systems such as the skeletal system and the muscular system. Muscles and bones increase in size and strength. The heart, lungs, stomach and kidneys attain their final adult size and level of functioning during the *adolescent growth spurt.* (You may be aware the term "growth spurt" refers to a sudden increase in the rate of growth). There is also a great increase in blood volume. This is necessary for the improvement in the functional capacity of the respiratory, digestive and circulatory systems. As the period of adolescence draws to a close, growth is completed and adult size is reached. By then all organs and body systems reach their maximum possible level of maturity and development.

The *appearance of sex characteristics* during the adolescent years is of great importance. The major observable sex-related changes include enlargement of the breast, pubic and axillary hair, and menarche in girls between 12 and 14 years of age. The term menarche refers to menstruation or the monthly loss of blood (for 3 to 7 days) in the girl. It signals the fact that her reproductive system has begun functioning and is approaching maturity. It is important to note that the growth spurt precedes menarche.

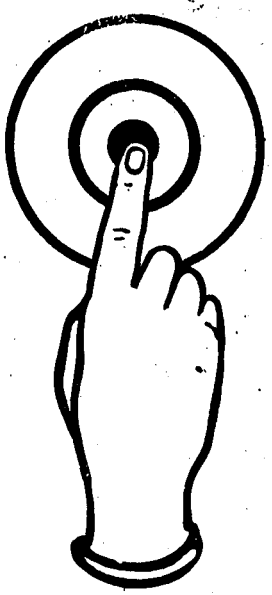
In the case of boys, hair appears in the pubic, axillary and other body regions such as cheek, chin and upper lip and there is a change in the voice.

We have just talked about several sex characteristics. We must add that sex characteristics are basically of two types—primary and secondary—as indicated in the chart on the next page.

Type of Characteristic	Primary Sex Characteristics	Secondary Sex Characteristics
Description	Body changes directly associated with sexual reproduction	Physical changes that distinguish males from females but are not associated with sexual reproduction
Examples		
Girls	Menarche Development of ovaries (female sex glands)	Breast enlargement, body hair, change in shape & size of hips
Boys	Development of testes (male sex glands)	Body hair, deepening of voice, widening of the shoulders

The chart mentions alterations in body build and appearance. In the case of girls, fat deposits are laid down in the abdominal region and the breadth of the hip increases. In boys there is an increase in the muscle mass, particularly in the shoulder and upper arm regions. Such differences in body composition first appeared in the school years, if you remember. They now become well established.

The physiological changes we have just described mark the onset of puberty. You would probably have heard this term before. What does it mean? Puberty refers to the physiological changes involved in sexual maturation as well as the other changes that occur during the period of adolescence. Once these changes have taken place i.e. at the end of puberty, sexual reproduction becomes possible.



However, we are left wondering about one crucial aspect. How does this amazing transformation take place? What causes these effects? These changes are, in fact, brought about by the action of specific hormones — the androgens (in the case of males) and the oestrogens (in the case of females). Androgens and oestrogens are also called sex hormones. The chart given below highlights their influence on growth, body structure and function.

SEX HORMONES
↓
Changes in
* Body structure
* Body composition
* Rate of growth
* Sex organs

It is quite obvious that the sex hormones regulate sexual maturation. In addition to this they also trigger off changes related to growth and development. It is almost like pressing a switch.

The sex hormones account for the pronounced sex differences in growth in adolescence. The timing of the growth spurt and the nature of the changes in body composition are examples of these differences. The adolescent boy gains more height at a faster rate than girls. His growth spurt, however, starts later than that of the girls. Skeletal growth continues longer and more muscle is added. In the case of the adolescent girl more total body fat is deposited as we mentioned earlier.

As you would have understood by now, *adolescence is a period of physiological stress for the body because of the extremely rapid rate of growth.* The diet plays a crucial role in promoting and sustaining growth. It is in this context that we must talk of adolescent pregnancy. In India, many adolescent girls become mothers because of the early age at marriage. Many have already had two or three children before they cross the age of twenty.

Highlight 6 emphasizes the burden of supporting both growth and foetal needs in adolescent pregnancy. We have dealt with it in the subsection on RDIs so that you are better able to understand the impact of pregnancy on the nutrient requirements of the adolescent girl.

Viewed in this context, there is need to pay particular attention to the diets of girls between 10 and 16 years since they are future mothers and the health of the next generation depends on their health. If they are given additional supplementation, the earlier deficits in growth and development can be made up to a great extent. Once adolescence is passed and growth is completed, any health or nutrition measure will have no influence. On the other hand, if determined efforts are made to give them

additional nutritious food over and above what they usually eat, their nutritional status can be improved. This is true for boys as well. The extra food aids catch-up growth as you learnt in Unit 9 of this block. The term, of course, means that the child catches up on the growth that could not be achieved earlier. Compare the situation to two individuals participating in a race. Initially, one maintains a steady pace, while the other lags behind. Then the latter increases his speed and both reach the finishing line at the same time. If the second runner does not increase his pace soon enough it will become impossible for him to catch up with the other runner.

Here, as you would have noticed by now, the first individual represents a person undergoing growth at the normal pace. The second represents an individual who lagged behind in growth initially but caught up later on (see Figure 10.5).

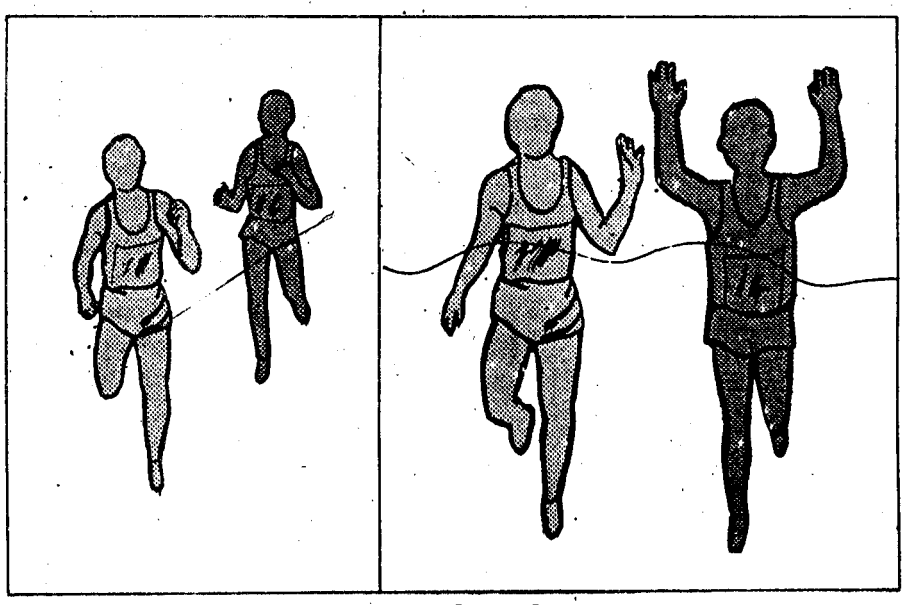


Fig. 10.5 Adolescence is the last chance for catch-up growth

10.3.1 Recommended Dietary Intakes for the Adolescent

The recommended dietary intakes for adolescents are listed in Table 10.3.

Table 10.3 : Recommended Dietary Intakes for Adolescents

Nutrients	Age Group (years)			
	13-15 (Boys)	13-15 (Girls)	16-18 (Boys)	16-18 (Girls)
Energy (Kcal)	2450	2060	2640	2060
Protein (g)	70	65	78	63
Calcium (mg)	600	600	500	500
Iron (mg)	41	28	50	30
Vitamin A (μg)				
Retinol or	600	600	600	600
Carotene	2400	2400	2400	2400
Thiamine (mg)	1.2	1.0	1.3	1.0
Riboflavin (mg)	1.5	1.2	1.6	1.2
Niacin (mg)	16	14	17	14
Vitamin C (mg)	40	40	40	40
Folic acid (μg)	100	100	100	100
Vitamin B_{12} (μg)	0.2 to 1.0	0.2 to 1.0	0.2 to 1.0	0.2 to 1.0

Source: Nutrient Requirements and Recommended Dietary Allowances for Indians, ICMR (1990)

If you look at the table carefully, you would notice the high RDIs for energy, protein, iron and calcium. This is necessary to suport the rapid growth of all body tissues. Adolescents, like school children, are generally very active. This pushes up energy needs. The increasing blood volume and growing skeleton accounts for the increase in iron and calcium needs. In the case of the girl, loss of iron through the monthly blood loss is also considered when working out the iron needs. Can you explain why? The discussion on differences between boys and girls in Highlight 5 is also relevant here.

Thiamine, riboflavin and niacin RDIs are specified, as you know, according to energy needs. The more the energy need, the more would be the need for these B complex vitamins.

Iodine is a mineral not mentioned in Table 10.3. This is because the exact RDIs for the trace elements have not been worked out. However, it is very important for the adolescent to be provided with sufficient iodine in the diet. Iodine is, as you know, a part of the hormone thyroxine produced by the thyroid gland. Thyroxine regulates the rate of metabolism and is crucial for proper physical and mental growth. This makes it important particularly in high growth phases such as infancy and adolescence.

We have so far taken a look at the recommended dietary intakes for adolescents. You would realize how high these RDIs are even in comparison with the adult. Let us consider the adolescent girl. Her nutrient needs are close to that of the adult sedentary woman and even exceed them in the case of several nutrients such as energy, protein, calcium, and the B vitamins. Now how would these RDIs change if the adolescent girl becomes pregnant? You will find the answer in Highlight 6.

HIGHLIGHT 6

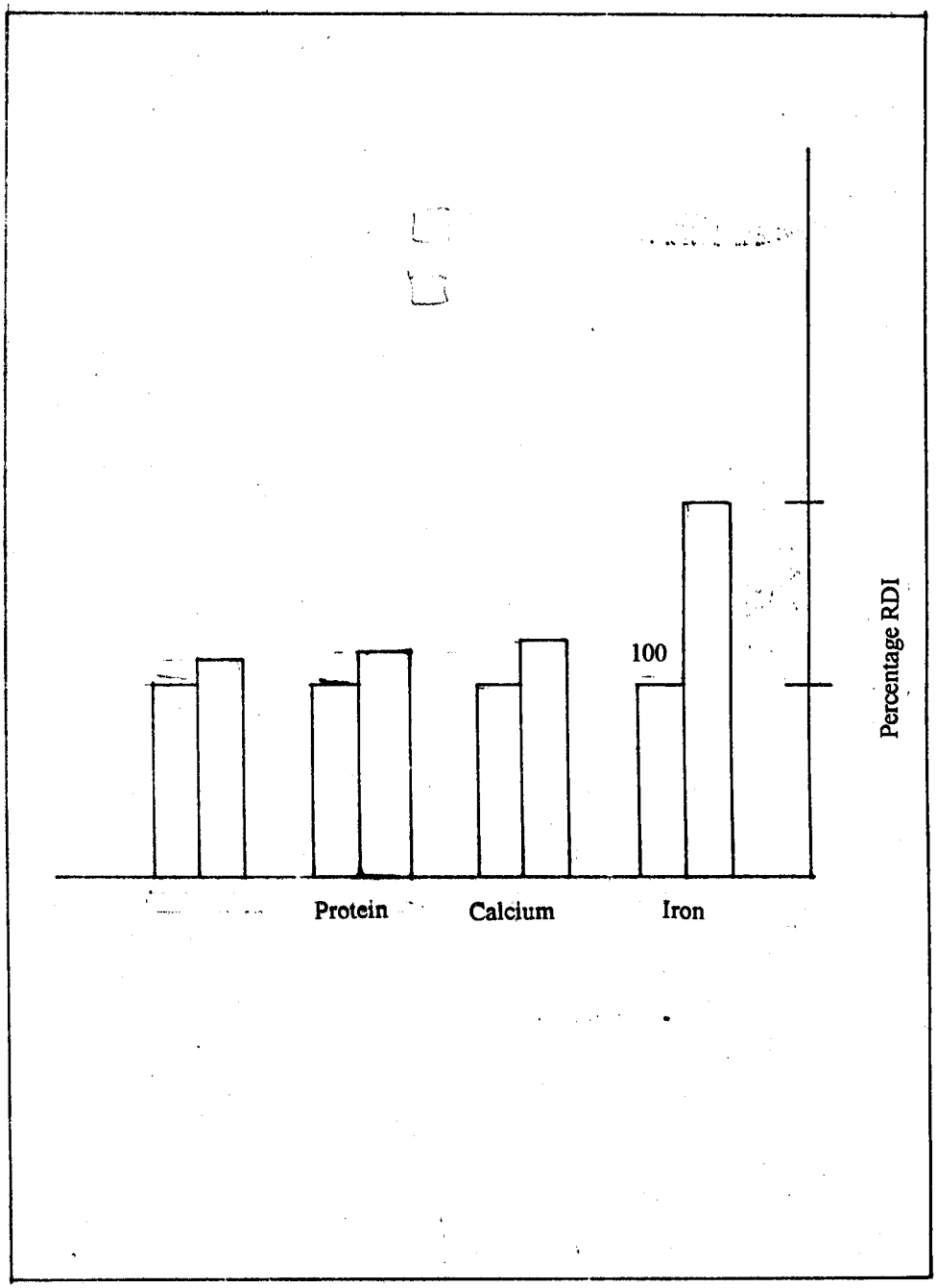
Pregnancy in adolescence

Adolescence is a period of physiological stress because of the rapid rate of growth. To sustain this growth high intakes of several nutrients are required. The girl therefore carries the "burden of growth needs". In other words this means the burden of meeting the high nutrient needs required for growth. Now imagine the adolescent girl who is pregnant. She would have to bear the additional burden of increased nutrient needs in pregnancy. You can imagine the strain on her body! Figure 10.6 shows this symbolically as heavy burden on the adolescent girl. The girl has to carry the almost unbearable burden of maintaining her own growth and development as well as maintaining the growth and development of the foetus.

Fig. 10.6 The heavy burden of adolescent pregnancy

Now, for comparison's sake, suppose we assume that the adolescent girl's additional nutrient needs remain the same as that for an adult woman in pregnancy. Look at the following chart.

Nutrient	RDIs in Adolescence (16-18 years)		RDIs in Adolescent Pregnancy (16-18 years)
Energy (kcal)	2060	+300	2360
Protein (g)	63	+15	78
Iron (mg)	30		38
Calcium (mg)	500		1000



Check Your Progress Exercise 4

1) Match the items in Column A with those in Column B

Column A	Column B
i) Menarche	a) Sharp increase in height
ii) Androgens	b) Menstruation
iii) Grown spurt	c) Primary sex characteristics
iv) Sexual reproduction	d) Adolescent pregnancy
v) boys	e) Iron needs
	f) Increased muscle mass
	g) Voice changes
	h) Catch-up growth

2) Why should we pay particular attention to the diets of adolescent girls? Give one reason which you think is most important.

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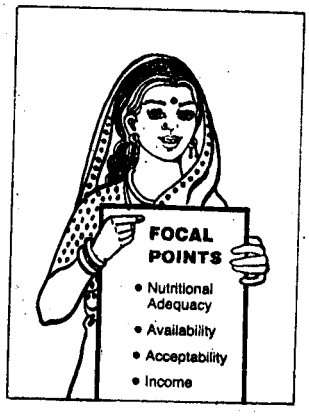
10.3.2 Meal Planning for the Adolescent

In addition to factors such as nutritional adequacy, income, acceptability and availability we must keep the following major considerations in mind:

Whom are we planning for?

- Is the adolescent in the 13-15 years/16-18 years category?
- Is the adolescent a girl or a boy?
- What income group does the person belong to?
- Where does the person stay?
- What is the religious and cultural background?



Once you have outlined these characteristics, you can list the RDIs for the adolescent.

Which nutrients are of particular importance?

Nutrients of particular importance in adolescence are:

- energy-giving nutrients (carbohydrates and fats)
- protein
- iron and
- calcium

Which foods to select?

Selection of foods for the adolescent's diet would mean including

- items from each food group in each meal
- good energy and protein sources
- cereal-pulse combinations to improve protein quality
- animal protein, if possible and acceptable
- good calcium and iron sources

As mentioned earlier the items and combinations selected would be determined by how much money is available to be spent on food. Which foods the person likes or dislikes would also be of importance.

What meal pattern should be adopted?

The daily routine of an adolescent who attends school would be similar to that discussed earlier for the school child. The college-going adolescent would, however, tend to have a more variable schedule. One would, therefore, need to consider the likelihood of the person consuming a packed lunch on some days and consuming lunch at home on others.

As in the case of school children, well planned, balanced snacks are of importance. They help to increase the meal frequency and thus decrease the tendency of the main

Fig. 10.8 Losing weight the easy way?

meals to become heavy. This would ensure that the child consumes enough food to meet his needs. Suitable snacks providing substantial energy, protein, calcium and/or iron can be offered mid-morning and at tea-time.

What specific considerations should we keep in mind?
In addition to the points we mentioned in the case of the school child, some other aspects become important:

i) Adolescents sometimes adopt extreme or bizarre (strange) diet patterns in order to reduce weight in the case of girls or build muscles, in the case of boys. Figure 10.8 takes a light -hearted look at the tendency of adolescent girls to try different "diets" in search of the ideal cure for overweight.

Adolescent girls frequently want to lose weight — sometimes even when there's no need. They, of course. seek the easiest way to do it! They look for "diets" which can help them reduce in hours or days. But we must remember that they must be actively discouraged from adopting such "diets". There is no such shortcut to weight reduction or muscle building for that matter. The same is true of boys. Remember that we are using the word "diet" here to indicate a rather extreme diet pattern. The best advice is to keep to a reasonable dietary pattern. *Reducing or increasing the total amount of food consumed must be done with great care because of its impact on growth.* People frequently make statements such as "Try this diet. You could lose 8 inches off your waistline in ten days". or "You can add two inches to your shoulder muscles in a fortnight with this diet". Adolescents must know that such statements are wrong. They should never cut down on intake of water or adopt diets based on protein foods only. Such measures are dangerous and can lead to serious diseases and even death. The best and safest remedy for overweight in the growing years is plenty of exercise. Overeating should, of course, be avoided.

ii) Too much emphasis should not be placed on fat-or carbohydrate-rich items, particularly refined carbohydrate or sugar-rich items. Consumption of too much ready-to-eat snacks and processed foods also needs to be avoided. *Foods such as milk, dark green leafy vegetables, deep yellow vegetables and fruits and whole cereals should be emphasized.* Eating such foods helps to add valuable minerals and vitamins to the diet. Vitamin A and vitamin C-rich foods are frequently neglected and must be included in addition to iron and calcium-rich foods.

iii) Even in the matter of food, *group acceptance is very important for the adolescent.* They quickly adopt food patterns prevalent among their friends. They frequently consume snacks which are junk foods such as potato chips and fast foods such as noodles, pizzas, hamburgers, fish and chips. You are already familiar with the term 'junk food'. Let us also talk of the fast foods. Fast foods are generally not elaborate and can be prepared by relatively simple cooking methods. They are commonly served at snack bars/pizza parlours in cities. The fast foods available commercially tend to be rich in energy and may not provide enough protein, vitamins, minerals and fibre. However, *these foods can easily be modified to improve their nutrient content.* A sandwich with butter can be modified to a sandwich with a paneer or meat or egg filling mixed with tomato and onion. Pizzas are commonly described as junk foods. But they can be nutritious. A pizza with cheese and mixed vegetables as topping is balanced because the pizza base is made of refined wheat flour (maida). Similarly when hamburgers are made with a meat or cottage cheese and mixed vegetable cutlet rather than just potato they become a balanced snack. This shows how simple modifications can help to make common and popular snacks more nutritious and balanced.

You have so far gone through a number of aspects related to meal planning for the adolescent. Here's a quick review of points you would find useful.

POINTS TO REMEMBER
The adolescent

DO'S	DON'TS
1. Do include rich sources of energy, protein, iron and calcium	1. Do not include too many fast foods
2. Give whole cereals rather than refined cereals	2. Avoid serving junk food
3. Include foods like milk, dark green leafy, vegetables and fruits	3. Discourage the adolescent from eating too many processed foods.

4. Increase meal frequency to 5-6 meals, if possible	4 Do not let them adopt extreme "diets" meant to reduce weight or build muscles. Such diets are usually useless and sometimes dangerous
5 Include substantial snacks providing 1/4-1/5 of the RDIs for energy, protein, calcium, and/or iron, mid-morning or at tea-time	5. Avoid too much of fat-rich or sugar-rich foods
6 Give more energy-rich, protein-rich and protective foods to the pregnant adolescent girl	6. Avoid, strictly, the use of alcohol or drugs, particularly if the adolescent girl is pregnant

NOTE : LOOK UP SECTION 6 OF THE PRACTICAL MANUAL-PART I FOR DIETS FOR SCHOOL CHILDREN AND ADOLESCENTS

Check Your Progress Exercise 5

1) Read the followign statements carefully. Each statement gives a dietary instruction for adolescents. Indicate whether each statement is correct or incorrect. Give reasons for your choice.

i) Adolescents are usually extremely active and hence must consume substantial amounts of foods providing energy such as sugar-rich items and items rich in refind carbohydrate.

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.....

ii) Snacks for adolescents should be rich in energy with some protein, vitamin and mineral content.

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iii) Fast foods cannot be balanced and hence must be eliminated from the diet.

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iv) Consumption of milk, vegetables and fruits must be encouraged in adolescence.

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v) Using iodized salt can help to supply adequate iodine in the diet.

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10.4 LET US SUM UP

This unit discussed the important characteristics of the school years and adolescence. We learnt that the rate of growth slows down during the school years and then increases again in adolescence. This sharp increase in rate of growth is called the adolescent growth spurt.

Considerable development of organs and body systems takes place in the school years. This process continues during adolescence so that maximum growth and development is achieved by the end of the period. Sex differences appear in growth and body composition between boys and girls after the age of 10 years and become more pronounced during adolescence. These differences influence nutrient requirements.

The process of sexual development in adolescence is marked by the appearance of primary and secondary sex characteristics.

Keeping in mind the high nutrient needs and the child's capacity to eat, it is preferable to increase meal frequency and include nutritious snacks mid-morning and at tea-time. Popular and acceptable snacks/dishes can often be modified to make them more nutritious. Giving nutritious packed lunches is important both for school children and college-going adolescents.

Particular care has to be taken to ensure that the school child and adolescent adopt good, healthy food habits. Poor habits can result in the individual falling prey to certain diseases like heart disease and obesity later in life.

Children and adolescents must be encouraged to consume less of food supplying only or mostly energy and, instead, have more of foods rich in energy, protein, vitamins and minerals. Too much fat and sugar must be avoided.

Adolescents and school children may be tempted to try and reduce weight or build muscles. Modifying food intakes in any way can have adverse effects on growth and hence should not be tried.

One final point about children indulging in vigorous physical activity. Physical activity (such as sports) pushes up energy needs. More energy-giving foods must, therefore, be included in the diet. Care has also to be taken to ensure adequate intake of fluids and minerals such as sodium and potassium.

10.5 GLOSSARY

Axillary : Region of the armpits

Circulatory system : The system of blood vessels in the body which carry blood from the heart to the tissues and then return it from the tissues to the heart.

Growth spurt : A sudden increase in the rate of growth in terms of height or weight.

Hormones : Chemical substances secreted by certain glands which exert their effects elsewhere in the body e.g. the sex hormones are produced by the sex glands and cause effects in the sex organs and are responsible for the appearance of secondary sex characteristics.

Menarche : The time when menstruation i.e. monthly loss of blood in the girl, begins. In other words, the time when the first menstrual cycle occurs.

Processed foods : Foods which have been subjected to certain procedures such as drying, exposure to heat/cold and then packaged for sale. Processed foods usually require further cooking after unpackaging.

Pubic : Middle part of the lower abdominal region; pubic hair refers to the hair appearing in this region.

Ready-to-eat foods : Foods already cooked by roasting or frying or baking which can be consumed as such.

Respiratory system : The system consisting of the body parts necessary for breathing i.e. (i) *nasal cavity* (entry for air through the nose) which leads into a tube called the (ii) *trachea*. The trachea branches into the (iii) *bronchi* which enter the (iv) *lungs*.

10.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) Any two of the following: steady pace of growth, vigorous physical activity,

exposure to infectious diseases, period of preparation for adolescent growth spurt

2) i) Energy, protein, iron, thiamine, riboflavin, niacin
ii) A. Energy B. Iron C. Protein

Check Your Progress Exercise 2

1) You could tell Neerja: "Take more meals and less food at each meal".

2) You could tell Shyam: "Eat more food at each meal. Eat regular meals".

Check Your Progress Exercise 3

1) a) ii) and v) These alternatives are suitable because they use GLV in a form which the child would readily accept and which could easily be incorporated into a balanced meal e.g. rotis can be combined with a pulse/meat/cheese preparation and cutlets or tikkis can be made with mixed vegetables, potatoes and pulse/meat to be consumed with rice or rotis or bread.

iv) can also form part of a balanced meal but being a sweet item the child may not wash his mouth or brush his teeth thus leading to tooth decay—such an item can be offered sometimes but not regularly.

b) iii) and vi)

Check Your Progress Exercise 4

1) i)-b); ii)-g); iii)-a); iv)-c); v)-f)

2) Adolescent girls are future mothers. Some may become mothers during adolescence itself. All efforts must be made to ensure that they remain healthy and grow to the maximum possible extent so that their children also remain healthy and get a head start in life.

Check Your Progress Exercise 5

1) Incorrect (i) – (iii)
Correct (iv) and (v)

i) More energy can be supplied by cereals rather than sugar. Cereals supply nutrients other than carbohydrate. In fact whole cereals are preferable to refined cereals for reasons you already know i.e. the former is rich in B vitamins and other nutrients in addition to carbohydrate.

ii) Snacks should have substantial protein, iron and/or calcium content; not just some content.

iii) With some thought and effort, fast foods can be modified to made them nutritious while remaining acceptable.

iv) This is good practice since it adds protein, vitamins and minerals to the diet.

v) In areas where iodine is not present in adequate amounts in foods consuming iodized salt is beneficial and essential.

ANNEXURE 1

Annexure-1 has six cards each telling you the rich sources of particular nutrient. You can cut out these cards along the scissor marks and paste them on a thick sheet/cardboard. Now you can use these cards as a handy reference for Block 3 as well as the Practical Manual. You will find Annexure 1 in duplicate. Let the duplicate sheet remain in the block and refer back to it in case you lose your cards.

NUTRIENT SOURCES

ENERGY-RICH FOOD	
Cereals	245-362*
Roots and tubers	97-120
Sugar	398
Jaggery (cane)	383
Fats and oils	729-900

*All values are in Kcal/100 g. edible portion

PROTEIN-RICH FOODS	
Milk and Milk Products	
Milk (Cow's)	3.2*
Milk (Baffalo)	4.3
Curd (Cow's milk)	3.1
Paneer (Cottage cheese)	18.3
Khoa (Cow's milk)	20.0
Pulses	
Soyabean	43.2
Others	17.1-25.1
Flesh Foods	
Egg	13.3
Fish (Rohu)	16.6
(Hilsa)	21.8
Goat's meat	21.4
Fowl	25.9
Nuts	
Groundnut	25.3
Cashewnut	21.2

*All value are in g/100 g. edible portion

CALCIUM-RICH FOODS			
Cereals/Millets		**Green Leafy Vegetables**	
Ragi	344*	Agathi	1130
Amarnath seeds	510	Amarnath	397
		Fenugreek	395
Pulses		Rape leaves	370
Bengal gram whole	202	**Milk & Milk products**	
Horse gram whole	287	Cow's milk	120
Rajmah	260	Buffalo Milk	210
Nuts & Oilseeds		**cheese** 790	
Gingelly seeds	1450	Khoa	956
Mustard seeds	490	**Fish & Sea foods**	
Cumin seeds	1080	Hilsa	180
Poppy seeds	1584	Rohu	650

* All values are in mg/100 edible portion

IRON-RICH FOODS			
Flesh Foods		**Pulses**	
Liver (sheep)	6.3*	Soyabean	10.4
Mutton (muscle)	2.5	Moth Beans	9.5
Green leafy vegetable		Cowpea (lobia)	8.6
Mustard leaves	16.3	Lentil	7.6
Mint	15.6	Peas (dry)	7.1
Bathua	4.2	Horse gram	6.8
Amaranth leaves (tender)	3.5	Bengal gram (dal)	5.3
Lettuce	2.5		
Fruits		Bengal gram (whole)	4.6
Water melon	7.9	**Jaggery** (Cane)	2.6
Raisins	7.7		
Dates (dried)	7.3		
Apricot (dry)	4.6		
Phalsa	3.1		
Cereals			
Rice flakes	20.0		
Bajra	8.0		

Wheat (whole)	5.3
Wheat flour (whole)	4.9
Ragi	3.9

*All values are in mg/100 g. edible portion

VITAMIN C-RICH FOODS

Fruits	
Amla	600*
Guava	212
Orange juice	64
Lime	63
Papaya (ripe)	57
Strawberries	52
Musambi	50
Lemon	39
Pineapple	39
Orange	30
Green Leafy Vegetables	
Drumstick leaves	220
Knol-khol greens	157
Cabbage	124
Amaranath leaves (tender)	99
Fenugreek leaves	52

*All values are in mg/100 g. edible portion

VITAMIN A-RICH FOODS

Foods containing Retinol

Milk and Milk products	
Milk (Cow's)	52*
Milk (Buffalo)	48
Khoa (Cow's milk)	149
Paneer (Cow's milk)	100
Fats and oils	
Butter	960
Ghee (Cow's)	*600
Hydrogenated oil	700
Flesh foods	
Egg	*260
Liver	690

*All values are in µg/100 g. edible portion

* In addition contains 6 µg carotene

* In addition contain 600 µg carotene

Foods containing Carotence

Green leafy vegetables	
Amarnath	5520
Colocasia leaves	10278
Fenugreek leaves	2340
Mustard leaves	2622
Spinach	5580
Fruits and vegetables	
Mango	2743
Papaya	666
Orange	1104
Carrot	1890
Apricot	2160

*All values are in µg/100 g. edible portion

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Bathua	4.2	Horse gram	6.8
Amaranth leaves (tender)	3.5	Bengal gram	5.3
Lettuce	2.5	(dal)	
Fruits			
Water melon	7.9	Bengal gram	4.6
Raisins	7.7	(whole)	
Dates (dried)	7.3	**Jaggery** (Cane)	2.6
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Phalsa	3.1		
Cereals			
Rice flakes	20.0		
Bajra	8.0		

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Special food preparations for pregnant/lactating women

Pinni:(Preparation from the North) The preparation is made of wheat flour, sugar (powder), khoa, ghee, raisins and nuts. Wheat flour is first roasted in ghee to a golden colour. Khoa is added and roasting continued for a few minutes. The powdered sugar along with raisins/nuts is then added and mixed and allowed to cool. The mixture is made into small balls.

Panjiri: (Preparation from the North) The preparation is made of semolina (suji) or whole wheat flour, sugar, ghee, almonds/cashewnuts, raisins and cardamom. Almonds are soaked in water, peeled and sliced. Suji or atta is fried in ghee till quite brown. It is then taken off the fire and powdered cardamom and raisins are added to the mixture and mixed well.

Bengal Gram Payasam: (Preparation from the South) The preparation is made of semolina (suji),bengal gram, jaggery and coconut milk. Suji and bengal gram are first boiled in water till soft. The thick first extract of milk of a mature coconut is extracted and set aside. To the coconut residue water is then added and the thin milk extracted. The thin milk along with jaggery (which has been dissolved in 60 ml water) is added to the boiled suji and bengal gram and cooked again till semi-solid. The thick coconut milk is then put in and the payasam is taken off the fire.

Methi Pak: (Preparation from the West) The preparation is made of fenugreek (methi) seeds, jaggery, fat and dry ginger. A little wheat flour (atta) may also be used. To prepare methi pak, first wash the fenugreek seeds and then ground coarsely. Roast wheat flour in the fat till light brown and add jaggery (which has been dissolved in water) and fenugreek seeds. The mixture is then set in a thali (plate) and allowed to cool or alternatively small ladoos can be prepared from this mixture.

Kaatu: It is a typical food preparation from the West (Gujarat) prepared specifically for lactating women. The preparation is made of wheat flour, jaggery, fat and various kinds of nuts and oilseeds like almonds, cashewnuts, makhana, black pepper seeds, piyal seeds, coconut, dried powdered ginger, khus etc. The wheat flour is first roasted in fat till light brown.All other ingredients are then added to the wheat flour and mixed well.

Dinkache Ladoo: (Gond Ka Ladoo): It is a special food preparation for lactating women in Maharashtra. The preparation is made of gond (gum), coconut, groundnut, raisins, cashewnuts, jaggery/sugar and fat/oil. The gond is first fried in fat/oil then grinded. A sugar/jaggery syrup is made to which gond, grated coconut, groundnut (coarse grind), raisins and cashewnut is added. The mixture is made into small balls.

ANNEXURE 3

New forms of supplementary food (Basic mix) for infants (5-6 months)

Rice Porridge: Take 20 g of rice flour. Roast the rice flour in a little ghee/oil till light brown and keep aside. Take 125 ml of milk and dissolve 15 gm of sugar/jaggery in it by heating slightly. Add this solution to the roasted flour and stir well.

Wheat Porridge: Roast 20 g of wheat flour in a little oil/ghee till light brown. Dissolve 15 g of sugar/jaggery in 125 ml water or milk and add to the roasted flour and stir well.

Jowar Porridge: Take 5 g of oil/fat and heat it. Add 25 g of jowar flour to the oil and roast the flour till brown and remove from fire. Dissolve 15 g of sugar/jaggery in 150 ml milk by heating slightly. Pour the milk to the roasted flour and stir well.

Maize Porridge: Take 20 g of roasted maize flour. (Maize flour can be roasted in 5 g ghee/oil). Dissolve 10-15 g sugar/jaggery in 125 ml milk by heating slightly. Pour milk to the roasted flour and stir well.

Sago Porridge: Heat 5 g of ghee/oil and roast 15 g sago flour in it. Take 10-15 g sugar/jaggery and dissolve it in 125 ml milk. Heat the milk and add to the roasted flour and stir well.

Note: One-fourth to half teaspoon of ARF can be added to the cooked porridge when it is still hot (70°C) and stir well.

ANNEXURE 4

Few ideas of supplementary food (Multimixes) for infants (6-10 months)

Ragi or bajra infant food: Take 60 g of dehusked, roasted ragi or bajra, 15 g of roasted green gram dal (or any other pulse), 10 g of roasted groundnuts and 5 g of roasted gingelly (til) seeds. Powder all these roasted ingredients and store in air tight container.
At one time, take 10-15 g or about three tea spoonfuls of this mixture to make the porridge. Mix suitable amount of hot milk to the mixture, cook for a few more minutes and serve with sugar or jaggery.

Rice-dal-groundnut porridge: Cook 50 g of rice till soft slightly tender. Add to the cooked rice 15 g of powdered roasted groundnut, 25 g powdered roasted green gram dal. Next add 30 g of sugar or jaggery and cook for a few minutes. Serve luke warm.

Gehuna: Roast 35 g whole wheat, 20 g green gram dal (or bengal gram), 10 g groundnut separately. Grind and mix together. Add 30 g of sugar/jaggery to this mixture and mix well again. Store in an air-tight container.

Whenever required, take suitable amounts say 10-15 g or 3 teaspoonful of the mixture to which add suitable amounts of hot milk or hot water. Add more sugar, if required, before feeding.

Vegetable mix: Roast and grind 10 g of moong dal (washed). Next take 20 g potato, 10 g carrot, 10 g spinach, boil and mash these vegetables. Mix dal, mashed vegetables with 20 g curd and 30 g jaggery and form a fine paste. Serve to the infant.

Shishu Ahar: Take 40 g puffed rice, 20 g bengal gram dal, 10 g groundnuts and 30 g jaggery. Roast and grind the puffed rice, bengal gram dal and groundnuts separately. Mix all the dry ingredients. Before serving add jaggery and make a paste of the mixture with water. If sugar is added one can use milk.
NOTE: Broken wheat may be substituted for puffed rice if so desired.

Khichri: Take 50 g rice and 25 g roasted moong (dehusked). Cook in water till done. Take 50 g spinach leaves. Wash and boil in water. Mash the leaves and strain through a sieve. Mix the strained spinach soup with boiled rice/dal and add salt to taste. Cook the mixture.
NOTE: Boiled carrot, potato, yellow pumpkin may also be added along with spinach.

ANNEXURE 5

Few ideas of snacks for preschool children

Wheat besan ladoo: Roast 25 g wheat flour and 15 g bengal gram flour (besan) separately till light brown. Mix the two together and fry for 10 minutes in fat. Add 40 g powdered sugar and prepare balls. (In place of wheat, rice powder can also be used to form rice-besan ladoo.)

Bajji or pakora: Take 45 g of bengal gram flour. Make a thin paste with water. Add salt and mix well. Take small amounts of vegetables like potato, onion, brinjal, cauliflower. Slice the vegetables. Dip the slices in the thin paste and deep fry. Bajji is ready. For *Pakora* the bengal gram flour paste is made somewhat thicker and the vegetables are cut into small pieces and mixed in the paste and then deep fried. Green leafy vegetables can also be added to the paste.

Spinach-potato-gram tikki: Take 60 g potato. Boil, peel and mash. Take 20 g chana dal, pick, wash and cook in sufficient water till soft. Mash dal. Wash and chop spinach and steam cook it. Fry little onion and garlic. Mix mashed potato, chana dal and spinach, onion/garlic. Add salt and little garam masala.. Prepare small balls and flatten them. Shallow fry on a tawa.

Egg sandwiches: Hard boil one egg. Remove the shell and mash the egg with a spoon. Sprinkle salt and pepper. Take 2 bread slices and apply butter. Spread the egg mixture between the two bread slice. Cut from the centre and serve.

Spinach-groundnut burfi: Wash and cut 100 g spinach leaves. Steam and grind the spinach leaves to a paste and cook till slightly dry. Roast 50 g groundnut seeds. Remove the skin by rubbing with hands. Grind groundnuts coarsely. Mix 50 g jaggery in water. Bring to boil. Prepare jaggery syrup of two thread consistency. Add spinach mixture and powdered groundnut to the syrup. Cook for a while. Pour the mixture on a greased tray and flatten. Cut in square pieces when set.

Sogo-peanut vada: Wash and soak 25 g of sago in water for 20 minutes. Boil 100 g potatoes. Peel and mash them. Wash and chop 100 g bathua leaves. Roast 25 g groundnut, remove red skin by rubbing with hand. Coarse grind. Mix all these ingredients together add salt and amchur (mango) powder. Make small balls, flatten them and shallow fry on a tawa.

Vegetable cutlets: Boil, peel and mash 50 g potatoes. Wash and chop 50 g amaranth (chaulai) leaves, or any other green leafy vegetable. Mix mashed potato, chaulai leaves, boiled peas (20 g), crushed cottage cheese (20 g), salt and garam masala. Take a small portion of the mixture, shape into cutlet and roll in bread crumbs. Fry in hot oil till golden brown.

Sprouted moong bonda: Sprout 30 g green gram dal (whole). Steam cook. Wash and chop 50 g spinach or any other green leafy vegetable. Boil 50 g potatoes, peel and mash them. Wash and chop 25 g onion. Mix sprouts, leaves, potatoes, onion, salt and garam masala and divide the mixture into small balls. Prepare besan batter by adding a little salt. Dip each ball in besan batter and fry in hot oil till golden brown.

Ideas for Packed Lunches

Every child opens his or her lunch box with a sense of anticipation "What is there to eat today?" There is nothing the child appreciates more than variety. New preparations and different ways of preparing the same items are exciting.
Packed lunches usually consist of items like

- idlis with coconut chutney/dosa with coconut chutney
- fried rice with vegetables or pulse or meat or fish
- curd rice/tomato rice/tamarind rice
- paranthas stuffed or plain with vegetables/ pulse/meat preparation and pickle.
- poories stuffed or plain with vegetables/pulse/ meat preparation
- rotis with pulse/vegetable preparation
- sandwiches with butter/jam/cheese/ meat filling
- hamburgers and other bread-based snacks such as bread rolls or toasted bread rolls.

When we think of packed lunches we must not forget to keep the three food groups in mind. Jam sandwiches are fun but not balanced so why not try sandwiches with butter, cheese and a fruit jam made from bananas or apples or pineapples or oranges. Similarly, rotis with pickle are not balanced. But poushtik rotis with besan and green leafy vegetables certainly are balanced. We must try to include rich sources of either calcium or iron or both, if possible. Packed lunches should be easy to prepare and easy to handle and consume. This means that the items are often prepared dry but care has to be taken that these remain soft and a little moist. If the preparations become too dry, they become difficult to eat. If one uses one's imagination one can think up so many interesting ideas for packed lunches. Here are some:

1) **Curd rice with vegetables:** Fry onions till golden brown after allowing mustard seeds to splutter in hot oil. Add mixed vegetables and fry till cooked. Put in boiled rice, stir till hot; take off the fire, mix in curd and warm slightly. Fry red chillies and mustard seeds in a ladle and pour over curd rice.

2) **Bhakarvadi:** Prepare a stiff dough using whole wheat flour, besan, salt, roasted ground onion and coriander seeds, red chilli powder and a little oil for the filling. Cook together boiled, mashed potatoes, spinach, green chilli, coriander seeds and a little curd after frying mustard seeds, asafoetida and curry leaves in oil. Roll dough in a squarish shape. Sprinkle filling evenly. Roll up the square and cut small circular slices. Fry. Serve with green coconut chutney.

3) **Paneer bhoorji with doodhwali roti:** Make doodhwali rotis using whole wheat flour, salt and little oil and mixing with milk and water to give a soft dough. The bhoorji can be prepared by cooking grated paneer or cottage cheese with turmeric powder, salt and pepper. Ginger, green chillies and coriander leaves can be added after cooking. Vegetables can also be cooked with the bhoorji.

4) **Besan-spinach cheela stuffed with potatoes:** Prepare a batter mixing besan and chopped spinach, salt, red chilli powder. Pour onto a hot tawa smeared with oil. Smooth out into a round shape. Prepare potato stuffing as desired.

5) **Poushtik roti:** Prepare rotis with whole wheat flour and besan and a green leafy vegetable (chopped). The dough can be made soft by mixing flour with milk while preparing the dough. Bake on a tawa and serve with pickle or any vegetable preparation if desired.

6) **Egg-bunnies:** Cook eggs with tomato, garlic, green chillies and coriander leaves. Preparing an omelette makes it easier to handle. Slit hamburger type small buns and cut rounds of omelette to fit in the buns.

7) **Spinach poori with dry pulse preparation:** Cook spinach slightly, mash and drain off excess water. Mix with wheat flour and salt and prepare dough. Use dough for preparing poories by deep frying the small rounds. Serve with dry pulse preparation. Alternatively, the pulse can be stuffed into the poories. Instead of pulse, a meat preparation can also be used.

8) **Carrot Paranthas:** Make a smooth dough of wheat flour, besan and curds. Ferment overnight. Add grated carrot, green chillies, ginger, coriander and curry leaves chopped together. Add a little more besan and a little oil to the dough. Make small paranthas and bake on a slightly greased tawa.

9) **Hamburgers:** Prepare cutlet with cooked minced meat (keema), salt, garlic, onion, coriander and bread crumbs or alternatively with mixed vegetables such as boiled potato, carrots, beans, spinach, onion, green chillies and bread crumbs. Fry the cutlets on a heavy pan. Add a little butter and lime juice or tomato sauce. Place the cutlets in hamburger buns which have been slit down the middle.

10) **Kabab rolls:** Cook mince meat, bengal gram (small amount) and seasonings (cumin, cloves, coriander powder, green cardamom, chillies). After cooking, add coriander, mint leaves and green chillies and grind to a paste. Mix in a little cream and curd. Shape the kababs and slide on to a hot tawa. The kababs are then rolled with half a roti, sticking the edges with flour paste. Fry crisp and wrap in a cloth while still warm.

11) **Sandwiches with cream cheese filling:** Prepare sandwiches by spreading a mixture of cream cheese, salt, coriander leaves, onions and black pepper powder onto bread which is a day old. To prepare cream cheese, first set curd but do not allow to get sour. Turn into a thick, coarse muslin bag and let the liquid drain off — what is left should be thick and creamy. Wrap in a damp cloth.

12) **Soft Upma:** Splutter mustard seeds in hot oil. Fry bengal gram dal and black gram dal in the same oil till brownish. Add onion, green chilli, ginger and curry leaves and fry till soft. Add water (about 2½ times the suji), salt and a little lime juice and let it boil. Toss in the suji and stir. After the water is absorbed, lower the flame and let the mixture thicken. Do not mix.

You will also find the following tips for packing lunches useful:

- use a reasonable sized lunch box preferably with a separate container or inbuilt compartments for different items; aluminium and plastic boxes are common. No paint should be applied on the metal lunch boxes; plastic ones should be sturdy and of good quality.
- line the lunch box with bread wrappers, brown paper or clean transparent polythene or cloth napkins or paper napkins; never use newspaper or any other printed paper; select wrappers depending on convenience and cost.
- wrap items like sandwiches in a moist cloth to keep them soft.
- serve accompaniments (e.g. pickles, chutneys, sauces) separately from the main dishes; similarly a dessert, if offered, such as burfi, laddoos, churutu, halwa, mysore pak should also be kept separately.

NOTES

Utter Pradesh
Rajarshi Tandon Open University

Nutrition for the Community

Block

4

EFFECTIVE UTILIZATION OF FOOD RESOURCES

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Sept 1994 (Reprint)

ISBN-81-7263-288-6

Reprinted by : Nitin Printers, 1 Old Katra, Manmohan Park, Allahabad.

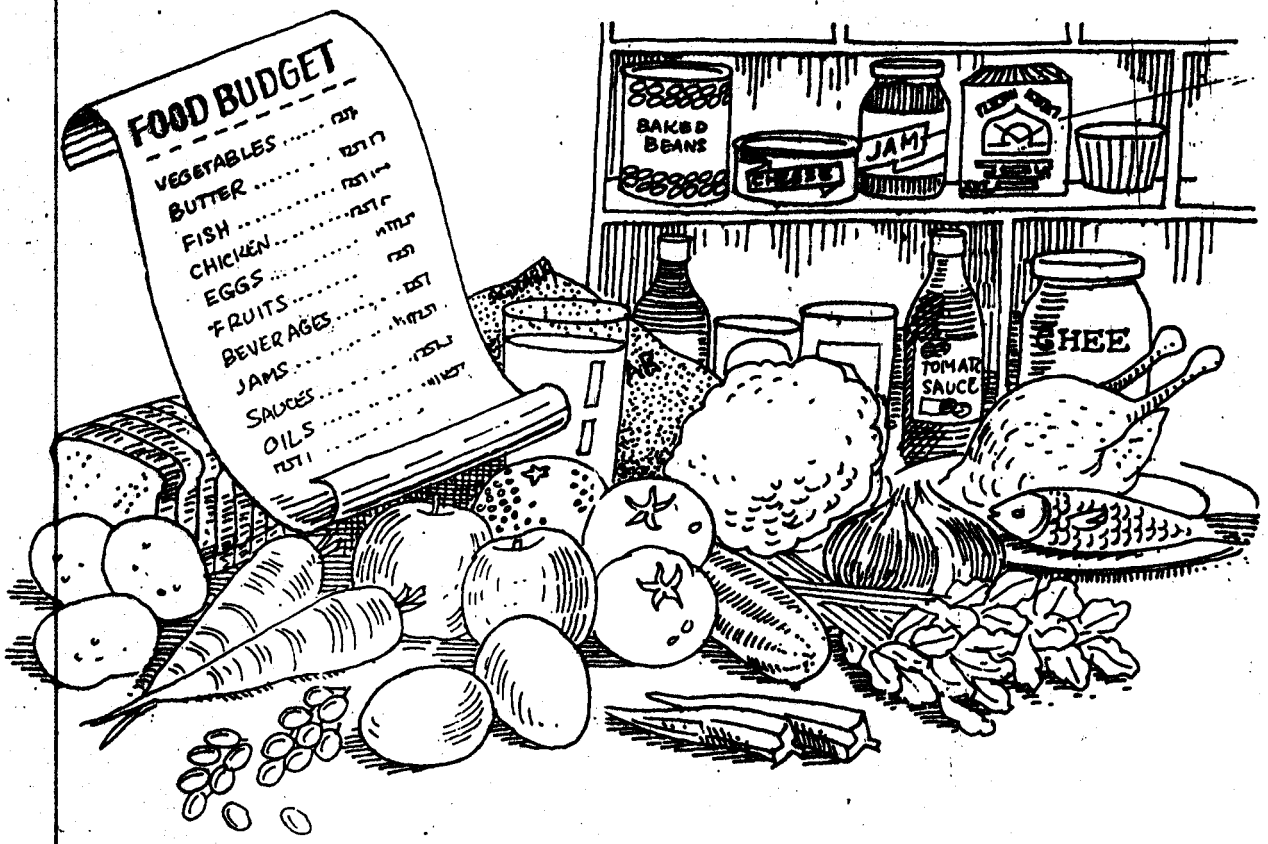
BLOCK 4 EFFECTIVE UTILIZATION OF FOOD RESOURCES

BLOCK INTRODUCTION

In the previous blocks you have learnt what health means, what are the foods that you need to maintain yourself in good health and how to make sure that you do get these foods every day. Now let us take a quick look at what Block 4 has to offer.

All of us are aware that the human population is increasing at a rate faster than the rate at which the earth's resources can be made to increase. This is especially so with regard to food resources. If we want to be able to provide adequate food for the ever increasing human population, we must get the maximum value out of whatever food resources we have. In other words, we must make the most efficient use of the food available to us.

In Units 11 to 16 of this block we hope to be able to show you (1) how you can get the maximum food value from the limited amount of money you might have by carefully planning your food expenditure, (2) how you should select your food, take care of it, and store it, (3) how you can get the maximum nutritional value from the foods that are available to you by using processes that preserve and enhance the nutrient content, (4) how you can preserve food and prevent its wastage.



STUDY GUIDE

The following points will help you organize your study of Block 4.

1) The block deals with effective utilization of food resources at the home level. Uni 11 talks about how to plan our food expenditure. The different steps involved in the prepara ion of food budget have been discussed. Read this section carefully. Based on this information you can plan the food budget for your family.

2) Units 12 and 13 present a detail discussion on how to select different food items available in the market. You will find the information useful. Handy tips on how to select different food items available in the market are also listed towards the end of each section under the heading 'Points to Remember'. Read these points carefully. You will find them useful in selecting food items the next time you go t the market.

3) In unit 15 the emphasis is on home scale food preservation. It would be useful to remember the principles of preservation underlying each method of preservation.

4) Food safety is a vital aspect specially when food as a carrier of substances and microorganisms can cause harm to us. How to supply safe food to consumer is, therefore, the focal point of unit 16. Read the text carefully.

5) As in the previous block, Highlights are included to emphasize important aspects

6) At tne end of the block you will find Appendix 1 to 5. Appendix 1 is a list of spices commonly used in day to day cooking and includes handy tips on what points to remember while buying these spices. Appendix 2 presents recipes for home scale food preservation. You can try them out for making squashes, murabhas, jams at home. Appendix 3 includes a list of food borne illnesses — causative agents, foods involved — and what measures one need to take to prevent these illnesses. Appendix 4 and 5 deals with detecting adulteration in foods. It gives information about what equipment, chemicals and simple tests or can use to detect adulteration in foods. Read this section carefully.

expenditure within the limits determined by our income.

The steps in making a budget are listed here for easy reference.

Steps in making a budget

- Make a list of the items on which you need to spend money.
- Arrange these items in the order of preference. The essential ones like food, clothing, shelter, health and education get top priority.
- Estimate the probable expenditure on each of these items.
- Estimate the total money that will be available.
- Make an estimate of the maximum essential expenditure that you can incur on each of the items of expenditure with the assured income.
- Now balance the budget to bring your expenditure into line with the income.

In the overall family budget, food is the first of the three fundamental necessities, other two being clothing and shelter. Expenditure on food is essential expenditure and for most families the amount spent for food is the largest single item of expenditure in the family budget, ranging from about 50 per cent of the total income in the rich families to 90 per cent of the total income in the poor ones.

11.3 FACTORS INFLUENCING FOOD BUDGETING

We have so far talked about budgeting in general. We can also talk about specific *allocating money for food out of our total income and then deciding how to spend it.* This is called *food budgeting.*

Several factors influence the amount of money that needs to be allocated for food expenditure. Some of these relate to the individual and family, while others relate to food availability and food cost. You will be introduced to the following factors in this sub-section:

- The income of the family
- The size of the family
- Current food prices
- Nearness of the family to the source of food supply
- Opportunity for home production and processing of foods, and
- Relative interest of the family in food and in other commodities.

The income of the family: In talking about expenditure of any kind we talk about the actual amount of money we spend, and also look at this expenditure as a percentage of the total money income we have. Since there is a basic minimum that you need to eat in order to live and work, the actual money spent on food becomes a higher percentage of the income as the income falls. People with a lower income spend a greater percentage of it on food. On the other hand, people with a higher income spend a lower percentage of it on food. However, the rich person would still be spending much more on food. Let us take an example. If the total amount spent on food is Rs. 100/- and the income Rs. 200/- the expenditure on food is 50 per cent of the income. If the income increases to Rs. 500/- and the quality of food improves, the amount spent on food goes upto Rs. 200/- but the expenditure on food is now 40 per cent of the income. If the income is Rs. 1000/- and the total amount spent on food is now even more, say Rs. 300/-, it is only 30 per cent of the income. In other words, the lower the income the higher the percentage of it spent on food. At the lowest of the low levels of income, a very large part of the income goes to find enough food for the family. A large section of our society lives at this level and spends upto 80 to 90 per cent of all its income on food. As you have seen, this major difference in food expenditure is not as much because of the total quantity of food consumed as it is because of the difference in the quality and variety of foods consumed (see Table 11.1). This is because there is a limit to which a person can eat and yet remain healthy. But a rich person has the access to a great variety of foods and food of superior quality. The specific examples in Table 11.1 will make this concept

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Table 11.1: Influence of income on food selection

Food items	Low income	Moderate income	High income
Cereal	Rationed wheat Rationed rice	Rationed wheat Good quality rice	Sharbati wheat Basmati rice
Pulses	Green gram dal	Red gram Black gram	Red gram Rajmah Bengal gram
Leafy Vegetables	Amaranth	Spinach	Salad leaves (raw)
Other Vegetables	Bottlegourd Brinjal or any seasonal veg.	Ladies fingers Cauliflower	Capsicum Parwar
Roots and tubers	Colocasia	Potatoes	Potatoes
Milk	Milk (toned milk)	Milk (rich quality milk)	Milk Cheese (processed) Paneer
Oil and fat	Unrefined, cheapest	Refined, cheapest	More expensive refined oil Ghee Butter
Sugar and Jaggery	Jaggery	Sugar	Sugar
Additional	None	1) Some seasonal fruit like orange or mango 2) Some pickles and papads 3) Can have a wider choice of vegetables 4) Can include curds in addition to milk	1) Can choose from a variety of fruits available 2) Can use jam and jellies and pickles freely 3) Can buy prepared sweets from the market 4) Can use noodles etc. in place of rice, wheat 5) Can use more milk and paneer 6) Can use more vegetables

In the lower income group money is spent on cheaper foods like cereals and among cereals, cheaper cereals like bajra and jowar. These are the foods that provide most of the calories in this income group. In the higher income group superior quality of cereals are used which are more costly, like basmati rice and sharbati wheat. Remember, that people belonging to the high income group do not always exclude cheaper foods from the diet. For example in Table 11.1 we have mentioned that green gram dal may be selected by the low income group. This does not mean that rich people would not consume it. As you are aware, foods such as milk and milk products, eggs, meat, fish and poultry rarely figure in the diets of low income group individuals. Expensive fruits and vegetables are also excluded.

The size of the family: It is quite obvious that with more number of people in a family, you spend more money on food. However, the expenditure *per person* declines as the number of people increases. This is the principle on which costing of meals for large groups is done — the larger the group you are cooking for, the lower are the charges per person and the smaller the group you are cooking for, the higher the charges per person, the menu being the same.

Current food prices: The trend of food prices in the market has a direct influence on the food budget. If food prices are low, you spend less money on food. When food prices rise your expenditure on food also increases. Being a necessity, food can very easily push the other items of expenditure out of the family budget thereby influencing the quality of life.

So what is the implication of this for food budgeting? We must make sure that we keep current food prices in mind when preparing a budget. Seasonal fruits are a good example. Including mangoes in the summer budget would mean allocating less than if we were to include it in winter.

Nearness of the family to the source of food supply: Our country is still largely rural. With the exception of a few large cities, most towns and cities are close to rural areas which produce most of our food particularly fresh fruits, vegetables, cereals, milk and eggs. The cost of food in areas of its production is very much lower than the cost of it in the city or town market, because (1) you are paying for the transport of food from the place where it is produced to the market; (2) you are paying for the damage to the food in transport — some eggs might break, some fruits and vegetables would get spoilt; (3) you are paying for the rent of the market area, and (4) you are providing income to the people who make a living by selling foods in the city markets. All these add up to a lot. No wonder the potatoes will perhaps cost Rs. 6/- per kilogram in the city as against Rs. 2/- per kilogram in the village where they are grown.

Between the place of production and the city or the town markets there are other selling points which one can take advantage of. In many towns there are *weekly markets* on the outskirts of the town where producers bring their product to sell. There prices are lower than those prevailing in the city/town markets since one or more of the four factors that determine the market prices is eliminated. No rent is paid for market area, for example. Transport and damage costs may also be minimal. In addition to weekly markets, *wholesale markets* are common in towns and cities. Items are sold in bulk to retailers at wholesale markets. Here the prices are again lower than the city market prices because only large amounts are sold at a time. If you have adequate storage facilities and enough money to invest, you can save money by purchasing from such wholesale markets. In addition to these, in large towns you also have *auction markets*. Here you have to bid for a certain stock or pile of the item, assessing the quality by just looking at it. One can take advantage of it in group buying during the pickling season, or when making tomato sauce, orange squash for the year. In fact two or three families could get together to make such large scale purchases.

Opportunity for home production and processing of foods: Producing and processing certain items of food at home helps to reduce expenditure on food besides improving the quality of meals consumed. This, however, depends upon the facilities and the expertise the family has for doing this. Growing vegetables, particularly the green-leafy ones like spinach, amaranth, mint and coriander in your garden, and preparing jams, jellies, butter, tomato sauce, tomato puree, all kinds of squashes, pickles and papads at home saves a lot of money in addition to improving the quality of the meals.

The relative interest of the family in food and in other commodities: This is a very important factor in determining the emphasis on the quality of food and the consequent expenditure on it. To some people what they eat matters a lot. They are particular about the quality of food as well as its nutritional adequacy and are prepared to make an effort to prepare good meals. Some, on the other hand, would not bother beyond the point of getting enough of the right kind of foods. Yet others might spend essential food-money on non-food items such as clothing. People with this kind of an attitude towards food need to be extra careful if they do not want to b undernourished.

Check Your Progress Exercise 1

1) List the three basic needs of man:

a) ..... b) .....

c) .....

2) List the steps in preparing a budget:

a) ..... d) .....

b) ..... e) .....

c) ..... f) .....

3) List the factors that influence food expenditure:

a) ..... d) .....

b) ..... e) .....

c) ..... f) .....

4) Indicate if the following statements are true or false. Modify the false statement(s) to make it/them correct.

a) In low income families the proportion of the monthly income spent on food is high. (True/False)

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b) The larger the group you cook for, the more the expenditure on food per person. (True/False)

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c) The major difference between the food expenditure of low and high income groups is because of the total quantity of food consumed. (True/False)

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11.4 ECONOMY IN FOOD BUDGETING — FACTORS AND PRINCIPLES

To plan a food budget and keep the expenditure within the limits of the income is not an easy task. This is because our needs are much more than we can meet with the money available. To be able to fulfil our needs with the least amount of money then becomes very important. This is called economy and it requires a great deal of knowledge, information and expertise besides intelligent planning and careful execution of the plans. We shall now discuss three important factors which can bring economy in food budgeting.

A) KNOWLEDGE OF NUTRITION: The study of nutrition has given us an insight into our nutrient needs. Today we know a great deal about what we should eat and how much to eat. Information is available which can help us assess the nutritional requirements of each member of our family, and plan the food budget in such a way that it takes care of each member's nutritional needs.

Enough information is available in India regarding nutritional requirements of individuals, the nutritive value of foods, as well as planning nutritionally adequate diets (see Table 6.2 of the Practical Manual – Part I). In this block we will only mention that to get optimum satisfaction out of the money spent on food we should avoid food items with little or no nutritional value. If and when we do buy such food items it should be for a specific purpose, and only after the basic nutritional needs have been taken care of. Take the example of grapes. They contain approximately 80 per cent water and 20 per cent solids. The solid matter consists of 16.5 per cent carbohydrate in the form of sugar, and approximately 3 per cent cellulose and only 0.5 per cent of minerals. Eating grapes is almost as good as drinking a glass of water with a little flavour and sugar in it. Besides carbohydrate and some electrolytes (minerals like sodium, potassium, chloride) they do not provide any other nutrient to the body, and cost quite a lot in most places. As fruits, papayas and guavas are nutritionally superior to grapes as well as to apples and pomegranates and they are much cheaper too. Soups, particularly the thin watery kind, are not recommended for young growing children because they are nutritionally very dilute and occupy the space that could be filled by some other nutritionally superior foods like dal, meat or vegetables. You can probably add many more examples.

Do note that whenever there is a financial emergency in a family the first expenditure to be reduced is the expenditure on food. In such a situation it is very important to

make sure that in reducing your expenditure on food you do not reduce the nutritional adequacy of the meals. This is where the basic food groups help. You have studied about them in Block 2. You can adhere to the general plan of your meals and yet reduce the cost of meals by choosing cheaper items from each food group. As long as you select items from each group, the nutritional adequacy of your meal is assured.

B) INTELLIGENT BUYING: Getting the best product for your money involves a constant battle of wits between the seller and the buyer. In order not to be the loser in this, you need to know the following:

i) *Prices and quality available in different markets*: What are the different markets? Where can you get what you want and the quality you want at the most economical prices? We must remember that price is not the only factor to be considered; quality is also very important when assessing prices. We might prefer to pay a little more for better quality rather than buying the cheapest item.

We have earlier talked about small weekly markets, wholesale markets as well as auction markets. It is worth repeating here that the auction markets and the wholesale markets are cheaper. The same is true of the weekly markets in small towns or on the outskirts of the cities. While these weekly or village markets do not insist on any minimum quantities to be purchased, the wholesale and auction markets most definitely do. Select your markets for daily purchase as well as for the weekly and the monthly purchases keeping in mind the factors of time, convenience, cost of transport, prices and quality of items available. You might find the hawker who comes to your doorstep cheaper in the ultimate analysis!

ii) *Bulk buying is cheaper*: Any item when bought in bulk or large amounts costs less per unit — the cost of one lime when you buy a hundred, is less than the cost of one lime when you buy only six. The cost of onions per kilogram when you buy only one or two kilograms is more than when you buy a whole sack of 50 kilograms. All bottled or packed items are cheaper (per unit weight) in large packs than in smaller ones. You do, of course, need to have the facilities and the know-how for buying and storing such items. In addition, you will also need extra money for buying such large quantities at a time.

In the case of persons belonging to the low-income groups (LIG), the daily wages decide what food they can and will buy at any particular time. In the case of the middle income groups (MIG), which is generally the monthly salaried class, bulk buying can be a way to economize on food expenditure. One however needs to keep in mind that bulk buying involves extra time and attention to take care of the large amounts that you buy in order to maintain it well till the supplies finish. It is for the members of the family to decide how much work and expenditure they can afford in order to be able to take advantage of large-scale buying. Staggering your purchases between months and seasons is an important technique of such buying. It does, however, need careful planning and keeping a check on the stored material. You could perhaps buy a large bottle of tomato sauce one month which would last you for the next month also, and buy a large bottle of vinegar the next month — a month in which you are not buying tomato sauce.

Bulk purchase is recommended specially for non-perishable items like cereals, pulses, sugar and oils. It can then be done during the season when perhaps the item is best in quality and prices. Bulk purchasing also gives you uniformity of quality. Getting together with two or three other interested parties to join resources and share the labour involved for bulk purchasing, is one way of taking advantage of it without investing large amounts of money at one time — buy a 100 kg bag of wheat and share it among five families, buy a 15 litre tin of oil, or a bag of 500 limes, or a packet of 100 biscuits and share it with someone who also wants to economize in this manner.

iii) *Seasonal buying is cheaper*: Every food item is cheaper in season than out of it. This is particularly true of fruits and vegetables. Unlike most western countries, we are still very dependent upon seasonal availability of fruits and vegetables. It essential to take this into account while planning meals and making purchases. It is fun to have peas when they are in season but a drain on the food budget out o season. Tomatoes are an excellent example for seasonal buying. In the tomato season they are very cheap as compared to other times of the year. You can buy and preserve tomatoes as tomato puree (tomato pulp which is cooked like a ketchup but without any spices or flavouring). You can then use this puree in

cooking during periods when the cost goes exhorbitantly high. For making pickles, jams, jellies and squashes, seasonal buying is important. Even for wheat, rice, dals, and items like tamarind and coriander seeds, seasonal buying saves quite a substantial amount of money. If you have facilities for home freezing, buying peas and other such items in season and freezing them is very useful both in terms of saving money in the long run and adding variety to the meals.

iv) *Buying with a definite purpose in mind*: In other words, you need to know how each item of food that you are buying is to be used. For example if you are buying rice for making idlis you can buy the cheaper variety. If you are buying tomatoes for curries, you can buy the small ones which are cheaper rather than the large slicing variety. If you are buying mangoes for making mango-milk shake, buy the cheaper juicy variety rather than the expensive cutting variety. If you want to put cashewnuts in laddoos buy the broken variety which is cheaper than the whole cashewnuts.

v) *Awareness of weights and volumes*: In almost all packaged food products you will find net weight mentioned. This is the weight of the actual food material inside and does not include the weight of the packaging itself. It is important to note what the net weight of the item we are buying is, and what the cost per unit weight turns out to be. Take bread (loaf) for example. You will find that two loaves look alike in size but one is cheaper than the other; quite often, the cheaper one is also less in weight. At times this is done deliberately to mislead customers into buying a product in preference to others. Always look at the price as well as the weight or volume of the contents, and calculate the price per unit of weight/volume before deciding which one to buy. A large bottle of tomato sauce gives you cheaper sauce on a per gram basis than the small bottle. This would be true of almost every product.

vi) *Knowledge of grades, brands and labels*: Grade denotes a particular quality — superior or ordinary, "A" grade or "B" grade and so on. Brand tells us who makes the product — good or poor quality eventually gets associated with the brand names. Label is what is written outside the packaged product, and should give us enough information about what is inside to help us to decide whether we want to buy it or not. We should also be able to decide whether it would meet our requirements or not. With the variety of packaged food products flooding the markets day-by-day, it is essential that we understand what the different grades, and brands stand for, and how to use the information given on the labels to make our purchasing easier. We shall discuss grades, brands and labels in detail in Unit 13 of this block.

vii) *Preparing market lists*: This only means putting down on a paper food items that we need to buy. The foods we generally consume fall into the following categories:

Cereals and pulses
Sugar, salt and spices
Butter, ghee, vanaspati and oils
Milk, paneer and cheese
Meats, fish and eggs
Vegetables, onions, potatoes, sweet potatoes, colocasia
Fresh vegetables and fruits
Tea and coffee
Jams, jellies, pickles and papads.

You would notice that some of these can be purchased in large quantities and stored well for months if not a year or more. Some can be stored well for a month or two, and some need to be purchased on a daily basis unless you have a refrigerator or freezing facilities.

Cereals, pulses can most certainly be purchased in bulk and stored with appropriate precautions for even a year. It would be a good idea to buy in bulk. For a family of 2 adults and 2 teenage children you may need approximately 30 kg of cereals per month. This could mean 15 kg of rice and 15 kg of wheat per month or 180 kg rice and 180 kg of wheat per year. You can either purchase these for a year when they are cheapest in the market (in season), or purchase 100 kg at a time in the wholesale market and still save money. Oils are also cheaper if you buy a 15 kg tin, and it can last for a few months. Onions and potatoes last for a month without much trouble and should be purchased in bulk if you have storage space and can share your buying with someone. Milk is best purchased on a daily

basis unless you have a refrigerator where it can last for a couple of days at the minimum refrigerator temperature.

Fresh vegetables, fruits and eggs also need to be purchased on a daily basis unless you store them in the refrigerator. Meat and fish should be purchased daily unless you can keep them in the freezing unit of your refrigerator where they last for about a week at the minimum temperature. If you have deep freeze facilities with minus 18 degree celsius (– 18 degrees C) temperature, you can keep meats frozen for months.

Tea and coffee is best purchased for a month because they tend to lose flavour fast unless you have well sealed containers for storing them. Even spices need to be stored in air-tight containers.

This means that we have four kinds of market lists — *the annual purchase list, the monthly purchase list, the weekly purchase list and the daily purchase list.* If the annual or seasonal purchase is not practical, the items from these lists move to the monthly purchase list.

Knowing how much of a particular item needs to be purchased is an important aspect of preparing market lists. In this you should be guided by the recommendation of a balanced diet, the eating habits of your family and, of course, the cost of the food items. It is also important to know how many portions can be served from a given quantity of a food item, particularly in the case of foods that have a high proportion of inedible portion like leafy vegetables, peas in the shell, prawns and meat with bones etc. This information makes it possible for you to purchase the correct amount of food needed and be assured of having enough for the meal without any wastage.

viii) *Avoid unnecessary buying*: Let's take an example. Suppose you are planning to make banana raita for your family and you need only two bananas for it. If you buy six bananas you have four extra. These four will have to be eaten up to avoid wastage. We can call this "distress-eating". The "please-eat-otherwise-it-will-go-to-waste" kind of eating is unnecessary and costs more money besides adding unsolicited body weight. This is also a kind of wastage — any unnecessary expenditure is wastage. Those of us who have "enough" money for food, waste it by doing a great deal of unplanned buying and cooking, and then indulging in distress-eating, or forcing our family members into it. This brings us to another kind of buying which also leads to distress-eating and unnecessary expenditure of money. This is called "impulsive buying", i.e. you buy something on the spur of the moment without any plans about how you are going to utilise it. At times such buying does add interest to your purchasing as well as to your food plans. But this is so only when you are able to fit your impulsive purchases into your food plans for the week by making necessary alterations. You see something in the market which you did not expect to see and you buy it — perfectly acceptable as long as you start thinking about what you are going to do with it, and also adjust your remaining funds to accommodate the expenditure.

C) HOME PRODUCTION AND PROCESSING: Production means growing the food item while processing means further preparation of the food item to make it ready to eat. Very few of us produce the food we consume but most of us process nearly all of it, and in some cases, from stage one. Let us take wheat for example. We buy the wheat, clean it, perhaps wash and dry it in the sun, and get it ground for use as flour. However, with the advancement of science and technology and the boost to large scale, as well as small-scale business enterprise, our markets are fast getting crowded with completely or partially processed foods. Examples are noodles, tomato ketchup, packaged soups, soup cubes, jams and jellies, pickles, instant dosa, idli and gulabjamun mix, breads, biscuits, and other bakery goods, cleaned chicken cleaned and cut chicken, cleaned and packed meats and fish, besides ready-made foods from catering establishments. The cost of partially processed or completely processed food is naturally higher. It is for us to decide to what extent we make use of these items if at all, and to what extent we produce and process all that we consume in order to save money. It is also a question of facilities besides the expertise required. Some of us may have the facility to grow foods like vegetables and fruits at home and then use them to make pickles, papads, jams, squashes and sauces.

Here again we must consider those aspects of home production and processing where the savings are the largest over the cost of fully processed foods. Ordinarily there is more to be saved from home production of those items in which labour represents a very large part of the cost of production. The feasibility of home production of items which are adapted to small scale production and which can be processed with the tools available in your kitchen is much higher than of those adapted to large-scale production. It is easier and more practical to make jams, jellies and pickles at home than to prepare canned peas or pineapples. It is more purposeful, as well as economical to grow green leafy vegetables in the kitchen garden than to grow potatoes and onions, unless you are a farming family or have a large area of land where you live.

It is not practical to lay down any general rule about the desirability of any type of home production activity. Each family must take such decisions in the light of its own resources and objectives. One family can decide that they would rather do partial production and processing of their foods at home thus reducing the actual money being spent on food, while the other might decide to go in more for partially or even completely processed food so that the time saved can be used to earn more money as well as to do other things which are more satisfying. The extra money earned pays for the processed foods — a difference in priorities and, therefore, in approaches.

Check Your Progress Exercise 2

1) What are the three important factors that can help us economize on our food expenditure?

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2) Savita is a young housewife. What advice would you give her regarding the following:

a) There is a discount on squashes in bottles in the market. A free mug is also being offered with each bottle. Should Savita buy the squash?

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b) The guava tree in Savita's compound has brought forth a bumper crop. What would be the best way to utilize the guavas?

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c) The family loves lemon pickle. The vegetable and fruit 'mandi' is close to her home but only very large quantities are sold at a time. What should Savita do?

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11.5 PREPARATION OF FOOD BUDGETS

We have so far talked about the factors influencing food budgeting. Let us now discuss the ways in which we can prepare a food budget. Keeping any expenditure, and more so expenditure on food within your control is very difficult without a written plan. *This plan of expenditure made with the help of past experience, taking into consideration the present market prices and trends, and the individual's buying capacity.*

is called a food budget. We mentioned this earlier. Food budgets can be of two types : a short-term monthly food budget, and a long-term annual food budget.

A *short-term monthly budget* is the one a majority of us are most likely to prepare since most income is on a monthly basis. We usually try to plan our expenditure on food so as to remain within a certain proportion of our monthly income. Short-term budgets are easier to prepare because expenditure on semi-perishables (foods that can stay for sometime without spoiling like onions and potatoes) is monthly expenditure and in the case of perishables (foods that spoil rapidly like milk, meats and leafy vegetables) a weekly or even a daily expense. The monthly budget takes into account the expenditure to be incurred on monthly basis plus the daily and weekly expenditure. Expenditure on the so-called non-perishables like cereals, pulses, sugar can be ideally planned on a yearly basis in order to take advantage of the lowered seasonal costs, and the fact that when bought in bulk things cost less.

The long-term annual budget is the forecast of our expenditure on food and the money available for it during the coming year. It would include annual purchases, if any, plus the monthly expenditure on food for the twelve months. It tells you what your expense on food is likely to be for the coming year. This is very helpful since in the case of unexpected expenditures you have the time and opportunity to perhaps make suitable adjustments by reducing certain food expenditures which you can do without, for example, not freezing peas for the year — one can after all do without eating peas, or making less pickle than one usually does.

PREPARING A SHORT-TERM FOOD BUDGET: The following steps would be helpful in the preparation of a short-term monthly budget:

Step 1 — Estimate the dietary requirements of each member of your family in terms of food exchanges. Let us consider a family consisting of a father (works in an office), mother (school teacher), one son 10 years old, and one daughter 5 years old. We have already worked out balanced diets for these individuals in Table 6.2 given in Practical Manual — Part-I. The dietary requirement of this family has been given in Table 11.2.

Table 11.2: Daily food requirements of a family

Foods	Requirement for father	Requirement for mother	Requirement for son	Requirement for daughter	Total requirement per day (g)
Cereals	280	200	240	160	880
Roots & tubers	120	60	120	120	420
Sugar/jaggery	35	25	30	35	125
Fats and oils	40	35	40	30	145
Milk	500	500	500	500	2000 ml
Pulses	60	60	60	30	210
Eggs	one egg	—	—	—	one egg
Green leafy vegetables	100	100	100	100	400
Other vegetables	200	200	200	150	750
Fruits	240	160	240	160	800

Let us now convert these dietary recommendations into the daily, weekly, monthly and annual food requirements for this family:

Food requirements for daily purchase
2000 ml milk
400 g leafy vegetables
750 g other vegetables (these can be put on the weekly purchase list if you have a refrigerator, or the climate is cold)
800 g fruits

Food requirements for weekly purchase
2.94 kg roots and tubers — in cold climate these can be purchased once every fifteen days.

Food requirements for monthly purchase
26.4 kg cereals
6.3 kg pulses

4.35 kg oils and fats
3.75 kg sugar

Food requirements for annual purchase
321.2 kg cereals
76.65 kg pulses
45.63 kg sugar
(This is possible if you have adequate finance, storage space and facilities)

Step 2 — Convert the food requirements into the actual food items which the family would use. Refer to the basic food groups to ensure the nutritional adequacy of your diet. Add a little extra quantity in each case to take care of wastage in cleaning and cutting, as well as to have some extra food available for guests. In the case of cereals, the total amount required would be distributed among the different cereals the family needs and prefers. For example, in the case of this family, we could include wheat and rice. In the case of pulses, red gram dal, black gram dal, lentils, green gram dal, rajmah and bengal gram could be included. The purchase lists would look something like the following:

Daily purchase for 1 typical day
2 litres milk
500 g amaranth
750 g other vegetables (perhaps, 300 g brinjals + 300 g ladies fingers + 150 g tomato, or any other vegetable you like)
800 g fruits

Weekly purchase
2.94 kg roots, tubers and other vegetables (such as onion 1 kg, potatoes 1 kg and 0.94 kg colocasia)
7 eggs

Monthly purchase
Total pulses or legumes to be used is 6.3 kg. These could consist of the following:

Red gram dal : 2 kg
Black gram dal : 1 kg
Bengal gram dal : 1 kg
Lentils : 1 kg
Green gram dal : 1 kg
Rajmah : 0.3 kg

Total cereals to be used is approximately 26.4 kg. This could consist of 13.2 kg of wheat and 13.2 kg of rice, or any other combination you prefer.

Total amount of oils and fats is 4.35 kg. This could consist of: groundnut oil 3.5 kg (or any other oil you prefer), hydrogenated oils: 1.0 kg, Sugar can be purchased in amounts of 3.75 kg.

Step 3 — To this list of basic food items, you could add spices, salt, tea, coffee and other accessory food items like papads, jams, jellies and pickles that your family uses and enjoys.

Step 4 — Estimate the cost of the items of food on the daily, weekly and monthly basis. It would depend upon the market prices. Would you like to fill in the details in the charts that follow? It would help you to make monthly/weekly/daily purchase and expenditure lists for your own family.

Daily expenditure

Food item	Cost per kg (or per litre)	Total amount purchased	Total cost (A)
Milk		2 litres	
Green leafy vegetables		500	
Other vegetables		750	
Fruits		800	

Weekly expenditure

Food item	Cost per kg (or per litre)	Total amount purchased	Total cost (B)
Potatoes		2 kg	
Colocasia		0 9 kg	
Onions		1 kg	

Monthly purchase for non-perishables only

Food item	Cost per kg (or per litre)	Total amount purchased	Total cost (C)
Pulses			
Oils			
Sugar			
Wheat			
Rice			
Tea/Coffee & other accessories			
Fuel for cooking			

Now you can calculate the total cost for monthly purchase (30 A+4 B+C). We have left the total amount purchased column blank so that you can fill up details.

You can follow the same procedure in deciding on expenses for your own family. The information in Table 6.2 of the Practical Manual — Part I would be useful. First list the members in your family specifying sex and age. Then write down the diets for each member and add them up. Then work out daily, weekly and monthly purchases with expected expenses.

Let us now move on to the last step.

Step 5 — Compare the estimated cost of the planned food expenditure with the funds available for food in the monthly budget, and if the money available is not enough, do one or more of the following in order to adjust the food plan to suit the money available:

- *Cut out some of the accessory food items like jams, jellies, papads and pickles.* These are useful in making meals more appealing but do not contribute much nutritive value. These items also happen to be fairly expensive unless they are being prepared at home. If you can prepare appetising food, you can reduce the consumption of these food accessories.
- *Use cheaper varieties of pulses.* Most of us tend to have rigid ideas about food. For example, when we think of sambar we only think of using red gram dal which is one of the most expensive dals. Lentils or a mixture of red gram dal and lentils makes equally good sambar. Among the different dals and legumes there are considerable variations in prices but their nutritional contribution is very similar. We in India have quite a variety to choose from.
- *Use cheaper oils.* Today the market has quite a variety of refined oils. The most common one is refined groundnut oil. This is available under many different names. Besides groundnut you have sunflower, coconut, mustard, til (sesame), palm, cotton seed, and rice bran. Get adequate information about the merits and demerits of all these oils and choose one which, besides complying with your nutritional standards, is also the cheapest. You will find some useful guidelines on this in Unit 12.
- *Select cheaper vegetables.* Restrict yourself to seasonal ones only. If you use a lot of tomatoes and can process them at home, make tomato puree when tomatoes are cheap in the market and use it in place of fresh tomatoes when they are expensive.
- *You can reduce expenditure on wheat and rice by buying less costly varieties.* You could substitute part of the wheat and rice with millets like ragi (rich in calcium and iron) or bajra which are cheaper, or a combination of different cereals.
- *Pay very careful attention to meal planning with special emphasis on nutritional adequacy.* Remember when money is less and expenditure is more, the first tendency is to reduce the expenditure on food. Unless this is done very

judiciously, the health of family members can be affected adversely causing perhaps more expenditure by way of doctor's fees and medicine bills.

- *One-dish meals in which you combine cereals, pulses, and vegetables is nutritionally ideal.* We discussed this aspect earlier in Unit 6 of Block 2. Khichri, vegetable pulao, pulihara, bisibele-huli-anna (sambhar-bhat or bisibela-bhat), missal and haleem are examples of some of our one-dish meals. You would surely be able to think of many other dishes common in your family and in the area you live in. Serving these one-dish meals with a mint and coriander chutney and/or cucumber-tomato raita and curds, adds more vitamins and minerals. You also save on the total amount of oils and fats used, as well as on the fuel consumed and the time spent in cooking.
- *Make sure that food is not wasted.* Do not cook more than you need unless you have adequate facilities for storage, and can save time and fuel by cooking larger quantities at a time. Learn to use left-overs as quickly as possible. Avoid impulsive buying. When serving food do not give large helpings parts of which will be left uneaten. It is better to serve a second time than to have food wasted in the plate. Be careful in cooking, particularly in cooking rice. Much of the time rice gets semi-burnt or burnt at the bottom because it is left on the fire too long. A fair amount of rice gets thrown away in this way. This is a waste. Learn techniques whereby you can cook rice without the risk of scorching or burning it.
- *Save fuel in reheating a meal by* (a) using thermocole containers for keeping the serving dishes; (b) steaming all items in a large vessel with a small amount of water in it.

PREPARING LONG-TERM ANNUAL FOOD BUDGETS: We have just gone through the steps in preparing a short-term food budget. Now how would we proceed if we had to prepare a long-term food budget, say an annual budget? The long-term annual food budget takes into consideration the following:

a) The estimated monthly expenditure on food for the twelve months.

b) The annual expenditure related with food like making tomato sauce, pickles, papads, jams, jellies and squashes in different seasons.

c) Festivals and other occasions (birthdays and anniversaries) during the year which the family celebrates, and the expenditure on food incurred because of them.

d) Unexpected situations and guests which increase expenditure on food.

Thinking and planning about such expenditure for the coming year ahead of time and assessing the prospects against the income that you expect to have, can perhaps help to re-define priorities and mould the expenditure to suit the budget. You could estimate your annual expenditure using Chart 1.

Chart 1: Food Budget for the Year

S. No.	Item	January		February		March		April		May		June	
		Q	A	Q	A	Q	A	Q	A	Q	A	Q	A
1)	Rice												
2)	Wheat												
3)	Suji												
4)	Besan												
5)	Gram												
6)	Urad												
7)	Moong												
8)	Edible oil												
	a) Groundnut oil												
	b) Mustard oil												
	c) Palm oil												
	d) Coconut oil												
	e) Other vegetable oils												
9)	Salt												
10)	Sugar												
11)	Jaggery												
12)	Coconut												
13)	Copra												
14)	Coriander												
15)	Dry chillies												

16) Tamarind
17) Cashewnuts
18) Kismis
(dry grapes)
19) Others
20) Ready-to-eat foods
a) Ketchups
b) Jam
c) Bread
d) Baby foods
e) Biscuits
21) Beverages
a) Coffee
b) Tea
c) Others
22) Milk
23) Egg
24) Meat
25) Fish
26) Vegetables
27) Fruits
28) Milk products
a) Butter
b) Ghee
c) Cheese

Total

Q = Quantity A = Amount of money

You would notice that provision has been made for monthly purchases. This makes the plan easier to prepare on a yearly basis. It also allows flexibility in varying selection from one season to another.

If your finances and the facilities you have for storage permit annual purchasing of the non-perishable food items like cereals and pulses, you can save quite a lot of money by taking advantage of seasonal bulk purchases. Such purchasing will very much be a part of the estimated annual budget.

One point we must always keep in mind is that feeding a family is a highly individualized exercise. There is no one best way to feed a family; there is no best way to secure the family's food supply; there is no best way to make the money put aside for food go farther. In deciding which of the many options to use each family must keep in mind the amount of money, time, personal skills and equipment available, the availability of raw as well as processed foods in the market and the personal needs and preferences of the members. Each family must work out for itself the combination of materials and methods which will provide an adequate and attractive food supply with the finances available for food.

2) Suppose you were preparing a short-term budget for your family. You find that last month's expenses on food are excessive. Which of the following adjustments would you make in order to balance income and food expenditure?

a) Cut down on total food purchases
b) Cut down on purchases of milk, fruits and vegetables
c) Cut down on purchases of food items such as pickles and sauces
d) Reduce frequency of eating out
e) Cut down fuel costs by avoiding cooking procedures and preparing combination dishes
f) Reduce consumption of sweets
g) Select cheaper oils, cereals and pulses
h) Select seasonal vegetables and fruits

11.6 LET US SUM UP

In this unit you have learnt about:

- how you can get the maximum food value from a limited amount of money by carefully planning the expenditure on food i.e., by preparing a food budget.
- how factors like income and size of the family, the current food prices, the kind of markets from where the family buys its food items, the extent to which a family produces and/or processes some of the food items that it uses, and the importance that the family gives to food influence the expenditure on food.
- how you can economize on your expenditure on food by acquiring information regarding the nutritional needs of your family and the way these needs can be met; by exercising intelligence in buying in terms of prices and quality of food items, bulk purchasing, weights and volumes of food items, grade and brand specifications, and preparing lists of what you need to buy; by preparing some of the food items like pickles, squashes, jams and chutneys at home.
- how to prepare short-term as well as long-term food budgets.

11.7 GLOSSARY

Bisibele-huli-anna : A Kannada preparation of rice, pulses, legumes and vegetables.

Bulk : Large quantity.

Catering establishments : Those who take care of making food arrangements on payment.

Dressed chicken : Chicken that has been slaughtered and cleaned.

Haleem : A Hyderabadi preparation of wheat and meat cooked together like a porridge.

Laddoo : Indian sweet made with bengal gram flour or other ingredients in the form of balls.

Legumes : The fruit or seed of a pod-bearing plant such as peas, beans etc.

Missal : A Kannada preparation of different pulses sprouted and cooked together.

Percentage : Out of every hundred units, for example 5 out of 100 is 5 per cent.

Pulihara : A South Indian fried rice dish with nuts and seasoned with lime or tamarind.

Puree : Pulp of a vegetable or fruit.

Thermocole : A synthetic material used to make containers which

maintain the temperature of any item kept in it.

To can : To pack inside a can for long period preservation.

Tomato sauce : Tomato ketchup.

Toned milk : Milk which has been standardized to the composition of cow's milk.

Unsolicited : Without having asked for.

11.8 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) a) Food b) clothing c) shelter

2) a) Make a list of the items of expenditure
   b) Arrange the items of expenditure in order of preference
   c) Estimate the likely expenditure on each item
   d) Estimate total money available for expenditure
   e) Estimate the maximum essential expenditure on each item
   f) Adjust the expenditure plan to suit the amount of money available for it.

3) a) Income of the family
   b) Size of the family
   c) Current food prices
   d) Nearness of the family to the source of food supply
   e) Home production of food items
   f) Family's interest in food and other things

4) a) True
   b) True
   c) False; the major difference between low and high income groups is not as much because of the total quantity of food consumed as it is because of the difference in the quality and variety of foods consumed.

Check Your Progress Exercise 2

1) a) Knowledge of nutrition
   b) Intelligent buying
   c) Home production and processing of food items

2) a) Savita should decide to buy the squash if she needs it and can use it (not because of the discount and free gift), if the quality is satisfactory and date of packing/manufacture is recent.

   b) Savita could prepare jams or jellies with the surplus guavas. She could also prepare guava drink concentrate which she can dilute for use. Savita could well consider the possibility of selling these products to neighbours and friends.

   On the other hand she may prefer to sell the guavas depending on availability of products.

   c) Savita can talk to her friends and neighbours and find out who is interested in bulk purchase of lemons. They can then pool together resources and divide the purchased lemons according to the needs of the respective families.

Check Your Progress Exercise 3

1) **Market factors:** Relative cost of food items within a category e.g. cereals.

Family factors: Income or amount of money, personal needs and preferences, availability of time, equipment and use of personal skills.

2) (c), (d), (e), (f), (g) (h)
Depending on family factors you could select all the above or some of the above.

UNIT 12 FOOD SELECTION — I

Structure

12.1 INTRODUCTION

To keep the family supplied with food within the amount of money available for it, and to make sure that it not only meets the nutritional requirements of each member, but is also liked and enjoyed by them, requires an understanding of the nutritional needs of your family members and an appreciative awareness of their likes and dislikes; and it requires ingenuity not to sacrifice one for the other. It also requires knowledge and information about foods, the choices that are available to you, and the ability to obtain the maximum value for the money you spend.

While money is a serious limiting factor for most of us, having lot of money is no guarantee that we shall be adequately fed. To know what foods are, what they contribute towards your health, and where and how to get them, is very essential. You may have plenty of money to buy what you want but if you do not know what you need and where best to get it from, you will not get the optimum value from the money you spend on your food.

In the previous unit we have discussed how to plan food expenditure within one's income, and we saw how and why expenditure on food forms the major part of the income of most families in our country. In this unit and the next we shall discuss how best you can spend this money in selecting food for your family, keeping in mind, that to a very large extent what you select molds the eating habits of your family, and will be reflected in the health status of its members. What are the different kinds of energy-giving and body-building foods available in the market? How to select these foods keeping in mind the nutritive value, suitability and ease of preparation? These are the issues discussed in this unit.

Objectives

After studying this unit, you will be able to:

- identify the different types of energy-giving and body-building foods available in the market
- list the different food items that are available in each category of the food
- select foods to meet your requirements, both in terms of food quality as well as cost and
- list the criteria for selection of these foods

12.2 SELECTION OF ENERGY-GIVING FOODS

In this section of the unit we shall identify for you the different types of energy-rich food items (cereals, roots and tubers, fats/oils, sugar/jaggery) that are available to meet our nutritional requirements. Our markets are full of a large variety of energy-rich food items; within this category of food there are many different kinds that are available; similar or similar looking foods are available at different prices. The purpose of this section is to help you understand how can you decide which food stuff would best meet your needs. We begin our study with selection of cereals.

12.2.1 Selection of Cereals

From earliest time grain has been man's chief means of subsistence. The word 'cereal' is derived from Ceres, the Roman goddess who was believed to be the protectress of grains. The term cereal includes plants that produce grains, the grains themselves, and the food products made from these grains, for example bread. Cereals largely used in our country are rice, wheat, jowar, maize, bajra, barley and ragi. Rice and wheat are classified as fine cereals, whereas bajra, ragi, jowar are the coarse cereals and are referred to as millets.

a) Wheat: The total wheat production in India in 1988-89 was 54 million tonnes. Most of the wheat used in India is used in the form of whole wheat flour. Since almost all wheat flour is used to make either chapaties, puries or paranthas, the quality of wheat produced in India is meant to be suitable for making these products.

Wheats suitable for making baked products like bread, biscuits and cakes are different from those suitable for making chapaties. The Indian chapati wheats have the capacity to absorb water to the extent of about two-thirds of their own weight. They make a dough which is non-sticky and stretches with a little effort, but once stretched it stays that way; in other words, it is suitable for rolling into any shape you want — round for chapati, triangular or rectangular for paranthas. How does this happen? What is it that is present in wheat flour that gives the dough this characteristic property? You will find information on this interesting aspect in Highlight 1.

HIGHLIGHT 1

Wheat Proteins

To understand the stretching quality of wheat flour, consider the following exercise. Take some whole wheat flour and knead it into a stiff dough. Now that you have kneaded the dough divide it into two halves. Cover the first half with a wet cloth and leave aside. Knead again after about half an hour and make chapaties. Use the other half immediately for making chapaties. What difference do you notice in the texture and puffing quality of the chapaties made from the two dough? Yes, the difference is obvious. Chapaties made from freshly kneaded dough do not puff adequately and also the edges are cracked. In contrast, the chapaties are soft and puffy when prepared from the 'dough' which is kneaded much in advance. Why is it so? It is interesting to note that the baking quality of wheat is due to the formation of an insoluble protein called *gluten* during dough preparation. Wheat, as such, contain about 10-13 per cent protein and of this 8-10 per cent is gluten. Gluten gives the dough its sticky, rubbery and stretchy quality that is so desirable for our cooking. When chapati dough is kneaded, gluten is formed and the strands strech, forming a net-like structure in which the starch granules are embedded. This structure helps the dough to retain gas and makes the chapaties soft. Gluten itself is a mixture of three constituents. One is called *gliadins* which give stretchability to the dough, the second are *glutenins* which give elasticity and strength to the dough, and the third are called *residue proteins*. These are brittle and tend to form crumbs. Wheats that carry about equal proportion of these three constituents and an overall high gluten content, give chapaties that are soft and that puff well. An excess of residue proteins causes a leathery chapati and an excess of gliadins gives you a stiff chapati. The next time you see leathery or stiff chapaties, blame the wheat — not the cook!

The traditional Indian varieties of wheat known as *Sharbati* and *Bansi* are particularly suited to chapatti. We also have the traditional soft white wheats called *pissi* which are suitable for making maida, and *dara* wheats of medium-hard quality specially used for making broken wheat and semolina. For making wheat products like vermicelli, we have the very hard wheat of a special variety called *durum*. These traditional varieties of wheats have been very suitable for our food requirements. The situation changed with the introduction of the high-yielding varieties of wheats, and with the growing popularity of baked products of wheat like breads, cakes, biscuits etc. The quality of wheats needed for these baked products is very different from the traditional varieties that we have been growing in our country and since wheat varieties introduced into India have to be suitable for making chapaties, they are often not the best ones for making bread and cakes. This is why at times we do have problems with our breads and other baked food items.

In the late 1960s the high-yielding Mexican wheats with dwarf plants such as *sonora* were introduced into India. These had dark brown grains and the chapaties made were dark and unappetising. Since these were not acceptable the dark wheats were crossed with the Indian varieties like sharbati to give a new variety like *sharbati-sonara*. Some of these new crossed varieties still give dark-coloured chapaties. After some more efforts wheat varieties like *kalyan sona, C-306* and *C-308* were developed to give normal chapaties. Later varieties like *Arjun, Janak, Pratap* and *WL-711* were added to the list.

So now you see we have quite a collection of wheat varieties in the country. The prices also differ a lot from one variety to the other. The most expensive and also the best for our purposes is the grade 1 of sharbati. Bansi is cheaper but not very far behind in giving good quality chapaties. *Nutritionally speaking it does not make a difference which variety you use, therefore, you can make your choice either going by the price of the wheat or the looks of the chapaties you get from it. While buying any wheat look for plump looking kernels which are not broken, shrivelled, or insect eaten. See that the wheat is free from insects and chaff etc.*

b) Rice: In broad terms rice is classified as fine, medium and coarse. There are strong regional preferences for size, shape, flavour and cooking texture. Fragrant, long-grained varieties like Basmati, Tilakchandan, Hansraj are used in the north even for everyday eating. In the south these are used for making special fried rice preparations like pulaos and birianies (fried rice cooked with meats or vegetables marinated in curds, lime and spices) and the smaller, medium or coarser varieties are preferred for everyday use. In eastern parts of India, parboiled rice, slightly yellow in colour is popular while in Kerala parboiled rice of a rather strong boiled flavour is preferred. Each rice growing area in our country has its own popular varieties. *However, everywhere in India, rice that is at least a year old is preferred since it cooks to a firm texture while leaving the grains separate.* This is in contrast to countries of the Far East, where a lumpy and sticky mass of cooked rice is desired.

Rice qualities vary a great deal in the way they behave in cooking. The amount of water and the temperature of cooking are crucial. Some absorb more water and cook to a larger volume compared to others. Old and superior qualities of rice cook well in this respect.

Selection of rice is a very individualistic matter. However, *it is good to remember that rice should be at least a year old for better cooking.* If one has adequate storage space it is economical to buy freshly harvested (new) rice and leave it to mature before starting to use it because new rice is cheaper than old rice. The long-grained fine varieties are more expensive than the medium or coarser varieties. However, in the medium varieties there are many which cook to a good volume and consistency if they are at least five months old.

About half the rice grown in India is parboiled. You would remember reading in Unit 4, Block 2 that parboiling involves steeping the paddy (rice) in cold water for a few days and subsequently boiling it till the grain is soft, after which the grains are spread out to dry. This treatment makes the husk more easily detachable, renders the grain less brittle and more elastic, and toughens the outside of the rice grain through the gelatinisation of starch. Besides improving the nutritive value of the rice, these operations result in a much improved yield of the whole rice during subsequent milling of the paddy. Table 12.1A and 12.1B gives nutritive value of various forms of rice.

Table 12.1A: Major constituents of various forms of rice

	Brown rice	Polished white rice	Hand-pounded rice	Parboiled rice
		(All figures as percentage)		
Starch	77.1	80.9	78.1	78.0
Protein	7.5	7.1	7.7	7.0
Fat	2.4	0.4	1.5	0.8
Ash	1.2	0.5	0.8	0.5
Fibre	0.9	0.1	0.9	0.1
Moisture	10.9	11.0	11.0	13.6

Table 12.1B: Retention of vitamins and minerals in various forms of rice

	Brown rice Quantity*	Polished white rice	Hand-pounded rice	Parboiled rice
		As percentages of the quantity in brown rice		
	Micrograms			
Thiamine	320	15	66	72
Riboflavin	56	35	87	66
Niacin	4600	37	85	83
Folic acid	36	22	60	30
	Milligrams			
Calcium	40	25	65	95
Iron	2	155	145	133

*Values of brown rice are taken as 100 per cent.
Source: K.T. Achaya: Everyday Indian Processed Foods, National Book Trust, India.

The nutritive value of all varieties of polished rice is almost identical. It is only the consistency of the cooked product and the volume to which rice cooks, that influence one's choice, besides of course the cost factor. However, in the case of unpolished brown rice (which still carries its coat of bran), hand-pounded rice, and parboiled rice, there is a definite advantage in terms of B-complex vitamins when compared with polished rice.

Use of parboiled rice in the Eastern and Southern parts of India is an excellent practice since rice becomes a major source of B-complex vitamins. It is interesting to note that *parboiled rice is also cheaper than polished rice. In areas where hand-pounded or parboiled milled rice is used, beri-beri (thiamine deficiency disorder) does not occur, but it does when polished rice alone is the main food.*

c) Millets: Besides rice and wheat which are classified as fine cereals, we also have a number of coarse cereals or millets that are raised on poor soil. They are called dry crops, and can grow where there is not enough rain to grow rice, or where it is too hot to grow wheat. The commonly used ones are jowar, bajra and ragi. These are commonly grown in the whole of the Deccan plateau where the rainfall is unreliable. Like rice and wheat, these also have to be dehusked. The grains may then be soaked and made into a porridge or ground into a meal. These processes are usually carried out in the home since millet eaters are mostly peasants. *Jowar* is the more widely used of these three millets. Grinding this whole in a heavy chakki gives a coarse flour that is used, especially in western India, to make the roti called bhakri (refer to Section 4, Practical Manual – Part I). Milled jowar flour makes an excellent dosa ingredient in place of rice, and also gives a tasty chapati if hot water is used in making the dough. *Bajra* is grown mainly in Central and Western India. This is used in much the same way as jowar. You can buy milled bajra flour in the market. *Ragi* is grown mainly in the south, and is an excellent source of calcium. Ragi is soaked, then sprouted for a couple of days, dried, and ground with a little salt and pepper into a powder which is used either as a porridge for young children, or in the form of steamed balls by the rest of the family. Germinated ragi powder is also available under various brand names for use as a breakfast porridge. Ragi can be milled in much the same way as wheat. *Maize* is mostly grown in Punjab, Uttar Pradesh, Bihar, Rajasthan and Maharashtra. It is milled to make flour in very much the same way as wheat is. You can buy maize in the market and can make delicious roties from it. Table 12.2 gives a comparison of nutrients in coarse grains and wheat.

Table 12.2: Nutrients in coarse grains compared with wheat

	Wheat	Jowar	Bajra	Maize (dry)	Ragi	Barley
			(figures as percentages)			
Moisture	12.0	12.0	12.0	12.0	12.0	12.0
Carbohydrates	65.6	72.6	67.9	68.8	72.9	70.1
Protein	10.8	10.4	11.6	11.3	7.4	11.5
Fat	1.5	1.9	5.0	3.6	1.3	1.3
Fibre	2.2	1.6	1.2	2.8	3.7	3.9
Total ash	1.5	1.6	2.3	1.5	2.7	1.2
			(Figures as micrograms/100 g)			
Thiamine	350	370	300	420	420	470
Riboflavin	160	130	250	190	100	200
Niacin	5,400	3,100	2,300	1,800	1,100	5,400
			(Figures as milligrams/100 g)			
Calcium	45	37	42	10	344	26
Iron	4	6	5	2	6	3

Source: K.T. Achaya: Everyday Indian Processed Foods, National Book Trust, India.

Nutritional factors in selection of cereals: Cereals are the best as well as the cheapest sources of energy. This is the reason why they form the major portion of most dietaries around the world, and particularly so when money available for food is very little.

Starch, the valuable energy food, makes up about 75% of any cereal. Cereals also contain significant amounts of proteins, the tissue-building food. These cereal proteins, although incomplete because of a deficiency of amino acid lysine are well utilized by the body, and when properly supplemented with milk, eggs, meat or pulses and other cereals, they largely meet the body's requirements satisfactorily. Cereals also contain certain amounts of fat as well as fair amounts of minerals and vitamins. They are relatively high in phosphorus but uniformly low in calcium except for ragi. Their iron content varies widely.

Nutritionally speaking all cereals make similar contributions to the diet except for ragi which, as mentioned earlier, is very rich in calcium. *The choice of cereal largely depends upon availability, dietary habits and cost.* For proper selection, however, keep the following guidelines given in 'Points to Remember' in mind.

POINTS TO REMEMBER

Selection of cereals and millets

1) While buying wheat look for plump looking kernels which are not broken or shrivelled.
2) Ensure that the grains are clean, free from dirt, gravel etc.
3) Check carefully and ensure that the cereals are not infested with moulds, fungus or insects.
4) Buy rice which is atleast a year old since it looks better.
5) Select according to your needs. The long variety of rice are used for making pulao, fried rice etc. while short/broken variety are suitable for making khichri, pongal, idli etc.
6) Buy parboiled rice as it is cheaper and has more nutrients than milled rice.
7) Ensure that the cereal flour (wheat, jowar, maize) is free from insects, lumps and moulds.

Check Your Progress Exercise 1

1) Indicate if the following statements are true or false. Correct the false statements.

a) Nutritionally all varieties of wheat are equal. (True/False)

.....

b) Rice contains a unique protein called gluten. (True/False)

.....

c) Ragi contains much more calories than other cereals do. (True/False)

.....

d) Rice is parboiled to prolong its life. (True/False)

.....

e) Cereal proteins are well utilized by the body. (True/False)

.....

2) Match items in column A with items in column B:

Column A	Column B
a) Ragi	1) Gluten
b) Wheat	2) Thiamine
c) Cereals	3) Calcium
d) Parboiled rice	4) Cheapest source of energy

12.2.2 Selection of Roots and Tubers

Some of the commonly used roots and tubers in our country are potatoes, sweet potatoes, tapioca, yam, colocasia. They are all rich in carbohydrates and provide calories. As a matter of fact, potato ranks third as a source of energy in the world's dietaries; they also contain significant amounts of vitamin C as well. Tubers like yellow varieties of yam are rich in carotenes. Root vegetables like tapioca, commonly used in Kerala, are such high yielders per acre of land that they have served as emergency or famine foods in times of cereal shortages.

Potato is the most versatile of all roots. It can be cooked in innumerable ways, and is enjoyed by everyone in some form or the other. Unfortunately, however, we in India do not use it as a main part of our meals. We use it only as an accompanying vegetable with rice or wheat products. There is a very strong case in favour of potatoes being used in place of rice and wheat in our diets, and with the variety of cooking styles available to us we can surely evolve suitable meal patterns to accommodate the potatoes as the main item of the meal. It can be easily done in a State like Himachal Pradesh where potatoes grow a plenty. This becomes particularly significant when we look at Table 12.3. You can see that the yield of potato per acre of land is almost six times higher than that of rice or wheat. *When buying potatoes, make sure they are of one variety, well-shaped, smooth and roughly of one size. They should be clean, firm and free from decay.* Unless early or "new" potatoes are desired, they should be matured. *The skin should be unbroken and should cling tightly. Excessive dirt, scabbiness, sunburn, hollow or black heart, and decay are all objectionable qualities in potatoes.* If you want to mash potatoes do not buy new ones because they become sticky and lumpy. *"Old" potatoes are best for mashing or making cutlets.*

Table 12.3: Yield of calories from roots and tubers as compared with cereals in India

Commodity	Average yield per acre (kg)	Calories per acre
Rice	888	307,0000
Wheat	822	284,0000
Jowar	290	101,0000
Ragi	391	128,0000
Potato	5103	495,0000
Sweet potato	3328	399,0000
Maize	904	309,0000
Tapioca	2940	994,0000

Note: The data for all crops except tapioca is for 1986 (Food and Agricultural Organisation's 1986 Production Year Book, Vol. 40; Andhra Pradesh, Seasons and Crop Report; Bureau of Economics and Statistics, Hyderabad); the data for tapioca is for 1956-57.

Some tips on how to select Roots and tubers are listed in Points to Remember.

POINTS TO REMEMBER

Selection of Roots and Tubers

1) Select roots and tubers which are firm, heavy, free from sprouts, with shallow eyes and without green discolouration.
2) While buying potatoes ensure that they are of one variety, well shaped, smooth and roughly of one size.
3) Reject potatoes with deep eyes, green skin or with cuts.

4) Select according to your need. Buy old potatoes if you want to make cutlets or any other mashed potato preparation. Avoid new potatoes as they become sticky and lumpy.

12.2.3 Selection of Fats and Oils

The visible fats that we use in our food are ghee, butter, vegetable oils and hydrogenated vegetable oils called vanaspati. Out of these the ones that are liquid at room temperature, you know are called oils and those that are solid are called fats. However, scientifically the term fat refers to both fats as well as oils.

Unlike the West where solid fats like tallow (fat derived from goat or sheep mutton) and lard (fat derived from pig meat) were the chief cooking media till quite recent times, our fats have come mostly from vegetable oilseeds. The earliest of these seem to have been sesame seeds (gingelly seeds), mustard seeds and coconut. These oils seem to have been in use even before the commencement of the Indus Valley Civilization (2700 B.C.). The only recent major addition to these traditional oils has been the groundnut, which was brought to India by the Portugese traders who followed Vasco-da-Gamma in the 16th century. We now also have safflower, sunflower, rice-bran and a host of other oils to choose from.

For solid fats as cooking medium we have a large number of hydrogenated oils (vanaspati) in addition to ghee which is derived from milk. These hydrogenated oils are cheaper than ghee, and therefore, to a very large extent, have replaced ghee in the Indian cuisine. What does the term 'hydrogenated oil' mean. *Hydrogenation is a process by which oils are rendered solid at room temperature.* It involves partial conversion of the unsaturated fatty acids of oil to saturated fatty acids thereby making the oil look and behave like ghee at room temperature. In Unit 3, Block I you studied about saturated and unsaturated fatty acids. But, what is the significance of saturated and unsaturated fatty acids in our diet. Read Highlight 2 for information on this interesting aspect.

HIGHLIGHT 2

The significance of saturated and unsaturated fatty acids

Like vitamins, fatty acids also play a role in the growth and [illegible]. Three of these fatty acids need to be present in the diet on a [illegible] are essential to our diet, since they cannot be manufactured [illegible] linoleic, linolenic and arachidonic. Arachidonic can actually be [illegible] the body from linoleic. *The EFA and the derived EFA together are called poly-unsaturated fatty acids (PUFA). PUFA are essential for [illegible] biochemical processes in the body.* It helps in the healthy functioning of the [illegible]. Table 12.4 you can see that saturated fats like ghee and vanaspati have very low PUFA, while oils have much higher contents. Here again there is quite a lot of variation from one oil to another with coconut oil being even lower than ghee or vanaspati. It is interesting to note that even though coconut oil is liquid at room temperature it becomes solid during cold season. It does contain quite a lot of saturated fatty acids.

Table 12.4: Poly-unsaturated fatty acids in some edible oils and fats

No.	Fat or oil
1)	Coconut oil
2)	Ghee (butter, fat)
3)	Vanaspati
4)	Olive oil
5)	Mustard oil
6)	Groundnut oil
7)	Rice bran oil
8)	Sesame (Gingelly) oil
9)	Maize oil (corn oil)
10)	Cottonseed oil
11)	Soyabean oil
12)	Safflower oil (Kusuma oil)

Source: Nutritive Value of Indian Foods by C. Gopalan, B.V. Rama Sastri, National Institute of Nutrition, I.C.M.R. (1987) Hyderabad.

It is obvious that a diet based completely on ghee, butter and vanaspati will be very low in essential fatty acids. It is also true that there is a very strong and traditional bias in favour of ghee in our country. Next to ghee it is hydrogenated fats because they look and behave like ghee. Oils, unfortunately, are the last choice. Certain dishes like paranthas, puries and pulaos are just not accepted in oil. Oil is also not accepted as a substitute for ghee in dals and on chapaties. *The best solution is to use ghee and vanaspati where we absolutely must but use oils rich in PUFA for much of the cooking. The minimum intake of vegetable oils rich in PUFA should be 15 gms per day.*

The colour and flavour of the fat: Freshly crushed oils usually look yellowish as a result of coloured materials carried over from the oil seeds. Sesame seed, mustard, coconut and groundnut oils, are all coloured, some like mustard oil, more than the others. Some of the newer oils have even stronger colours like the soyabean oil which is greenish yellow, the rice bran oil which is reddish yellow and the cotton seed oil which is very dark in colour. Some of the oils also have rather strong flavours which are not always appreciated. These newer oils are not acceptable for cooking in the form in which they are obtained. Therefore, they are put through processes by which their colour and flavour are removed. *They are then called refined oils.* Since these new oils in their refined and bland form have become very popular, it has become a practice to refine even traditional oils like the groundnut. Mustard, coconut and til oils are still used in the raw form but even they can be refined. A lot depends upon whether you like the flavour of a particular oil, and also on the cost, since refined oils are more expensive.

It is therefore, suggested that select fats and oils according to your needs and budget, but, while buying ensure the following points as listed in 'Points to Remember'

POINTS TO REMEMBER

Selection of fats and oils

1) Ensure that the fats and oils you buy are clean and free from any solid particles, dirt, dust and bad odour.
2) Use more of vegetable oils as compared to ghee since they are rich in poly-unsaturated fatty acids (PUFA).
3) Do not buy oils/fats loose from the market, as they might be adulterated. Instead buy, in tin or polyjars.
4) Ensure that the fats/oils you buy have a natural colour and flavour.

Check Your Progress Exercise 2

1) Indicate if the following statements are true or false. Correct the false statement.

a) Ghee is good for health [illegible] could be used for all cooking if you have the money to buy it. (True/False)

.....

b) Oils have less calories than [illegible] (True/False)

.....

c) Hydrogenation makes fats [illegible] at room temperature. (True/False)

.....

d) Oils provide us with unsaturated fatty acids that are essential for our health. (True/False)

.....

e) Ghee and vanaspati are [illegible] poly-unsaturated fatty acids. (True/False)

.....

f) The process of refining [illegible] flavour to the oil. (True/False)

.....

g) Mustard and coconut oil cannot be refined. (True/False)

.....

h) All fats provide 4 calories per gram. (True/False)

.....

i) Fats are a good source of proteins. (True/False)

.....

j) Potatoes are good substitute for pulses. (True/False)

.....

12.2.4 Selection of Sugar, Jaggery and other Sweetening Agents

People in India knew the art and science of making jaggery and rock sugar as way back as 1500 B.C. In 7th century A.D. a Chinese emperor sent a mission to the kingdom of Magadha (modern Patna) to learn how sugar was made.

Traditionally we have made either crude brown sugar called gur or jaggery, or khandsari which is lumpsy rock sugar. Fine white crystal sugar has been manufactured only since the beginning of this century. This is the sugar we now use.

Sugar, jaggery as well as khandsari are used as sweetening agents in beverages and other foods to increase their palatability. Their main, and in the case of white crystalline sugar, the only contribution to the diet is energy. White crystalline sugar is 99.5 per cent pure sucrose. Jaggery contains a small amount of iron as well. The different forms of sugar, and other sweetening agents available in the Indian market are:

a) **White crystalline sugar:** This is sugar as we know it. The quality of sugar depends upon the size and whiteness of the crystals. There are five grades of sugar, and commonly only three large-sized and superior grade of white sugars are meant to be sold to the public but one very often has to do with the last two poorer grades as well particularly in small-town shops. The smaller crystal sugars are easy to adulterate particularly the ones that are powdery like semolina (suji). The bigger crystal sugars are purer although they take longer to dissolve. *It is better to buy large crystal sugars.*

b) **Cube sugar:** This is made by compressing small-grained sugar crystals mechanically into cubes. Since this process is expensive the cube sugar is also costly. The cubes are hard enough to retain their shape in packing and transport but porous enough to disintegrate when added to a liquid.

c) **Icing sugar or castor sugar:** This is made by grinding crystal sugar into a fine powder; usually about 5 per cent of starch powder is added to it to prevent it from forming lumps. This is generally called for in baking and icing recipies.

d) **Brown sugar:** The real brown sugar is made by crystallising the final molasses (which is the name given to the dark liquidy mass of cooked cane juice) that one gets in the process of sugar making. However, in India most, if not all, the brown sugar in the market is just white crystalline sugar which is given a surface colour by coating the granules with *molasses* or *caramel* sugar solution, which causes the sugar crystals, when disturbed, to move or creep about in life-like way. The brown sugar lacks the distinctive flavour of true crystalline brown sugar. The cost of this brown sugar is approximately Rs. 22.00 per kilogram. At this cost, this artificially prepared brown sugar which does not have the flavour of true brown sugar, could just as well be replaced by white crystalline sugar, in most recipies. If you are particular about the colour, just add a teaspoon or so of caramalized sugar.

e) **Liquid sugar:** This is just sucrose which is broken down to glucose and fructose either by acid treatment or by enzyme action. It is as sweet as sugar (sucrose) itself, and being a liquid, it is easier to measure out and dissolve in making soft drinks and in canning or baking.

f) **Glucose:** This is available in two forms — the solid glucose as powder or as tablets and the liquid glucose which contains 15 per cent water and is given by mouth for the treatment of dehydration.

A word about the use of solid glucose — sold as glucon-D or glucon-C in the market. These are recommended, and in many cases prescribed as instant sources of energy for not only invalids but also normal healthy persons. You see advertisements all over the place. The cost of these products is approximately Rs 55 per kilogram as compared to sugar which you can buy anywhere from Rs. 5/- to perhaps Rs. 10/- per kilogram. Sugar itself is 99.5 per cent pure sucrose and furnishes 4 calories per gram. In the stomach sucrose breaks down into glucose and fructose very fast, and gets absorbed as fast into the blood as would glucose when ingested as glucose. The time taken for sucrose as a source of instant energy particularly if you see the difference in cost. A patient of insulin coma would revive almost instantaneously when given a glass of liquid with lots of sugar in it. If you do need instant glucose in the blood, you perhaps need it intravenously. Taking it by mouth is just as good or as bad as taking sugar by mouth.

g) **Jaggery:** This is also called gur or bellum. It is a traditional product made from cane juice, coconut palm, date palm, toddy palm as well as sago palm. All these are very similar in calorie content but differ quite a bit in their mineral content particularly calcium. The main contribution of jaggery, however, is energy. It is very common sweetening agent in the rural areas.

Quality in jaggery is mainly a matter of light colour, sweet taste, granularity of texture and hardness, which reflects the amount of water present. Most jaggery in India is made from sugar cane. However, in West Bengal and Tamil Nadu toddy palm and date palm jaggery is also used. Coconut and sago palm saps are much less utilised for making jaggery.

h) **Honey:** This is not manufactured by man but by bees; it is however produced and marketed industrially today by farms that have artificial hives to lure in the bees. Indian honey contains approximately 20 per cent water and 80 per cent carbohydrates (a mixture of sucrose, glucose and fructose). It does have small amounts of vitamin-C and B-complex vitamins, but this is too small to make any vital contribution to our diets. Microorganisms, including pathogens, do not grow in honey, perhaps because of its high osmotic pressure. In cool climate sometimes sucrose and glucose begin to settle down in honey as mushy crystals. These can be redissolved by warming.

Many qualities attributed to honey do not stand to reason, for example, its contribution to longevity, youthfulness or fertility, since in its composition it is as good or as bad as ordinary sugar. It of course has a nicer texture, colour and flavour.

i) **Saccharin and related products:** These are substitutes for sugar particularly for diabetics, and those trying to reduce body weight. Saccharin is the oldest and the most commonly used of all such sweetening agents. A lot of it goes into the making of soft drinks as well. There has been some scare about the possibility of saccharin causing cancer but it has so far not been authenticated in human beings. *Sodium cylamate* is another such sweetening agent which has come under a similar cloud of concern. The latest *aspartame* has been cleared and is available in the Indian market. *Sorbitol* is another substitute for sugar gaining popularity in the Indian sweet industry today.

From our discussion above, it is clear that there are different types of sugars available. Tips given in Points to Remember will help you make the right choice.

POINTS TO REMEMBER

Selection of sugar, jaggery and other sweetening agents

1) Select sugar according to the need. Buy crystal sugar or sugar cubes for tea, coffee etc., icing sugar for cakes, biscuits and other baked products, liquid sugar for soft drinks.
2) Prefer jaggery to sugar as it is more nutritious and cheaper.
3) Ensure that the sugar you buy is free from lumps, dirt and adulterants like suji etc.
4) Honey should have the natural colour, texture and flavour.

Check Your Progress Exercise 3

1) What is brown sugar?

.....

2) How is the brown sugar generally available in Indian markets made?

.....

.....

3) How is liquid sugar made?

.....

.....

4) What is icing or castor sugar?

.....

.....

12.3 SELECTION OF BODY-BUILDING FOODS

Pulses, milk and milk products and flesh foods belong to the body-building food group, which are the main contributors of proteins in our diet. Plant sources of protein include dals, grams, nuts and oilseeds. Animal sources of protein include milk, egg, fish, poultry and meat. In this section we shall identify for you the variety of food items available in this category of foods and how best to select the food items according to your likes, requirements and of course income.

12.3.1 Selection of Pulses

Pulses include dals, grams and dried seeds of leguminous plants like french beans and cowpeas. We have an enormous variety of these in our country, and just as well, because they are the chief source of proteins for a vast majority of our population that is vegetarian either by conviction or due to financial constraints. Table 12.5 gives the commonly used varieties of pulses in our country. More than one variety is available in almost each type of pulse. It would be interesting for you to find out what varieties are available in your area.

Table 12.5: Commonly used pulses

Dals	Grams	Dried seeds of leguminous plants
Red gram dal	Bengal gram whole	Moth beans
Black gram dal	Green gram whole	Field bean
Green gram dal	Horse gram	Cowpea
Bengal gram dal		Peas
Lentil		French beans
		Soya bean

Nutritional factor in selection of pulses: Let us look into the nutritional contribution of pulses. As mentioned earlier they are the main source of proteins in our diets. They are very much cheaper than eggs, meat, chicken, fish and milk, and carry as much protein as in meat (16 to 23 per cent) or probably more. While it is true that the proteins of animal origin are superior both because of a better balance of the eight essential amino acids, and because of high levels in them of two of these amino acids, lysine and methionine plus cystine, we find that all pulse proteins are rich in lysine, and that cereals like rice, wheat, bajra, jowar and ragi have proteins that contain adequate levels of methionine plus cystine, although lacking in lysine. ***Therefore, when as happens in Indian meals, we consume pulses along with cereals there is reinforcing effect as regards these two essential amino acids and the quality of the total protein that we get from such meals is almost as good as what we get from milk or meat products.*** Pulses also provide us with B-complex vitamins, iron and calcium. These nutrients are present in all in more or less similar proportions, hence the choice of which ones to use depends more upon the cost of different varieties, availability and preference of the family. In the North, black gram and lentil are used much more than they are in the South, where red gram dal is the first choice for sambars and rasams even though it is the most expensive dal. One can prepare equally delicious sambars and rasams using lentils, and at a lower cost.

It is important to mention at this point that there is a little problem with the use of pulses as food and it concerns the carbohydrates present in the pulses. Carbohydrates consisting of starch, or sugars (like sucrose, fructose, maltose or galactose) can be easily broken down to glucose by the digestive enzymes. Pulses contain three sugars which are not easily digested. *These sugars find their way into the large intestines where the microorganisms present ferment them to give rise to gases which can cause discomfort and even pain. Green gram dal produces the least gas. That is why it is preferred for feeding children.* Bengal gram dal produces the most gas. Next come red gram and black gram dals. Sprouting for 48 to 72 hours reduces these sugars and so does fermentation, as in idli and dosa making.

Look up Points to Remember for tips on how to select pulses.

POINTS TO REMEMBER

Selection of pulses

1) While purchasing pulses make sure that they are clean and free from gravel, twigs, trash, dirt, mud, stones and sand.
2) Check carefully and ensure that the pulses are not infested with insects.
3) Ensure that the pulses you buy are dry, otherwise, fungus/molds may grow on it.
4) Inspect the grains for uniform size, soundness of grain, absence of broken pieces or any foreign seeds.

12.3.2 Selection of Milk and Milk Products

We have two main sources of milk in our country — buffaloes and cows. To a very small extent goat's milk is also used but this is strictly a home affair. Those that raise goats use its milk. Some use it because they believe it has medicinal value.

A tremendous technological revolution has taken place in our country as regards milk processing and supply. Only a quarter of a century ago cows or buffaloes were brought to your door step for giving you fresh milk, or the milk-man would bring it to you in milk cans. The milk-man still continues, but in most big towns, he now brings milk to you in bottles or plastic sachets. In large cities the milk-man has now been replaced by milk vending machines or large milk trucks like the Mother Dairy ones in Delhi. However, only just one-tenth of all the milk produced in India at present passes through this modern system. Let us take a quick look at this modern system of processing milk.

The milk comes from village families who own one, two or more cows or buffaloes. It is carried to the milk collection centres. The milk is tested for its quality and paid for. The quality is assessed by the percentage of fat present in the milk. The collected milk is taken by truck to the chilling centre where it is quickly chilled to prevent the bacteria present in it from multiplying. If the dairy is nearby, the milk is taken directly to it by the villagers.

At the dairy all the milk is pooled together whether it is buffaloe's or cow's, and then processed. There are two important steps in this processing which are important for us to understand. One is *standardizing* and the other is *pasteurisation.* Let us learn about these processes.

Standardizing: In standardizing milk, cream is either added to the milk or a bit of it is removed to ensure that the milk supplied would be of identical composition everyday.

Pasteurisation: Pasteurisation, on the other hand, is a process which consists of heating milk to certain temperature for a definite time to ensure destruction of pathogenic bacteria, which are likely to be present. It is a very important step in processing milk.

The nature of milk makes it an excellent medium for the growth of living organisms which may have an adverse effect on its quality. The quality of milk also depends upon the health of the cow or the buffalo, the conditions under which the cattle was milked, and the health and cleanliness or otherwise of the person milking the cattle. In our country at present almost all the milk that is available is milked by hand. Pasteurisation destroys both bacteria that are not really harmful (but can cause milk to spoil), as well as, those that can cause disease. We have had a practice of boiling milk which renders it safe on both the accounts. We have, in fact, become so used to

the idea of boiling milk as well as to the flavour of boiled milk, that even when we now get pasteurised milk from dairies we still cannot help but boil it before use, although this is totally unnecessary.

In pasteurisation, milk is heated to a high temperature for a short period of time to destroy the bacteria. The time factor depends upon the temperature to which milk is heated. At lower temperature more time is needed to achieve sterility. *Milk pasteurisation can be done at 63 degree C for 30 minutes or at 72 degree C for 15 seconds* (called high temperature-short time pasteurisation), *or at 150 degree C for about half a second* (called ultra high temperature pasteurisation or uperisation). *Immediately after heating, milk is quickly chilled at 5 degree C or lower.* This process not only makes the milk safe but gives it a longer lease of life, which means that it can be transported (in chilled condition) in rail cars or road tankers to cities even 300 kilometers away for distribution. To make doubly sure it is again pasteurised after reaching such a distant city before distribution to the customers.

Kinds of milk available: Almost ninety per cent of milk we consume in India is still either from the cow or the buffalo. Cow's milk has about 4.5 per cent fat and gives a yellow butter and ghee. Buffalo milk is richer in fat (7 to 9 per cent), and has more calcium and phosphorus than cow's milk has. Cow's milk has carotenes which turn into vitamin A inside our body, and being yellow in colour are responsible for the slightly yellow colour of the cow's milk, butter and ghee. Buffalo milk has readymade vitamin A which is colourless, hence the colour of the buffalo milk, butter and ghee is white. In all other respects cow and buffalo milk are almost similar.

Thanks to the modern devices which collect, process and supply milk to many of us, we have what is called *toned milk. Toned milk is a recombined or technologically standardised product with 3.0 per cent fat and 8.5 per cent of other solids.* The percentage of fat can be still varied to as low as 1.5 per cent or as high as 4.5 per cent while keeping the percentage of other solids at 8.5 *Toning of milk is done by adding water to the milk to bring the fat percentage to the desired level and then adding skimmed-milk powder to take the milk solids back to the desired 8.5 per cent.* The purpose of doing this is to stretch the supply of milk to cover more people. Generally milk is toned to have 4.5 per cent fat. This is the natural composition of cow's milk, and is more than adequate for our purpose. During the summer months, when the milk supply to the dairies gets reduced because there is not enough green fodder for the cattle, milk is toned to even 1.5 per cent fat in order to keep up the supply.

The skimmed milk powder added to milk in the process of toning it has to be mixed into the milk very well, by a process of homogenization. If for any reason, this process is not done well, the milk solids settle down and scorch in the process of boiling giving the milk a burnt flavour. Sometime the skimmed milk powder used for toning has vitamin B complex added to it; this gives the milk an undesirable flavour. All this, however, happens very rarely.

Food products derived from milk: The most commonly used milk products are cream, butter, ghee, curds, paneer and khoa. Cheeses that are popular in the western world cuisine are also made from milk. Some of them are now beginning to make an appearance in the Indian households as well. One can also buy condensed milk and powdered milk — both whole and skimmed (fat-free), in the market. We shall briefly talk about each of these milk products.

a) Cream: We are all familiar with the fact that when milk is left undisturbed, particularly in the cold, a layer forms at the surface which can be scooped out. This layer is formed by the fat globules from the milk clumping together and rising to the top (fat being lighter than water) as a thick layer. This is cream as all Indian housewives know it. Cream is also separated from milk with the help of a machine which can either be run mechanically or electrically. Cream, thus separated, can be thin (20 per cent fat) or thick (60 per cent fat), and is either available fresh from the dairies or in the market. You can also buy cream in cans. Canned cream can be sweet or plain, and usually has 20 per cent fat. Buying cream from the market is always more expensive than collecting your own. *When buying cream make sure it is fresh and free from a sour taste or smell.* In most cases home collected cream can be used in place of cream called for in Western or Indian recipies. All you have to do is to collect and store it in the cold and whip it up with a tiny bit of milk to get a smooth texture and then proceed as per the instructions in the recipies.

b) Butter: You can make butter at home either from the collected cream or as is traditionally done by churning curd which gives you butter and butter milk. You can, of course, buy readymade butter in the market. The butter made at home has a much higher percentage of water than what is available commercially. If made from buffaloe milk it will be white, if from cow's milk slightly yellow. The commercial butter has yellow colour and salt added to it. *When you buy butter from the market ensure that it is packed in a hygienic package. It should be firm and have a fresh flavour.*

c) Ghee: This is one milk product whieh enjoys tremendous popularity in our country. Using it has, in fact, become a status symbol. The truth of the matter is that ghee contributes next to nothing besides calories to the diet. It of course, gives a fragrance and a flavour to the food, but at an expense that is totally out of proportion with the pleasure one gets from it. Total dependence on ghee as a medium of cooking is positively harmful for health as it deprives us of the essential fatty acids required by the body and present in vegetable oils.

d) Curds (dahi): This is also a very popular and fortunately, a very beneficial milk product in our country. It contributes excellent quality proteins and a fair amount of calcium, phosphorus, vitamin A and riboflavin to the diet besides providing useful bacteria which grow and multiply within our intestines, in turn preventing the growth of harmful intestinal bacteria. This provides us a certain amount of protection from intestinal infections. A small amount of curd goes also a long way in improving the protein quality of a vegetarian diet. It is also an excellent substitute for milk for people who cannot digest milk. *Curd should be fresh, with a delicate sour flavour. It should not be very sour and pungent,* which is how it becomes if allowed to remain at room temperature long after it sets. *The best and the safest curds is what you make at home.* You can, however, buy it in the market too, generally from shops that sell Indian sweets.

f) Paneer (cottage cheese): This is a concentrated source of milk proteins. Fortunately, it has acquired universal popularity in our country. Most homes make their own paneer by separating milk with either lime or curds. The latter technique gives a softer and finer grained paneer. It is also available in the market in most big towns — generally at sweet shops or the local dairy. *When buying paneer make sure it is moist and free from fungus or any unnatural smell. It should be almost white in colour.*

g) Khoa: Khoa or mawa is made by heating milk in an open kadai (vessel) till most of the water evaporates and a doughy produce (khoa) remains. The milk is stirred throughout the process to prevent scorching. Khoa can have as little as 30 per cent water like in dry khoa which is used to make burfi and peda (Indian sweets), or as much as 45 per cent water as the one used for gulab jamuns. Khoa made from buffalo milk is softer and smoother because of the higher fat content of buffalo milk. Khoa is largely made in villages by those who own milk cattle. It is sent to the city markets in the form of large flat balls. You can now also get khoa in local dairies in most big towns. This is safer than buying from the general markets where you often find flies sitting on the product. *When buying khoa make sure it is firm and free from any unpleasant odour.*

h) Milk powders: These are made to reduce the bulk of the milk and to render it less perishable than liquid milk. Removing 85 per cent of water from whole milk gives *whole milk powder.* If fat has first been removed from the milk the resultant milk powder will be *skimmed milk powder* which has no fat and, therefore, does not become rancid as easily as whole milk powder does. Whole milk powder has 25 per cent fat and skimmed milk powder has only 1.5 per cent. These are convenient to carry when one is travelling or to keep for an emergency.

Table 12.6 gives the nutritive value of milk and milk products discussed above. Whatever be your need remember always purchase milk and milk products from a reliable source. The points to remember given below will serve as handy guidelines for the selection of milk and milk products.

Table 12.6: Proximate principles, minerals and vitamins in milk and milk products

Sl. No.	Name of food stuff	Moisture (gms)	Proteins (gms)	Fat (gms)	Minerals (gms)	Carbo-hydrates (gms)	Energy (Kcal)	Calcium (mg)	Phos-phorus (mg)	Iron (mg)	Vitamin A (I.U.)	Ribo-flavin (mg)
1.	Milk, Buffaloe's	81.0	4.3	8.8	0.8	5.0	117	210	130	0.2	160	0.10
2.	Milk, Cow's	87.5	3.2	4.1	0.8	4.4	67	120	90	0.2	174	0.10
3.	Milk, human	88.0	1.1	3.4	0.1	7.4	65	28	11	—	137	0.02
4.	Curds (Cow's milk)	89.1	3.1	4.0	0.8	3.0	60	149	93	0.2	102	0.16
5.	Butter milk	97.5	0.8	1.1	0.1	0.5	15	30	30	0.1	0	—
6.	Skimmed milk, liquid	92.1	2.5	0.1	0.7	4.6	29	120	90	0.2	—	—
7.	Channa, cow's milk	57.1	18.3	20.8	2.6	1.2	265	208	138	—	366	0.02
8.	Channa, buffaloe milk	54.1	13.4	23.0	1.6	7.9	292	480	277	—	—	—
9.	Cheese	40.3	24.1	25.1	4.2	6.3	348	790	520	2.1	273	—
10.	Khoa (whole buffaloe milk)	30.6	14.6	31.2	3.1	20.5	421	650	420	5.8	—	—
11.	Khoa (skimmed buffaloe milk)	46.1	22.3	1.6	4.3	25.7	206	990	650	2.7	—	—
12.	Khoa (whole cow milk)	25.2	20.0	25.9	4.0	24.9	413	956	613	—	497	0.41
13.	Skimmed milk powder (cow's milk)	4.1	38.0	0.1	6.8	51.0	357	1370	1000	1.4	0	1.64
14.	Whole milk powder (cow's milk)	3.5	25.8	26.7	6.0	38.0	496	950	730	0.6	1400	1.36

Source: Adapted from Nutritive Value of Indian Foods by C. Gopalan, B.V. Rama Sastri and S.C. Balasubramanian, National Institute of Nutrition, (1987).

POINTS TO REMEMBER

Selection of Milk and Milk products

1) Prefer pasteurised milk to other milk as it is safe and does not spoil [illegible]
2) While buying cream make sure [illegible] and [illegible]
3) Ensure that ghee should have [illegible]
4) Make sure that the butter is wrapped in a hygienic package and is firm and has a fresh flavour.
5) Select curd which is fresh with a delicate sour flavour. Make sure that it is not too sour and pungent.
6) Preferably set curds at home as it is hygienic and much cheaper than the curds bought from the market.
7) While buying paneer make sure it is not [illegible] smell.
8) Ensure that the paneer is almost white in colour, it should not have any discolourations.
9) Buy khoa which is firm and free from any unpleasant odour.

Check Your Progress Exercise 4

1) It is generally observed that dairies standardise milk. What is standardising?

.....

.....

2) Why do dairies tone milk?

.....

.....

3) What is pasteurisation of milk?

.....

.....

4) Fill in the blanks.

a) Dal proteins are rich in .....

b) Wheat, rice have proteins that contain adequate level of ..... and .....

c) ..... dal produces the most gas in our body.

d) ..... is the chief source of proteins for most in India.

e) When fat is removed from the milk, the resultant milk is called ..... milk.

12.3.3 Selection of Flesh Foods (meat, poultry, eggs, fish and other sea foods)

Most of us in India are by and large vegetarians in practice either because of conviction or because of financial constraints. For those who eat the so-called non-vegetarian foods, there is quite a variety to choose from. Here again the choice of flesh foods is governed by conviction and cost. Certain sections of our society do not eat beef, certain others do not eat pork, and some do not eat either. Some eat fish but no meats or poultry. Some eat eggs but no flesh of any kind. These food items are some of the most expensive food items in our country. Therefore, one needs to know how to buy and prepare them economically. The kinds and forms of meats available include:

a) Mutton: The most common meat available is goat meat. We call it mutton. Note that in the West mutton is sheep meat. The westerners find goat meat too srong in flavour, while in India with the exception of the mountain regions of the north where sheep meat is eaten, in most other parts sheep and lamb are not relished and are sold as adulterants of goat meat. *Meat from a young goat is pinkish in colour and has almost no fat unlike meat from an older goat which is dark red in colour and has deposits of fat. The former cooks faster than the latter although the latter has more flavour.*

b) **Beef:** This in our country is either from cow or buffaloe. Unlike the west, where beef is the choicest meat and, as a result, the most expensive, here it is eaten by a relatively small section of our population and is the cheapest meat available. Because of the rising cost of mutton, chicken and fish, the number of beef eaters is on the increase. *Meat from a mature cow or buffalo is called beef and that from a young animal is called veal. Beef is darker in colour than veal which is more on the pinkish side. Veal cooks easily as compared to beef and is milder in flavour.*

c) **Pork:** This is meat from pigs. Being a high-fat meat it is more popular in some of the northern parts of the country and more so in the colder parts of the year. Initially all our pork came from stray animals raised by individuals and allowed to live off the dirt and filth of the area. This made the meat a health risk. This is still true in small towns, and therefore eating pork is risky. There is a special risk of infection by Taenia solium, a tape worm that gets into the flesh of pigs living in unhygienic conditions. Things have changed a great deal with regard to pork in the last couple of decades. There are government as well as private farms where pigs are raised under the most modern and hygienic conditions, and all varieties of pork products are sold through modern outlets. However, since such farm pork products have to be transported over distances one needs to be careful about the cold storage facilities of the suppliers, as well as, the pork shops particularly during the hot summer months. One should avoid using it in the summer months.

Mutton, beef as well as pork are available as — boneless meat, with bones, or as minced meat, which again can be with bones or boneless. Meat without bones is more expensive but in terms of edible portions you also get more; however bones provide extra flavour specially to curries and when meat is cooked with vegetables. You can also buy special cuts like chops, pasanda, steak etc.

d) **Poultry:** Generally this includes chicken, ducks, geese, and turkeys as well, but in India when we say poultry we generally mean chicken. Chicken is very popular meat here, and its availability has been increasing steadily over the past 10-15 years with more and more poultry farms spreading all over the country-side, and more and more chicken and egg shops dotting the towns and cities. There was a time when chicken were raised as side business by farmers in the villages. These birds were sold live in the market. You brought them home to slaughter, clean and cook. The poultry scene has changed drastically since those days. You have large farms devoted to only chicken rearing and eggs supply. The birds are raised under special conditions which keeps meat tender. *These are called broilers.* They are slaughtered and sold as dressed chicken. Broilers have large weight and tender meat compared to birds that are grown in an average country farm. It is true that the flavour of the two kinds of chicken meat differ, the country birds having more tasty meat than the chunky broilers. It is, however, a matter of taste and a question of getting used to it.

When buying country chicken (it is still available) we need to refrain from buying larger birds because they are older and the meat is tougher. A properly raised broiler however should be tender even if it is large in size. *In fact, it is economical to buy large broilers because the wastage in terms of bones on a weight basis is less.* In general, while buying *chicken ensure that the skin of the chicken is soft and tear easily.* The breast bone should bend easily. If you twist the wing it should break at the shoulder joint.

e) **Fish:** India can boast of over a thousand species of fish in its marine and freshwater bodies and estuaries. Fish is very popular with certain groups of people because of its distinctive flavour and characteristic texture. It is an important part of people's diet throughout the vast coastline of our country, and very popular in the inland and mountain areas as well where lakes and rivers provide the favourite varieties.

Fish is an excellent source of protein. It also provides good amounts of calcium, phosphorus and iron. Sea fishes are an excellent source of iodine as well. Fish also supply Vitam n A among the B Vitamins particularly niacin. On the whole, they are nutritionally very rich and the flesh is easy to cook and digest.

The edible portion of fish varies in fat content from 20 per cent to 0.2 per cent, a fact which has led to the classification of fish as fat fish and lean fish.

Fishes are frequently divided into two classes: *fish and shell-fish.* The shell-fish are, in turn, divided into two classes: *mollusks,* which have a soft unsegmented body, in most cases protected by hard shells; and *crustaceans,* which have a segmented crust-like

shell. Oysters, mussel, clams and scallop are examples of mollusks. The crustaceans include lobsters, crabs, prawns and shrimp.

Most of the fish available in our market are whole, uncleaned and uncut. You must carefully inspect it for freshness before buying. *In fish of good quality, the colour and skin are bright and the scales adhere well to the body. The eyes are clear and unsunken and the gills are red like fresh blood. The flesh is firm and elastic and has the odour of freshness. There is a little shine on the skin and the body is stiff.* As a rule, if placed in water, the fish will sink. In stale or spoilt fish, the skin is dull, slimy and pale in colour; the scales are loose, and the eyes grey and dull; the gills are dark or pale, the flesh flabby and soft, and an impression made with the finger remains. The odour is stale or even sour, and the body limp. Usually when placed in water the fish will float. Unless you have facilities to freeze food, *fish should be bought on the day you plan to use it.* It should be immediately cleaned, washed, cut if necessary and kept with a little salt and turmeric rubbed over it, till you are ready to cook it. The best is to store it in a refrigerator.

While the loss in cleaning of fish is between 25 to 30 per cent, the loss in cleaning crustaceans, that is prawns, lobsters, crabs etc., is almost 60 per cent. This needs to be kept in mind when estimating the quantity to buy and its cost in terms of the edible portions that you will get.

With a large variety of fishes available in India, both fresh water as well as salt water ones, from tiny ones which can be eaten whole to large ones, one can find enough to suit one's pocket. While a few popular ones are on the expensive side for most of us, there are a large number of reasonably priced ones, large as well as small. From the nutritional point of view small fish are just as good as the large and more expensive kinds — in fact the ones you can consume whole, bone and all, provide you with extra calcium and phosphorus in addition to the proteins.

Dried fishes also have a large market in India. These are cheaper and provide good amounts of proteins and clacium. They do have strong odours and one has to get accustomed to it. Small amounts of dried fish cooked along with vegetables particularly leafy vegetables gives you a highly nutritive and reasonably priced dish. Be careful however, if you have neighbours with a sensitive sense of smell!

A word of caution: Fish and specially shell-fish are one of the commonest causes of food allergy which is usually shows up as skin rash. Consuming fish which has not been properly stored or carefully processed is a common cause of stomach upsets resulting in severe stomach ache and diarrhoea.

f) Eggs: Eggs are much more universally eaten in India than flesh foods. The number of people eating eggs has also gone up since the last 20-25 years. This may be due, in a large part, to improved production and handling methods as well as to a recognition of the nutritional value of eggs.

Most of the eggs available in the markets are from large commercial poultry farms. However, country eggs are also available in local market, particularly in small towns. People who are fussy about the flavour of country chicken also swear by the taste of country eggs. From the nutritional point of view all eggs are similar, be they white or brown on the outside, small or big in size.

Eggs should be purchased fresh and, if possible, kept in the refrigerator. If you do not have refrigerator facilities you should buy the eggs for only 2 or 3 days at a time during the winters, and a day at a time during the summer and the monsoon. Eggs should be washed well before storage and use. *One of the ways to tell a stale and spoilt egg from a good one is to float them in a basin of water. The good ones will settle down firmly at the bottom while the spoilt or stale ones will either float to the surface or stand on end in the water. You will also notice that a very fresh egg when broken in a plate stands up in a rounded form* A stale egg has a tendency to spread on the plate and sometimes it is not possible to separate the egg white from the yolk.

Where does one go to buy meats, fish and eggs: In most large towns, there are slaughter houses that slaughter animals under the supervision of the municipality. The municipality also maintains markets for selling meat, chicken, fish and eggs. Meats available in such markets carry the stamp of the municipal corporation as a proof of the health and authenticity of the animal slaughtered. These items are, however, also sold in wayside little shops, particularly in smaller towns; in fact, this is where most

people buy them. Here too one ought to be able to buy meat from animals that have been certified by the municipal corporation as healthy and authentic, but this is not always so; most of these meat sellers slaughter animals themselves and, therefore, there is no guarantee of the safety and authenticity of the meat sold in these shops, and in the case of chicken it is difficult to ensure that you are getting the quality you are paying for.

Some points you should keep in mind while buying flesh foods are listed in Points to Remember.

POINTS TO REMEMBER

Selection of flesh foods

1) Select meat which is pinkish in colour and has almost no fat. Avoid dark red colour meat which has deposits of fat.
2) Make sure that the meat you buy does not have a strong flavour. Any bad odour is an indication of poor quality meat.
3) Always buy pork from a government licensed shop. Buying pork from an unauthorised shop is risky.
4) While buying chicken ensure that the skin is soft and it tears easily. The breast bone should bend easily. If you twist the wing it should break at the shoulder joint.
5) Select female birds, as they are more juicy and less tough.
6) When buying country chicken refrain from buying large birds as they are older and the meat is tougher.
7) Select fresh fish which is bright in colour, has clear unsunken eyes, red gills, stiff body, firm flesh and the outer surface is not shiny.
8) Press the skin of the fish with a finger. If the impression made with the finger remains do not buy the fish as it is of poor quality.
9) Before you buy place the fish in fresh water. Pick those fishes that sink in water. Stale fishes you would notice float on water, so avoid them.
10) Buy clean eggs with unbroken shell.
11) Before buying place the egg in water. A fresh egg will sink in water. Select such eggs.

Check Your Progress Exercise 5

1) Match the items in column A with column B

Column A	Column B
1) Goat meat	a) Veal
2) Pig meat	b) Broilers
3) Cow's meat	c) Shell-fish
4) Chicken	d) Beef
5) Young cow's meat	e) Mutton
6) Prawns	f) Pork

2) List the points one has to keep in mind while buying the following:

a) **Fish:**

.....

.....

.....

b) **Egg:**

.....

.....

.....

12.3.4 Selection of Nuts

We think of nuts as something to munch while travelling in a train, waiting at bus

stops, watching a movie, at picnics, or as salted and spiced treats served at meetings, parties or special dinners. We never think of nuts in terms of making significant contribution to our dietary intake. Surely, you must have come across a not-too-slim a friend saying "I had no lunch, just some peanuts", or "all I ate were some kajus (cashewnuts) at the meeting this morning"

The nuts we are most familiar with in India are almond, cashewnut, coconut, groundnut, pistachio nut, walnut and chilgoza. Almost all of these nuts are too expensive for an average pocket — shelled pistachio at Rs. 400/- per kilogram, shelled almonds between Rs. 200/- to Rs. 300/- per kilogram, shelled cashewnut at Rs. 200/- per kilogram, walnuts in the shells selling at Rs. 60/- per kilogram, and even the humble groundnut selling at Rs. 15/- per kilogram, shelled.

Besides being used as snacks some of these nuts are also an integral part of many Indian dishes — the coconut is used extensively in Kerala, Tamil Nadu and Andhra Pradesh. It is also considered an auspicious item to be distributed to all guests at marriages and other religious functions. Alas, it is now fast being replaced by banana! Cashewnut is also used in many food preparations in the southern states and so also the groundnut. Almonds, walnuts and pistachio nuts have been popular in the north Indian cuisine, although now they remain as constituents of only exotic dishes at very special occasions.

Nuts are similar to dried beans and peas in nutritive value. They are one of the few foods of vegetable source which contain proteins of high quality, some even being adequate or complete. The protein content of nuts varies from approximately 7 per cent in dry coconut to 15 per cent in walnuts, 19 per cent in pistachio, 21 per cent in cashewnut and 26 per cent in groundnut. Most nuts are not high in their carbohydrate content but all are high in fat content, and therefore also provide a lot of energy. All the nuts we use contain on average 50 per cent of fat, with fresh coconut and groundnut containing 40 per cent, dry coconut 62 per cent and walnuts 64 per cent. This high-fat and consequently high calorie content of nuts (from 450 to 700 energy per 100 grams) in addition to their high protein content is very significant from the point of view of adequate nourishment in our country. They are concentrated source of energy as well as of good quality proteins for the undernourished. However, their high energy content makes them almost taboo food items for the overweight.

While buying nuts, it is important to see that they are not spoilt. Any change in smell or taste will mean that these are stale. The appearance of the nuts is also important. Shrivelled nuts are to be avoided.

Shelf life: Being dried seeds, nuts have a fairly good shelf life but their high fat content does give them certain drawbacks. They become rancid, particularly in warm climates. With the exception of cashewnuts, most other nuts are marketed either shelled or unshelled. Shelled nuts are subject to contamination. They also tend to become rancid more quickly than unshelled nuts. The advantage of buying shelled nuts however is that they take less space to store. If you want to store for a long time, say six months or a year, you should store them in well-sealed packets in the refrigerator or even freeze them, if the facilities are there. If you do not have access to these facilities, it is advisable to buy them as and when you need them, and make sure what you buy is not rancid.

Some factors to be considered in the selection of nuts are listed in Points to Remember.

POINTS TO REMEMBER

Selection of nuts

1) Ensure that the colour of the nuts is natural and bright. Look out for unnatural spots as they are a sign of inferior quality.
2) Nuts should be free from insects, dirt, stones, foreign matters or/and parts of the plant.
3) Nuts should have a natural flavour. Any off flavour or change in smell would mean that these are stale. Such nuts should, therefore, be avoided.
4) Avoid selecting shrivelled nuts.

12.4 LET US SUM UP

In this unit you have learnt about:

a) the different types of food items available in the two categories of foods namely energy-giving (i.e. cereals, roots and tubers, fats and oils, sugar and jaggery) and body-building (i.e. pulses, milk and milk products, fresh foods, nuts and oilseeds).

b) The relative qualities of different foods in meeting your requirements in terms of nutritive value, suitability and ease of preparation as well as cost.

12.5 GLOSSARY

Caramel	:	Burnt sugar.
Cusine	:	Style of cooking.
Dietaries	:	It refers to diet; one's natural food.
Dressed chicken	:	Chicken which has been slaughtered, defeathered and cleaned.
Estuary	:	A passage where the ocean tide meets the river currents (i.e. mouth of the river).
Gelatinization	:	The term gelatinization is used to describe the swelling and disorganization process that occurs in starch granules when they are heated in the presence of water.
Homogenisation	:	A process by which the composition of a liquid is rendered uniform throughout.
Insulin Coma	:	Insulin coma is an acute complication of diabetes caused due to low blood sugar level in the body.
Osmotic pressure	:	It is the physical force necessary on the solution side of the membrane to prevent the next movement of water across the membrane towards the solution and to maintain equilibrium.
Rancid	:	Having an unpleasant smell or taste generally due to the fat getting oxidized.

12.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) a) True

b) False; wheat contains gluten which is a unique protein.

c) False; ragi provides the same amount of calories as other cereals but it is an excellent source of calcium.

d) False; rice is parboiled to retain its nutritive value.

e) False; cereal proteins in combination with pulse protein are well utilized by the body.

2) a — 3; b — 1; c — 4; d — 2.

Check Your Progress Exercise 2

1) a) False; vegetable oils are good for health and should be used for all cooking as far as possible.

b) False; both oil and fats provide same amount of calories.

c) False; hydrogenation makes oils solid at room temperature.

d) True.

e) True.

f) False; the process of refining an oil removes the flavour and colour of the oil.

g) False; all oils can be refined, but generally mustard and coconut oils are not

refined but used as such.

h) False; all fats provide 9 Kcal/gm.

i) False; fats are a good source of energy.

j) False; potatoes are good substitute for cereals.

Check Your Progress Exercise 3

1) Brown sugar is crystallized molasses.

2) By colouring white sugar with caramel or molasses.

3) Liquid sugar is made by breaking down sucrose into glucose plus fructose with the help of an enzyme.

4) Castor sugar is finely powdered ordinary sugar with about 5 per cent starch added to it.

Check Your Progress Exercise 4

1) In standardizing milk the dairies either add cream to milk or take a bit of the cream out of the milk to get uniform quality.

2) Dairies tone milk to stretch the supply of milk so that it can reach more people.

3) Pasteurisation involves heating the milk to a certain temperature in order to destroy the microorganisms present in it, and then cooling it down fast.

4) a) lysine; b) methionine, cystine; c) Bengal gram; d) Pulses; e) skimmed.

Check Your Progress Exercise 5

1) 1 — e; 2 — f; 3 — d; 4 — b; 5 — a; 6 — c.

2) a) Fish: The colour and skin are bright; scales adhere to the body: eyes are clear and unsunken; gills are red. Fish sinks in water.

b) Egg: Fresh egg when put in water will settle down firmly at the bottom.

UNIT 13 FOOD SELECTION – II

Structure

13.1 INTRODUCTION

Fruits and vegetables play an important role in improving the acceptability of a meal because of the innumerable shades of colour, texture and flavour they contribute. Spices, condiments and other food accessories also contribute significantly by improving the flavour and appearance of meals. Many liquids or liquorous foods (beverages) such as juices, shakes, coffee, tea, soft drinks contain stimulants or flavouring agents which perform useful functions. This unit presents a detailed discussion on these foods, the choices that are available in each category and how to make the best possible choice from among the numerous items available, so as to ensure acceptable meals as well as obtain maximum value for the money spend.

With the advent of new and large variety of foods (fresh, packed, processed) in our markets — brands, grades and labels are becoming familiar. What do we mean by brand, grade and label? What is their role in food purchase and selection? This is the second aspect discussed in the unit.

Objectives

After studying this unit, you will be able to:

- identify different fruits/vegetables, food accessories and beverages available in the market and the choices available in each category
- discuss the principles on which selection of the different categories of food are based and
- describe the role of grades, brands and labels in the selection of food.

13.2 SELECTION OF PROTECTIVE/REGULATORY FOODS

Fruits and vegetables as protective/regulatory food groups make important contribution of vitamins and minerals as well as fibre in our diet. A wide range of fruits and vegetables are produced in our country. The annual production of these crops is about 53 million tonnes. The area under fruit cultivation is about 2.5 million hectares producing 19.5 million tonnes of fruits. Vegetables are cultivated in about 5 million hectares with production of 32.5 million tonnes.

With a large variety of fruits/vegetables available in our markets it is crucial that we make a wise selection in terms of nutritional adequacy, individual preferences and of course economic considerations. This section presents detail discussion on what points to consider while selecting vegetables/fruits so that they not only help to meet our nutritional needs but are also liked and enjoyed by all and are within the limits of family income.

13.2.1 Selection of Vegetables

Vegetable markets are fascinating although we wish they were cleaner than what they are in our country. A visit to a vegetable market in a place new to you tells a lot about the food habits of its people, and in our country we never failed to find items which we have never known before. There is a tremendous variety available here — innumerable kinds of leafy green vegetables and beans, all shapes and sizes of tomatoes and brinjals of different hues and colours — small green ones to white long ones to purple round ones, some weighing more than 1/2 kg each, gourds of different kinds and a host of other vegetables like ladies fingers, bitter gourd, cauliflower, peas, cabbages, carrots, turnips and radishes.

Foods included under the term vegetables are plants or those parts of plants that are used for human food, however, the problem with this definition is that fruits and seeds (used as cereals) are also parts of plants and yet most of these are not classified as vegetables, fruits, cereals and nuts since they are all parts of plants but their role in our diet are different. Vegetables are plants or parts of plants but only in few cases is the entire plant eaten. Usually, one part is more desirable; it may be the leaf as in spinach, the stem as in kamalgatta (lotus stem) the flower as in cauliflower, the fruit as in brinjal, the seed as in peas, the bulb as in onions, or the root as in carrot.

Vegetables are fairly expensive in India because they require a lot of labour by way of constant attention and frequent watering to grow. They also perish very fast in the process of being transported from the farms to the city markets.

Vegetables *are rich sources of carotene and vitamin C.* They also provide high proportions of cellulose (fibre) to the diet and help alleviate constipation.

From the point of nutritional contribution to the diet vegetables are classified into two categories: (a) the leafy vegetables; and (b) other vegetables which include all those that are neither leaves nor roots or tubers.

a) Leafy Vegetables: Nutritive value of Indian Foods, published by the National Institute of Nutrition, Hyderabad, lists 112 varieties of leafy vegetables. The ones which are almost universally used in our country are spinach, amaranth, fenugreek leaves, coriander leaves, mint, cabbage and mustard leaves. Food composition tables given in Annexure II of Practical Manual Part-I lists few commonly used leafy vegetables with their nutrient contribution.

In general, the leafy vegetables are crisp, tasty and colourful, and are usually a better source of minerals and vitamins than other parts of the plants. This is specially true of vitamin A. As sources of vitamin C, leafy vegetables compare favourably with citrus fruits, specially those vegetables that can be eaten uncooked like mint, coriander leaves, cabbage. In general, the young growing leaves are higher in vitamin C than the more mature ones. Leafy vegetables as a class are not particularly valuable as sources of thiamine and niacin, but as sources of riboflavin, they rank quite high, and are of particular value in situations where the variety of food is limited.

Leafy vegetables also make a very significant contribution in terms of minerals. *As a rule they are valuable sources of both iron and calcium.* Thin green leaves and the outer leaves of lettuce and cabbage are usually higher in calcium and iron than the white inside leaves.

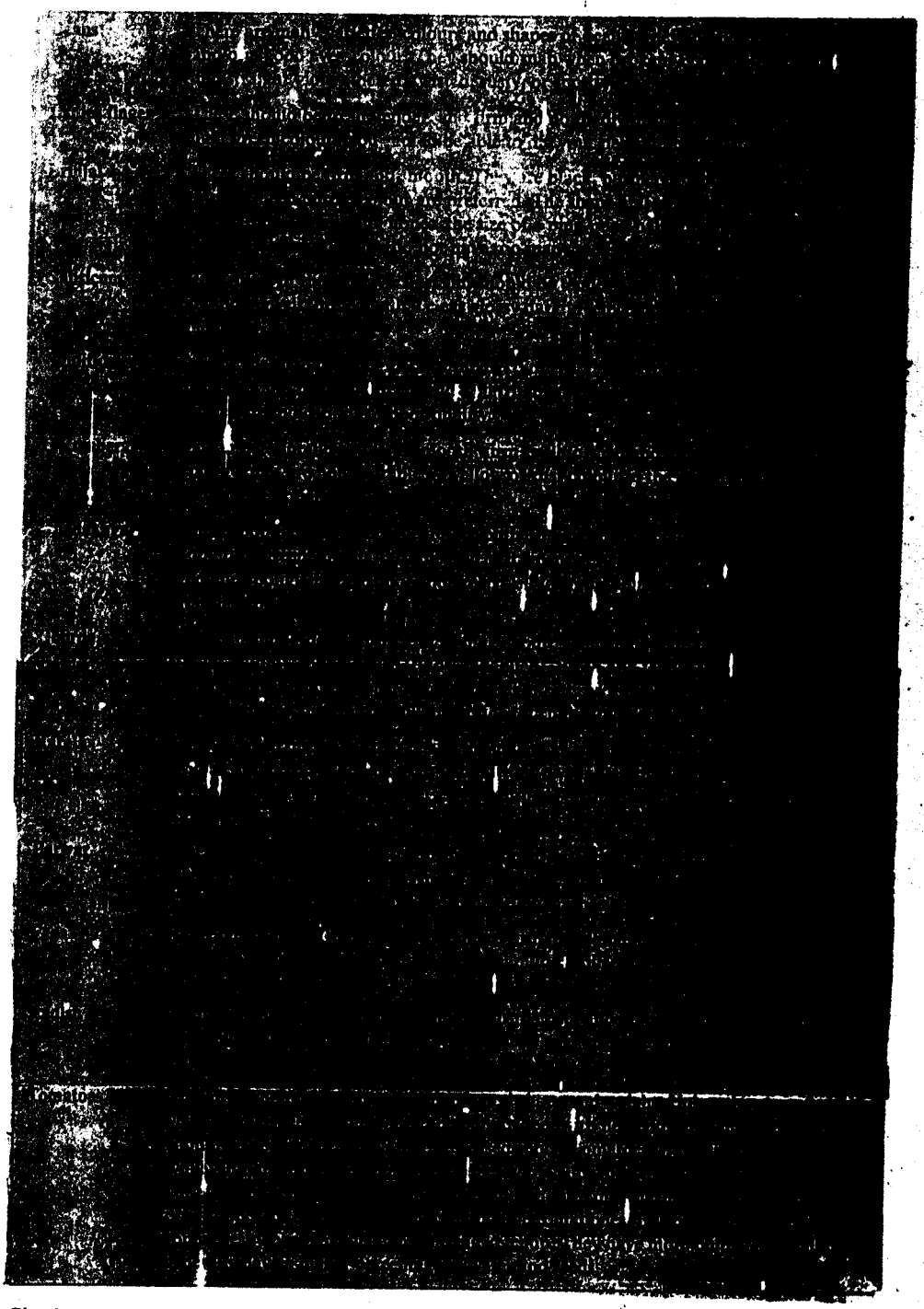
While buying leafy vegetables make sure they are tender, firm, crisp, and of a good green colour. Do not buy wilted or insect eaten ones or the ones with white insect eggs on the leaves. Look for them on the underside of the leaves.

b) Other Vegetables: There are many vegetables in India that do not classify as either leafy vegetables or roots and tubers. Tomatoes, brinjals, ladies fingers, beans of different varieties, various gourds (bottle gourd, snake gourd, ridge gourd, bitter gourd) carrots and cucumbers are some of the common ones eaten in India. They add a tremendous variety to our diet besides providing us with essential vitamins and minerals. Most of these vegetables are seasonal, but each season provides enough variety to fulfil our needs. The Nutritive Value of Indian Foods referred to earlier lists seventy three varieties under this category of vegetables.

Vegetables used in a family are largely determined by habit and taste. If a family likes certain vegetables it is probable that very few others will be used, despite the

monotony of having the same food served four, five or even six times a week. This fixity of habit in some homes prevents the introduction into the diet of new, palatable and nourishing vegetable items. A wide use of seasonal vegetables in the daily diet is a good food practice. But what are the points one should keep in mind while selecting the fresh vegetables. Some hints on better selection of individual vegetable items are given in Table 13.1.

Table 13.1: Selection of Vegetables



Check Your Progress Exercise 1

1) Green leafy vegetables make a very significant contribution in terms of which four protective nutrients.

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2) What points would you keep in mind while selecting the following vegetables.

a) Ladies finger:

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b) Tomatoes:

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Waste in vegetables: The waste in fresh vegetables is not generally realized and is not frequently considered in estimating the quantities to be purchased. The quality, size, shape and condition of vegetables determine the amount of waste. Frequently poor quality means a high percentage of waste, for example *poor* quality ladies fingers which have been sitting on the shelf for 2 to 3 days, are likely to have a higher number of hard and fibrous ones which cannot be eaten and, therefore, must be discarded; limp and thin skinned capsicum is likely to get spoiled faster even in the refrigerator than the dark green, fleshy and firm ones.

Size, as mentioned above, also makes a difference — in small onions, carrots or ladies fingers, the wastage in terms of tops and ends, or in terms of the peels is much more than in the case of larger sizes. Table 13.2 gives the percentage of waste in a number of vegetables we use.

Table 13.2: Wastage in some common vegetables

Vegetable	Wastage expressed as gm per 100 gm	Vegetable	Wastage expressed as gm per 100 gm
Amaranth	60	Fenugreek leaves	40
Cabbage	12	Lettuce	34
Coriander leaves	30	Mint	55
Spinach	13	Cucumber	17
Beet root	15	French beans	6
Carrot	5	Capsicum	3
Onion (big)	5	Karonda	2
Turnip	35	Knol-khol	26
Bottle gourd	14	Snake gourd	2
Brinjal	9	Tinda	1
Cauliflower	30	Tomatoes	2

Source: *Nutritive Value of Indian Foods*: Gopalan, Rama Sastri and Balasubramanian, National Institute of Nutrition, Hyderabad.

13.2.2 Selection of fruits

The National Institute of Nutrition book on "Nutritive Value of Indian Foods", lists 103 varieties of fruits that are available in our country. Ours is, perhaps, the only country where cherries and mangoes are available at the same time of the year. We have a large variety of apples, oranges, bananas, melons and berries, and they are cheap where they grow. Our main problem is storage and transport as a result of which fruits cannot reach areas where they do not grow without a very high percentage of damage and deterioration. Whatever little does, appear in the markets is out of reach of an average pocket. Fortunately, some fruits are available almost universally and are generally within the reach of the average man, for example, bananas and guavas. In addition, different parts of the country have their special seasonal fruits which are plenty during the season — oranges in Nagpur during late winter, cherries in Kashmir and apricots in Ladakh during summer, custard apple in Hyderabad during October-November and the lichies in Dehradun during June.

Let us now look at the points one should keep in mind while purchasing some of the commonly available fruits.

Bananas: Some variety or the other of bananas is available everywhere all through the year. A banana should be just ripe and yellow in colour. *It should not be over-ripe with too many dark spots or a dark brown skin, or under ripe with greenish skin and hard and pronounced ridges.* Before a banana ripens the carbohydrate in it, is present in the form of starch. As it ripens it changes into sugar making the banana sweet. It is not

advisable to buy bananas to last you for more than a couple of days. You should also not buy it early in your shopping trip and then keep it in the bag for three to four hours before reaching home. A ripe banana deteriorates very fast.

Oranges: Most of our oranges come from Nagpur (Madhya Pradesh) and its surrounding areas. Some are grown in Nellore (Andhra Pradesh) as well. The latest in the northern markets is kinno, grown in Punjab. It looks more like a large sweet lime (mausambi) has a light yellow and rather thick skin. A good quality kinno can be very juicy. Oranges are available in quite a large variety — loose jacket ones, tight skin ones, large ones and little ones. Fully ripe oranges, no matter what the variety is, have a pleasant odour. *They should be firm and heavy with no soft or moulded spots.* The loose jacket Nagpur oranges are good for peeling but if you want to squeeze out the juice with an orange squeezer it is better to buy the tight skinned ones. *The thinner the skin of the tight skinned orange the better the quality.*

Lime: This is the usual small size neebu available everywhere. They are cheaper in winters but expensive during hot season. *Look for yellow lines with a thin and shiny skin.* They are more juicy than the ones with a thick skin. Quite often the larger looking ones have a thick skin and are less juicy. The thin skin ones are also called kagazi neebu in the north.

Custard apple: This is called shareefa. It does not ripen completely on the tree because if allowed to do so it falls off much before ripening. Besides the birds, the squirrels get it before we can. When you are buying custard apple either buy ready to eat ripe ones. *These must be firm but pliable to the touch with yellowish green skin with the crevices between the eyes white in colour. There should be no brown discolouration on the outside and the skin must not be brittle and hard.* You cannot keep these for more than 24 hours as they deteriorate very fast. If you want to keep them for a few days before using buy hard fruits light green in colour with the crevices between the eyes just beginning to turn white. Do not buy the green ones with the eyes tightly closed. These have been plucked too early and will not ripen satisfactorily.

Pineapples: The most desirable pineapples are heavy in relation to their size. They are a dark orange yellow in colour, with a fragrant odour. The eyes are flat or almost hollow. When the pineapple is ripe, the leaves are flat and almost hollow. When the pineapple is ripe, the leaves can be pulled out of the top easily. *Plump, square fruits are better to buy than those that are long and tapering. There should be no mold at the base. Pineapples picked too green are not good to buy.*

Papaya: A common fruit in our country, it is a rich source of carotenes. Unripe papaya is a rich source of the enzyme papain which digests proteins. It is used to soften meat or dals in cooking. *A ready to eat papaya should be firm and turning yellow in colour.*

Some hints on better selection of fruits and vegetables are listed in Points to Remember.

POINTS TO REMEMBER

Selection of fruits and vegetables

1) Select fresh fruits and vegetables, which are firm, crisp, bright in colour, with no visible bruises or signs of decay and wilting.
2) Buy seasonal fruits and vegetables, as the quality is high and the price low.
3) Select clean leafy vegetables, which are tender, crisp and brightly coloured.
4) Ensure that the leafy vegetables you buy are free from flowers, insects, mud and spots or holes in the leaves.
5) While buying head vegetables such as cauliflower, cabbage look out for hard, heavy and compact heads; free from bruises and worm injuries.
6) Prefer small or medium sized vegetables which are likely to be more tender and less fibrous in texture than large and very mature ones.
7) While buying citrus fruits such as oranges, lemons — select firm and ripe ones which are thin skinned and heavy in relation to size.
8) Buy according to your need. For example for salads select large and fleshy tomatoes, whereas small and medium sized ones can be used in mixed vegetables.

[redacted]

Check Your Progress Exercise 2

1) State whether the following statements are true or false. Correct the false statements.

a) The carbohydrate present in a ripe banana is in the form of starch. (True/False)

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b) Full ripe oranges should be light, soft with no moulded spots. (True/False)

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c) While buying lime one should look for a yellow lime with thin and shiny skin. (True/False)

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d) One should buy custard apples which are light green in colour with the crevices between the eyes just beginning to turn brown. (True/False)

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e) Ripe papaya is a rich source of an enzyme, which digests protein. (True/False)

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13.3 SELECTION OF FOOD ACCESSORIES

Food accessories include those edible materials that are primarily used to improve the flavour and appearance of our food. All spices and herbs, salt, vinegar, tamarind, lime, flavouring extracts like kewra, vanila, orange essence, strawberry essence, and all colouring matter come in this class of food items. *They are also referred to as food adjuncts.* We shall discuss some of these to understand them better.

a) Spices: You will generally find these under a double-barrel title "spices and condiments". We do not quite know how this got started, but ever since it did, different people have tried to give different meanings to the term "spices" and "condiments". According to the International Organisation Standardization (IOS), there is no clear-cut division between spices and condiments and the term *"spices and condiments" applies to such natural plant or vegetable products or mixtures thereof, in whole or ground form, as are used for imparting flavour, aroma, and piquancy to and for seasoning of foods.*

Since ancient times spices have been a highly priced commodity and exported from their home in the East to Middle Eastern and European countries. Spices were the motivating force behind many expeditions to the orient in the past, the cause of many battles fought, and the reason for many a country being discovered. History tells us that it was as much the lure of spices as of wealth that brought many western adventures to our shores. Vasco-da-gama was one of them who returned to Portugal with two ships laden with spices and was able to pay for the cost of his voyage sixty times over.

Out of the seventy odd different spices grown around the world at least fifty are grown in India, which has been known as the land of spices. It is curious that spices are consumed more in hot sultry tropical climates than in colder regions. This may be

partly explained by the fact that the food is frequently seasonal and monotonous in the East due to the low buying power of the people and also due to inadequate transport facilities.

The main reason why spices were considered so valuable during the times of Vasco-da-gama was their preservative action — they were valuable in stretching Europe's inadequate supply of food. Remember, this was long-long before any of the modern methods of preserving food like canning or refrigeration were known. Meat could be preserved for as long as a year by pickling it with cloves, wood smoke, mineral salts and so on. Even today drying by wood smoke is used in the mountain regions of North India to preserve game meat for later use. Cloves contain a chemical called "eugenol" that inhibits the growth of bacteria. Mustard was also found to have preservative qualities. When spices were not available people went hungry because they could not preserve food to carry them over the winter. Today when spices cost so little it seems unbelievable that they were once a royal luxury. During the middle age in the West a pound of ginger was worth a sheep, a pound of mace worth three sheep or half a cow. Pepper was counted out in individual pepper-corns, and a sack of pepper was said to be worth a man's life.

In India, where pickling vegetables, fruits and meat products with spices has almost been perfected to an art, spices are more and more widely used for their ability to change or add flavour to everyday dishes. *Spices impart distinctive flavours to the food because they contain volatile materials known as essential oils which give them their characteristics flavour and odour which appeal to the sense of smell and taste and make the food more palatable.*

Most spices can be stored very well in a dry place. Many of them, however, do loose their aroma on long storage particularly if they are in the powdered form. It is best to buy spices whole, store them as such in tightly closed containers and powder them if necessary as and when you need them. The flavour and aroma thus remains fresh and strong. Spices do not make any significant contribution to nutrition since they are used in very small quantities.

The list of spices used in India is very long. However, some of the common ones are: asafoetida, ajwain (omum), cloves, nutmeg, mace, mustard, cinnamon, cardamom, pepper, red chillies, coriander, turmeric, ginger, cumin seeds, fenugreek seeds, fennel seeds, saffron, tamarind, mango-powder and garlic. See Appendix I "Spices and their use in foods" given at the end of this block for information about spices commonly used in India.

b) **Herbs:** Herbs are those plants whose leaves, stems and seeds have culinary or medicinal value. Herbs are the soul of flavour. Mint leaves, coriander leaves, curry leaves and soya leaves are herbs most commonly used in Indian cooking.

The best place to get herbs from is your own garden. All of the herbs used in Indian cooking plus most of those used in other styles of cooking (continental, chinese etc.) can be easily grown from seed and do not need much space or effort to cultivate. They can be grown in pots and window boxes.

Like green leafy vegetables *mint and coriander are also very rich in carotenes, calcium and vitamin C.* Unlike other herbs these two herbs are used in fairly substantial quantities by way of freshly made chutneys. Their contribution of carotene, calcium and vitamin C to our diet can be quite substantial particularly, if the chutneys are made with green chillies and fresh lime which also contain good amounts of vitamin C.

c) **Salt:** Salt is an indispensable food accessory. Even wild animals travel miles to find a 'salt-lick' to satisfy their craving for it. Gandhi's Salt March was not chosen as a symbolic gesture of protest for nothing. Man's insistent desire for flavour of salt has led governments to establish monopolies on its sale as a means of obtaining a constant and sizable income. This is what the British were trying to do in India when Gandhi led the Salt March. In fact the everyday common salt we use without even a second thought as to how much it costs us, has a fascinating history. Four thousand years ago the Chinese wrote about the preparation of salt from sea water. Roman soldiers were paid their wages in salt. The word salary is derived from the latin word 'salarium' which meant salt money. The 13th century traveller Marcopolo noted that in Tibet salt carrying the stamp of Kublai Khan was used as money. This is how

precious a commodity salt was, and in terms of its place in our food, it still is. The compliment given to man by God according to the Bible "you are the salt of the earth" speaks volumes for salt.

We obtain salt from many sources — solid deposits of rock salt at Mandi in Himachal Pradesh, from salt lakes such as the Sambhar lake in Rajasthan and the Chilika lake in Orissa, from underground salt springs as in the Rann of Kutch, in Manekudi lake in Kerala and the Vedaranyam swamp in Tamil Nadu, and mainly from sea water all around our 560 kilometer coastline, with Saurashtra supplying a major portion. Table 13.3 gives the varieties of common salt produced in India.

Table 13.3: Varieties of common salt produced in India

1)	Kyar salt	Produced at Sambhar lake
2)	Reshta Salt	Contain sodium sulphate and sodium carbonate as impurities
3)	Pan salt	
4)	Baragara salt	Produced from sub-soil brine at Rann of Kutch. Has a very hard crystal.
5)	Kuppa salt	Produced from sea brine, calcium and magnesium as impurities
6)	Kurkutch salt	
7)	Tuticorin salt	
8)	Crushed salt	
9)	Powdered salt	
10)	Double crushed salt	

Source: P. Subramanian; National Goitre Control Programme — Current Status, N.F.I. Bulletin, Volume 9, Number 3.

When buying salt in the market, try and select a clean and white product. Make sure it is not damp, particularly in the rainy season. Bring it home in a tightly closed packet preferably a polythene bag. Store it immediately in a container which can be closed tightly to prevent absorption of moisture from the environment. For table purposes, keeping salt in salt sellers during the rainy season is very impractical as the tiny holes which permit sprinkling of salt on food also allow the moisture to go in and dampen the salt. It is better to keep salt in air-tight container. Drying the dampened salt in the sun, or in a pan on fire, or inside a slow oven helps get rid of the moisture. Some varieties of 'free flowing' salts are also available in the market which ostensibly do not absorb atmospheric moisture but we have not found a satisfactory one so far.

d) Vinegar: Though not as widely used in Indian cooking as in the Western cooking, it is made in India and is used mainly for pickling. The word "vinegar" comes from two French words, *vin* and *aigre*, meaning *'sour wine'*. Vinegar is essentially a solution of 4 to 5 parts of acetic acid in a hundred parts of water. Synthetic vinegar is just this plus a little burnt sugar (caramel) to give it the colour, and barley malt to give it flavour. This is what we buy in the market if the bottle says synthetic vinegar. The real vinegar is made by fermenting sugar into alcohol and further fermenting alcohol into acetic acid. In India a large variety of sugar materials are fermented to get alcohol and later vinegar. Malt vinegar is made from germinated barley. Wastes from canning of fruits like pineapple, orange and grape, tapioca, coconut, sugarcane juice, molasses, jaggery and palm toddy are all used to make vinegar. In the West almost all the vinegar is from apple juice, and is called cider vinegar. Unfortunately, today in India only 1/4th of the vinegar we make is fermented product called malt vinegar; the rest is synthetic — an acidic material without any delicate flavours.

e) Tamarind: This is the ripe fruit of the tamarind tree which is used as a source of sourness in cooking in the southern parts of our country just like dry mango powder and dried pomegranate seeds of the sour variety are used in the northern parts. It grows all over the country but is specially cultivated in Madhya Pradesh, Andhra Pradesh, Tamil Nadu and Karnataka States.

The ripe tamarind fruit, on an average consists of about 55 per cent pulp, 33 per cent seed and 12 per cent fibre. You can buy de-seeded tamarind as well as tamarind which has been shelled but has the seed in it. The former is more expensive than the latter and understandably so. Both have almost similar amounts of fibre in them. The de-seeded variety keeps longer in storage because the one with the seeds tends to develop insect growth. Freshly harvested tamarind is light brown in colour and is available towards the early part of the summer season in India. It is the cheapest at that time and can be bought and stored for the year. As time goes by the stored tamarind will

develop a dark brown colour. Mixing some crystalline salt into it preserves it better in storage.

You can also buy bottled tamarind juice concentrate in the market. This has no fibre seed or other foreign matter, and is very hygienic besides being convenient to use as well as to store.

f) Flavouring extracts: These are either alcoholic solutions of true extract or essences of their chemical duplicates. Lemon, orange, vanilla-beans and kewra are the only few natural products from which it is practical to obtain a concentrated extract. All other extracts available are only synthetic preparations.

g) Colouring material: Nature abounds in colour — the blue skies, the golden fishes, the black stallion, the white cranes, the pink rose, the red tomatoes, the green peas, the orange carrot and the purple brinjals — just a few examples of colour in nature to stimulate you into thinking of the many many others that are there in every form of life. Natural foods alone have a large variety of colours which make them look beautiful, thereby, tempting you to eat them.

Colours which are naturally present in foods are acceptable to the human body; wherever it was not the item itself was found not to be edible. As long as we stick to natural and fresh foods, we do not have to give colour a second thought, except to appreciate it and to make sure that it does not get ruined in the process of food preparation and cooking. Till a few decades ago, this was all that was required, but the advent of the processed and preserved food industry made it imperative for us to look for colours other than those found naturally in foods. This led to the development and use of synthetic colours which could be used in the food industry. *They are commonly known as coal-tar colours or coal tar dyes;* a rather unappetizing name given to this set of colours because they are derived from substances such as benzene occurring in coal-tar. A great many of these synthetic colours are now in the world market for use in the food industry. A list of synthetic food colours permitted in India with their acceptable Daily Intake (ADI) is given in Table 13.4.

Table 13.4: Synthetic food colours permitted in India and the accepted daily intake

Colour		Name	Accepted daily intake (ADI) (mg/kg body weight)
A. Red	1.	Amaranth	0.75
	2.	Carmoisine	1.25
	3.	Erythrosine	1.25
	4.	Ponceau 4R	0.125
B. Yellow	5.	Sunset Yellow	2.5
	6.	Tartrazine	7.5
C. Green	7.	Green S.	5.0
	8.	Fast green	12.5
D. Blue	9.	Brilliant blue	2.5
	10.	Indigo Carmine	5.0

Source: Nutritional News: Vol. 9, No. 6, Nov. 1988, Dr. S. Babu and Dr. Shinolikar, National Institute of Nutrition, Hyderabad.

Most of the synthetic colours permitted for use have been tested for their toxicity. The toxic effects are observed at very high levels in the diet, levels that are never achieved in actual consumptions. In fact, the health hazards posed by synthetic colours are nothing compared to many other items that we use which are injurious to health, for example supari and tobacco which are well established causes of cancer in animals as well as humans. Nevertheless, it is true that most of these colouring substances are known to be carcinogens, and in permitting the use of these colours we take the relative risk into account.

Because of the vasteness of our country, the illiteracy among large sections of our population and our inability to convey information to the vast number of people spread out in our rural areas, we in India have a serious problem with synthetic colours in our food industry, most of which is in the hands of individuals like the cold-drink vendors, the icecream seller and the sweet shop owner who operate in small towns and villages from the backyards. A study carried out in Uttar Pradesh on 12,575 coloured food samples (mild-products, non-milk products, pulses, sugar products, soft-drinks, tea, spices and condiments) revealed the use of non-permitted

colours in 70 per cent of the samples. This is much more so in rural areas than in the cities. There was a time when textile colours were unscrupulously being used in foods. Fortunately this has been greatly reduced, perhaps due to the awareness of the toxic effects of non-permitted colours both among the manufacturers and consumers, as well as to the easy availability of permitted colours under the Bureau of Indian Standards (ISI) certification. The Bureau of Indian Standards (ISI) certification is an Act which has laid down standards of quality of processed food items supported by precise methods of testing these standards.

The natural colours which have been used for generations to give colour to our foods are turmeric, chlorophyl of the green leaves, and saffron. Caramel, obtained by heating sugar and cochineal derived from a small insect are sources of dark brown, golden and red colours. The use of colouring material to make food more attractive is understandable but its use to make inferior quality of a product is not right. Colouring dried peas a bright green, or a bright yellow are examples of this undesirable practice.

A few hints for the wise selection of food accessories from the market are listed in Points to Remember.

POINTS TO REMEMBER

Selection of Food Acc

1) **While buying spices make sure**
2) **Ensure that the spices are fre**
3) **Prefer natural colouring matter**
   permitted by the ISI.
4) **Buy whole spices. Get them grou**
   you from buying adulterated spic

Check Your Progress Exercise 3

1) Mention two functions of spices in food.

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2) Name four herbs most commonly used in India.

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3) What are the four sources of salt in our country?

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4) Indicate if the following statements are true or false. Correct the false statements

   a) Powdered spices loose their aroma faster than whole spices. (True/False)

   .....

   b) All vinegar in the market is made from sugar cane juice. (True/False)

   .....

   c) Ripe tamarind lasts longer if you remove the seeds. (True/False)

   .....

   d) Most food flavours in use today are synthetic. (True/False)

   .....

13.4 SELECTION OF BEVERAGES

Beverages are liquids for drinking. They subjectively refresh a person and also help to

supplement his fluid requirements. The beverages most commonly used in India are tea, coffee, fruit juices, cordials, squashes and aerated waters. Tea and coffee are generally taken hot and are classifed as *hot beverages* while the others mentioned above are classified as *cold beverages* or *cold drinks*. Let us learn about these beverages.

a) **Tea:** The original home of tea is China. The words tea or chah have originated from China. It were the British who brought tea into India in 1834. They first tried to grow the Chinese tea plant in Assam but soon discovered a local tea plant which had been traditionally cultivated by a hill tribe in Assam. It is this tea plant that put India on the world tea map within two years. Today numerous crosses between Assam and Chinese tea plants have been evolved that yield various qualities of tea. We are today the largest tea-growing country in the world.

The quality of tea varies from year to year, and season to season, even from the same tree from the same estate. Experienced and highly paid tasters rate each batch of tea for various characteristics. To ensure uniformity of qualities on the market all teas available are blends of different lots of processed tea leaves.

The two important characteristics of tea are flavour and body; body involves the strength and colour of the brew (decoction). These two characteristics generally do not exist together in tea leaves. In general tea plants grown at higher altitudes, near Darjeeling or Nilgiri hills yield tea of the most delicate flavour; these however make weak tea that does not have body. On the other hand, *the granular tea dust gives a strong tea with body but no flavour.*

The two important constituents of tea that we must be concerned about are *'tannins'* and *'caffein'*. Both of these dissolve out into the tea decoction. *Tannins are responsible for the astringent feeling in the mouth when you sip strong Indian tea without milk, or the Chinese green tea.* When fresh green tea leaves are fermented to make black tea as is the process, the tannins are rendered less soluble. The chinese green tea is not fermented, hence the astringent taste. Soaking black tea (the tea we use) for long gets more tannins into the decoction. Caffein provides tea its stimulant value. Long brewing also gets more caffein into the decoction. *Caffein is also responsible for the bitter taste of strong black tea. The aroma of tea is due to volatile aromatic constituents that are partly present in the leaf and partly arise during fermentation.*

Size, shape and flavour determine tea grades: While plucking leaves off the tea plant, two leaves and a bud are pinched off. The rarest and the most expensive type of tea has a high proportion of these buds. Numerous other grades of tea are available in the market. *The first are the whole leaf grades, consisting* essentially of leaves and some stalks and no buds, giving a fragrant thin tea. Orange pekoe is the best of this grade in our market. *The broken leaf grades are the next in quality.* Of these the Broken Orange Pekoe or BOP is the most popular brand, consisting half of all the tea sold today. The third in line are the *small sized grades derived from the finer leaf variety. Tea dust is the last and cheapest of the grades.* It is granular in shape and gives a strong tea with full body or mouth feel.

If you like *tea mainly for its fragrance and flavour* then you must buy the whole leaf varieties and do not allow them to soak too long. The tea you get will be thin but fragrant. It would be better to drink it without milk. On the other hand those who *like a strong cup of tea with milk and sugar* should buy the granular type which gives a strong decoction but does not have much flavour. *What some of us who like a combination of both flavour and body, do is to buy both, the leaf and the granular tea and mix them up in proportions to suit our taste.* This is blending, and can be suited to one's own requirements by trial and error methods. Tea should be stored in air-tight containers to prevent loss of flavour and aroma.

b) **Coffee:** Coffee is the berry of a plant now grown in India as well as in Kenya, Ceylon, Brazil, West Indies and some other places. In India it is a major crop in the south. Coffee seems to have first made an appearance in Ethopia some four centuries ago. From there it first travelled to the rest of Arabia and on to Turkey, and then into Europe and England where it became very popular in the 18th century. *The word coffee seems to have been derived from the Arab word kahwah, which originally referred to wine, and only later to the coffee decoction.* The first coffee plants in India were grown in the Karnataka hills, but by 1830 they were being grown all over the hilly areas of the south at heights between 600 and 1500 meters.

We grow two kinds of coffee in the south — *arabica and robusta.* Each has its own flavour and aroma, which are brought out when the beans are roasted and then ground. Roasting of coffee bean is necessary before it can be sold in the retail market. *The process brings out the full flavour of the coffee.*

From the stand point of beverage making the important components of coffee are caramelized carbohydrates, carbon dioxide, tannin, caffein, oils and fatty substances and caffeol. The *caramelized carbohydrates* are largely responsible for the brown colour and the flavour of the drink. The *carbon dioxide* held in the roasted bean is so closely related to caffeol that the loss of carbon dioxide is accompanied by loss of flavour. The *tannin* is soluble in boiling water much more than in water just below the boiling point and may produce a bitter flavour if coffee is boiled. *Caffein* is exceedingly soluble in water and provides the stimulating property of coffee. You can buy coffee in the Western market from which caffein has been removed called decaffinated coffee. *Caffeol* is perhaps largely responsible for the aroma and flavour of coffee. It is closely associated with the oils and fatty substances of the coffee bean and has frequently been confused with them. It is soluble in water and quite volatile.

Coffee, after grinding, undergoes a loss of flavour and develops staleness if exposed to the air. This is why most of the powdered coffee in the market is sealed and packed in air-tight containers with the air exhausted. Roasted coffee seeds if kept in closed containers retain their flavour longer than powdered coffee. Unroasted coffee beans store even better as long as they are kept dry and do not absorb moisture. A lot of people buy unroasted coffee and roast it at home before grinding for use. *Most of the coffee today however is roasted commercially and ground to varying degrees of fineness.*

Chicory in coffee: Chicory is the root of a plant that is grown in Coimbatore, the Nilgiris, parts of Kerala and Jamnagar. It resembles beet root. The green roots are sliced, crushed, dried and stored without the risk of spoilage. They are roasted and ground before mixing with coffee powder. Mixing chicory with coffee, to the extent of 50 per cent, is very popular. It lends a slight bitterness, colour and body to the decoction.

Instant Coffee: This is the most popular form of coffee used in homes today. It is easy to make and takes very much less time and effort. Modern techniques have ensured that instant coffee powders not only dissolve readily but also retain all the qualities of the regular coffee. A tremendous variety is available today in the markets — 100 per cent coffee or coffee with chicory.

'Points to Remember' given below present handy tips on how to select tea/coffee from the market.

POINTS TO REMEMBER

Selection of tea/coffee

1) Select according to your preference — try whole leaf variety if you want a light cup of tea full of fragrance and flavour. On the other hand, for a strong cup of tea select granular tea.
2) Always buy tea/coffee which is sealed and packed in air-tight container. Avoid buying loose from the market.
3) Preferably buy unroasted coffee beans and roast it yourself before grinding for use.

c) Cold Drinks: Besides fruit juices and squashes the cold beverages most popular in our country are *the milk-based drinks* and the *aerated soft drinks.*

i) *Milk-based cold drinks* are always made fresh and are very good for children and those convalescing from illness. Bananas, mangoes and sapota (chiku), besides coffee and cocoa are the most favourite accompaniments of milk in making such milk-based drinks called milk-shakes.

ii) *Aerated soft drinks* are flavoured water into which carbondioxide is added under pressure to give an effervescent liquid. This trick was discovered nearly two centuries ago. *The unflavoured carbonated water is called soda.* The first commercially prepared flavoured aerated soft drink arrived in 1809, and many varieties are available today, extremely popular throughout the length and breadth of our country with young and not so young alike. It is, therefore,

important to know what are some of the things that go into the making of the soft drinks.

Besides *carbondioxide* the aerated or carbonated soft drinks contain *saccharin* as a sweetner along with sugar. Every soft drink bottle with a volume of 180 ml has 9 gm of sugar and 18 gm of saccharin. They also contain *acidic material*, citric acid being the choice for the lemon, lime, orange, pineapple, and apple-flavoured drinks, and tartaric acid for grape-like drinks. All the cola drinks use phosphoric acid which makes them very acidic indeed. Flavouring agents specially citrus oils, with their flavours of lemon, lime and orange (natural or synthetic) are blended with *brominated vegetable oils* (BVo) to make the specific gravity of these drinks come close to that of water. What is BVo? Chemically BVo is vegetable oil (olive, sesame, corn or cottonseed) whose density has been increased to that of water by being combined with bromine. Flavouring oils are dissolved in BVo which is then added to carbonated or noncarbonated fruit-flavour drinks. The lighter-than water oils are dispersed throughout the drink by BVo, without which they would float to the surface and form a ring at the neck of the bottle. BVo also makes the soft drink slightly cloudy, giving the illusion of thickness or 'body'.

Now we come to the question whether these drinks should be selected for consumption by the family or not. From the nutritional point of view, aerated soft drinks have no nutritional value to recommend themselves except a few calories from the sugar present in them. On the other hand, we have substantial reasons to worry about them. The high degree of acidity, especially where phosphoric acid is used, as in the cola-type drinks, is not desirable since gastric acidity even otherwise is a common problem in India. The synthetic sweetner saccharin is also under suspicion as a co-carcinogen. However, its use over the last 50 years or so by millions of diabetics does give the impression that it may well be safe. Brominated vegetable oils have been banned in some countries after it was shown that bromine accumulated in the body fats of humans. They have recently been banned in our country too. With all these factors to worry about, and no food value at all except sugar which can kill a child's apetite if taken before a meal, these drinks do not seem very commendable.

Check Your Progress Exercise 4

1) Match items in column A with items in column B:

Column A	Column B
1) Cola-type drinks	a) Delicate flavour
2) Beverage	b) Arabica
3) Darjeeling tea	c) Gastric acidity
4) Coffee	d) Root of a plant
5) Chicory	e) Tea
6) Brominated vegetable oils	f) Specific gravity of carbonated drinks

2) Fill in the blanks.

a) The two important constituents of tea are ..... and .....

b) For making a strong cup of tea, one would use the ..... type of tea leaves.

c) ..... is responsible for the aroma and flavour of coffee, whereas ..... provides the stimulating property of coffee.

d) ..... are flavoured water into which carbondioxide is added under pressure.

13.5 THE ROLE OF GRADES, BRANDS AND LABELS IN FOOD PURCHASING

As of now we in India are relatively free from the burden of having to choose between grades, brands and labels. Ours has been and still is a producers market and not a consumers market as in the West. The difference between the two is tremendous and reflects in the standards and quality of food available. In a consumers market the consumer decides what she or he likes to buy. The producers have to woo the customer into choosing their product, which makes for competition in improving

quality. In a producers market, which is a result of basically there being more people who want to buy than the quantity being produced, the consumer buys what is available. We in India do not have much to choose from as regards most of the foods we consume. Even in those few cases where we do have a choice the price of the food plays the major decision-making role.

With the gradual and progressive entry of processed and packaged foods into our life styles, grades, brands and labels are becoming familiar — AGMARK ghee, AGMARK mustard oil, Brand X cheese, Brand Z ketchup, and so on. AGMARK denotes a grade (a quality) while X, Z are brands. What is written on the outside of the package or the tin is the label. Let us get to know more about grades, brands and label.

Grades: *A grade is a classification of grouping of units of a product having the same qualities and value.* The qualities by which a grade is determined may not be the same for every product. By means of grades, *many products have come to be classified and standardized according to size, maturity, colour and other constituents that determine quality.*

In our country the availability of food items in relation to the demand for them has always been very much less. Consequently most of us are grateful to get what we can, and the question of quality, if it ever crosses our minds, is reluctantly but definitely pushed aside. Even in this day and age when information and awareness regarding health, nutrition, food quality, adulteration, pollution and infection is increasing by leaps and bounds, a majority of us are not in a position to worry about them. The situation, however, is improving slowly but surely. Armed with adequate knowledge and information we can help improve it faster.

It was way back in 1935-36 that those in authority realised, as a result of marketing surveys, that selling of impure and adulterated food items was a common practice throughout India. The first food items that received attention in this respect was 'pure ghee' and it was found that adulteration of 'pure ghee' with vegetable products made from groundnut and other oils was at times as high as 80 per cent. Attention to food quality was thus first drawn by way of the need to prevent adulteration. The Bombay Act-11 of 1899 was the first one in India designed to prevent adulteration in foods. We shall go into it in a little more detail when discussing consumer protection laws later in Unit 16. It is sufficient to emphasize at this point that this provided a prima facie case for grading of agricultural produce in order to evolve a common basis for standard quality in the interest of both, the producers as well as consumers. The Agricultural Produce (Grading and Marking) Act of 1937, enabled the government to lay down grade specifications of quality, grade designations, and also methods of marking to indicate various grades. It was however left to the choice of the producer to have his produce graded and packed in accordance with the provisions of the Act and Rules and use AGMARK as a mark of grade/standard alongwith his own trade mark, for example AGMARK vanaspati ghee or AGMARK honey.

In India, AGMARK and the stamp of the Indian Standards Institution (ISI) specifies quality and a certificate by them is a certification of an acceptable specific quality. The grading is, however, only voluntary for domestic market. It is compulsory only for export. This is where the consumer can play a vital role by preferring to buy AGMARK or ISI certified goods, and asking for it as an assurance of quality — you do not ask for honey but for AGMARK honey, you look for ISI marking on coffee packets, and refuse to buy one that does not have either one of these. This will eventually make producers get the proper certification for their products and hopefully the quality will improve.

Brands: *A brand is a trade name under which a particular item of food is sold.* The effort of the producer is to establish his or her commodity as a standard and desirable quality product and to create demands specifically for his product — to influence your choice to an extent that when you shop you will ask for the product by the brand name. You will ask for X brand chocolate, not any other chocolate; for brand Y coffee not any instant coffee. This involves advertising campaigns which are centred on brands alone. The biggest of such campaigns can be seen with regard to soaps and tooth pastes in newspapers, magazines, on roadside hoardings, and on the radio and television. Great sums of money are spent annually to boost products through their brand names and to sell consumers the idea of buying entirely by this means not soap but brand Y soap not chai but brand Y chai and so on.

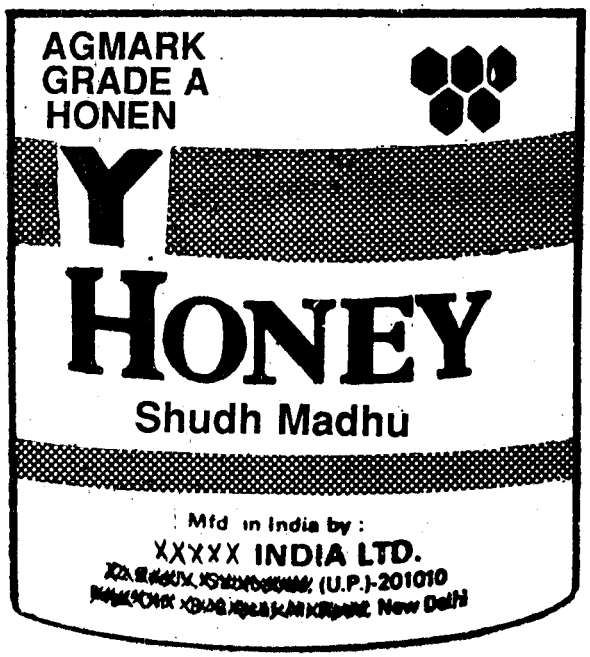
Some knowledge of trade and brand names is necessary in identifying food products in the modern marketing system. We need to be familiar with a number of brands and their qualities to know relatively which grade a particular brand represents, for example take the case of instant coffee; you have coffee with chicory added to it, and you have 100 per cent pure coffee. You need to know which brand sells which kind of coffee. Does a brand sell both grades of coffee, if so, under what names, and so on. By indicating to some extent the quality, the brand helps the buyer make a more intelligent purchase. As for the buyer, it is important for him to become acquainted with the standards of brands in order to be sure of buying a uniform quality product.

Labels: Closely related to grades and brands are the labels of products. These are important and you should read them carefully when buying any packaged food item. *Labels should give you information you need about the product you are thinking of buying.* Do not just look at the picture on the label and jump to a conclusion of what is inside; very often the picture is not that of the product inside, but is only distantly related to it (see label A). The type of label and the use producers and consumers made of it, is very important in getting correct information from it about the product inside.

LABEL A

A good label should have on it the grade of the product and the stamp or mark of the authority that has graded it, for example 'AGMARK' grade A, as noticed in label C. The alternative to grade indication is the quality certification by the Indian Standards Institution (ISI). See labels B and F. It should also indicate the brand and the trade name of the product. In label D, the brand is Z and the trade name is 'Sunrise'. In C the brand is Y

LABEL B

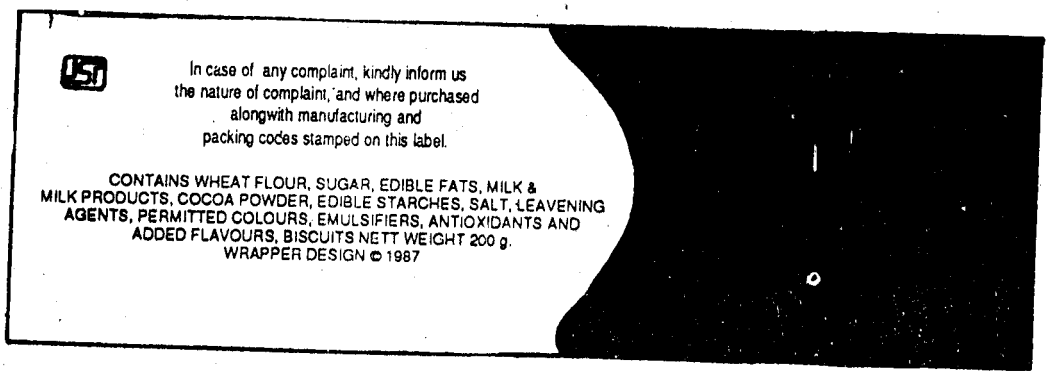


LABEL C

A good label should also give you a description of the product, for example in labels B and F, with preferably a picture of the product as in label E. Finally, it should give you *adequate information in simple terms regarding the use and care of the product.* This is so in label B. With the exception of label C which gives only brand and grade, all the other labels given here qualify as good labels. They provide you with almost all the information you would want to be able to make up your mind about buying the product. You should make a special note of the net weight, price and the date of manufacturing given on labels.

LABEL D

LABEL E



LABEL F

Check Your Progress Exercise 5

1) What does grade in a food item denote?

.....

.....

2) What does brand in a food item denote?

.....

.....

3) Name the two certificates of quality that can be given to a food product on the Indian market.

.....

.....

13.6 LET US SUM UP

In this unit you learnt about:

a) the protective/regulatory foods (fruits/vegetables), beverages and food accessories and the choices that are available in each of these categories.

b) how to make the best possible choice from among the numerous items available so as the ensure nutritional adequacy at the same time obtain maximum value for the money spend and

c) the grades, brands and labels and their role in the modern marketing system.

13.7 GLOSSARY

Brine : Refers to a strong solution of salt and water.

Caramalize : To heat sugar over low heat until it melts and develops characteristic flavour and golden brown colour.

Carcinogens : Refers to substances that produce cancer.

Decoction : Refers to boiling down so as to extract essence. The resulting liquid from this is the decoction. For example when tea leaves are boiled in water the resulting liquid is the decoction.

Game meal : Refers to wild animal, bird, fish etc. hunted for food/flesh.

13.8 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) Iron, calcium, vitamin C and carotene.

2) a) • They should be light green in colour, fresh, tender and firm.
• One should be able to dig the nail into them with ease while selecting.

b) They should be smooth, firm, of good shape and weight. There should be no evidence of diseased spots.

Check Your Progress Exercise 2

1) a) False; the carbohydrate present in a ripe banana is in the form of sugar.

b) False; full-ripe oranges should be firm and heavy with no soft or moulded spots.

c) True

d) False; while buying custard apples one should look for yellowish green skin with the crevices between the eyes white in colour.

e) False; unripe papaya is a rich source of papain (an enzyme) which digests protein.

Check Your Progress Exercise 3

1) Preservation and flavour
2) Mint leaves, coriander leaves, curry leaves, soya leaves
3) Rock, lake, underground springs, sea
4) a) True
   b) False; in the markets mostly synthetic vinegar is available which is made from acetic acid
   c) True
   d) True

Check Your Progress Exercise 4

1) 1 — c; 2 — e; 3 — a; 4 — b; 5 — d; 6 — f.
2) a) tannins; caffein b) granular c) caffeol; caffein d) Aerated soft drinks.

Check Your Progress Exercise 5

1) Grade in a food item denotes the quality of the food item
2) Brand tells us who has made the food item
3) AGMARK and ISI

UNIT 14 FOOD STORAGE

Structure

14.1 INTRODUCTION

Proper storage of food that is produced, purchased or prepared for the family is the first and the foremost step in effective utilization of family's food resources. It also plays a significant role in the efficient utilization of the family's income and ultimately influences the utilization of the available resources of the nation. As a matter of fact, every item of food needs immediate attention the moment it is harvested, manufactured or slaughtered, unless used immediately because the process of change in the composition of food begin soon after. More often these changes are for the worse and are termed as spoilage. In food storage, our effort is to minimize, if not totally prevent such spoilage.

Do you know which important characteristics of food should be preserved during storage? Food should be stored in such a way that it does not change much if any at all, in its appearance, taste, and composition. It should not only look and taste good but it should also be safe to eat and able to provide us with the nourishment it is supposed to provide. Between safety and nourishment, nourishment quite often, gets sacrificed during storage. Sometimes because it cannot be otherwise, but more often because of ignorance regarding the factors that can destroy the nutritive value of foods and regarding proper methods of storage. It is not enough to be able to select the food you need, it is also important to know how to take care of it and keep it well till you are ready to use it.

This unit deals with various causes of food spoilage, factors which influence food spoilage and home-level storage methods or the methods to prevent or minimize food spoilage.

Objectives

After studying this unit, you will be able to

- identify the various causes of food spoilage
- list the factors influencing food spoilage
- differentiate between perishable, semi-perishable and non-perishable foods and
- decide the most suitable method of storing various kinds of foods purchased for your family.

14.2 FOOD SPOILAGE

As you have just learnt, food spoilage leads to lowering of the quality of food. In order to check the extent of spoilage, you should know to judge the quality of a food item. *The quality of a food item is measured in terms of its sensory properties i.e.*

properties that can be detected by our senses of sight, smell, touch and taste — these are appearance, texture, flavour and aroma. In addition to these, three other important quality factors which cannot be judged by our senses alone, are nutritional value, safety and shelf life (keeping quality). Any adverse change in a food's quality, as defined above, may be considered spoilage (deterioration). It is in this sense that we mentioned earlier that most foods from the time they are harvested, slaughtered, or manufactured, undergo progressive deterioration which, depending upon the food, may be very slow or so rapid as to render the food virtually useless in a matter of hours. The degree or extent of spoilage is also significant. It might render a food aesthetically and nutritionally substandard or it might make it positively dangerous for health.

If the spoilage of food is limited to lessening of its appearance, texture, taste, aroma, or its nutritive value, it may still be acceptable as something to eat under certain circumstances. If, however, spoilage renders the food unsafe to eat then it has to be discarded without a second thought.

14.2.1 Causes of Food Spoilage

So far, you have learnt about food spoilage and its effect on food. Now, you would be interested in knowing about the causes of food spoilage. ***The major causes of food spoilage are microorganisms and naturalenzymes. Insects and rodents also play a role in food spoilage.*** Let us study about each of them.

1) **Microorganisms:** Foods are normally contaminated with microorganisms. They are present everywhere — in the soil, water and air, on the skin of cattle and the feathers of poultry and within the intestine and all other cavities of the animal body. They are also present on the skin and peel of fruits and vegetables and hull of grains and shells of nuts. They are there on all equipment used for cooking, as well as, on the hands, skin and clothing of persons handling food. Fortunately, they are generally not found within healthy living tissue such as flesh of animals or the flesh or juice of plants. However, they are always present near and around ready to invade the flesh of plants or animals through a break in the skin.

Microorganisms include bacteria, yeast, moulds, algae, protozoans and others. Among these *bacteria, mould and yeast* are the major cause of food spoilage. They feed on the food in which they live and cause variety of changes in it. Most of them are harmful and produce changes which lead to spoilage of food. However, some of the microorganisms have desirable effects on the food like in making curds we cultivate bacteria called *lactobacillus* which give curd its distinctive flavour. Vinegar is also a product of bacterial action.

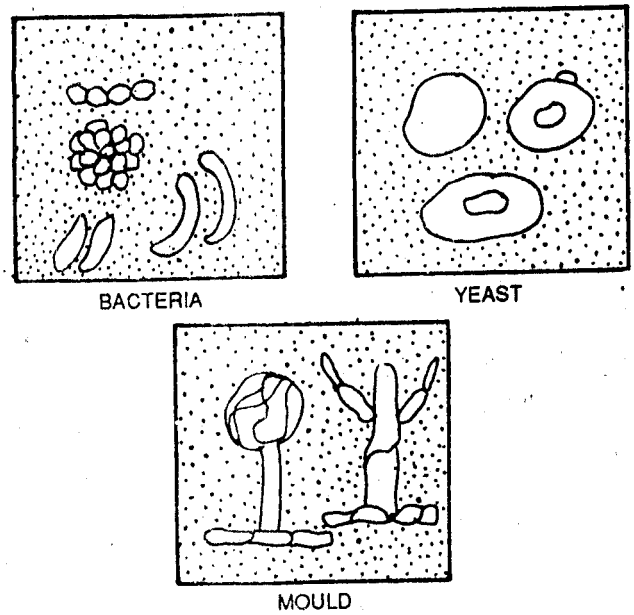


Fig 14.1 : Microorganisms under the microscope

Here, we will just concentrate on the activities of the "little devils" or the harmful microorganisms. Discussion about beneficial microorganisms is outside the purview of this unit. Let us now introduce you to various microorganisms one by one.

a) Bacteria: These little microorganisms are of various shapes — curved, long, slender, corkscrew. How interesting and simple they look under the microscope (Figure 14.1). But you may be surprised to know about their deeds — i.e. the variety of complex changes they can bring in foods. They play a major role in spoilage of meat, poultry, dairy and fish products. Bacteria do not thrive on foods which are distinctly acidic or alkaline in nature. They develop rapidly on foods which are neutral or near neutral in reaction such as vegetables, milk, eggs, meat and fish. Some bacteria are destroyed by boiling or by direct exposure to sunlight. Low temperature also affects their growth.

b) Yeast : Yeast represent another category of microorganisms. Yeast causes food to ferment. As you know, fermentation by itself is not altogether an undesirable process. It is often used in preparing foods (for example bread, dhoklas, idlis). However, when fermentation progresses beyond a certain point, it causes spoilage. The extent to which fermentation can harm the food is dependent upon the amount of alcohol produced in the food. The more the alcohol produced, more is the extent of spoilage. Fruits especially, the cooked fruit juices which have only small amount of sugar, ferment easily. You can see the carbon dioxide bubbles rising to the surface when you shake the fruit juice. So, when your orange squash or tomato sauce begins to produce bubbles, you can spot spoilage due to yeast fermentation. In sealed cans when this happens you will notice a bulge on top. You can press it down with a 'tick' sound. Now you know, it means the contents of the can are spoilt or fermenting.

c) Moulds: Moulds are minute plants. They grow on all kinds of foods and prefer warm, damp and dark places. They do look terribly ugly when growing on food. For example, the black hairy growth of moulds on bread or the grey fuzzy growth on cheese. They do not however, produce harmful substances. Quite often when the growth is slight you can physically remove it and eat the rest of the food without any risk whatsoever. If, however, the growth of the mould is heavy, the whole mass of food may be changed in flavour and sometimes in texture. In such cases you have to discard the food. Fortunately, mould (when in large quantity) is visible and also imparts a noticeable flavour, hence the risk of eating mouldy food knowingly is very small. There are a few moulds that do produce toxic material known as mycotoxins. Aflatoxins produced by moulds growing on groundnuts is one example.

Now you are aware of the fact that bacteria, yeasts and moulds are the most common cause of food spoilage. Fortunately in almost all cases their handiwork can be detected either by sight, smell or taste. There is a special kind of food spoilage that does not change the sensory properties of food and, therefore, cannot be detected. This is much more dangerous. We shall talk about them in Unit 16 under Food Safety.

2) Natural food enzymes: Food enzyme is not a new term for you. You are familiar with role of enzymes in the process of digestion. All healthy, food plants and animals have their own set of enzymes which help in the processes that go on inside the living cells — digestion, respiration, germination and so on. These enzymes continue to remain active even after the plant has been harvested or the animal slaughtered and the processes they help will continue. Some of the processes are desirable to a certain degree, for example the ripening of papaya, custard apple (shareefa), mangoes and tomatoes after harvesting. However, ripening beyond a certain point becomes deterioration or lowering of quality. The over-ripe bananas and papayas, the over-matured tasteless corn and peas in the market are examples of deterioration due to naturally present enzymes. Most of the deterioration (spoilage) of food that occurs in the field or in transport or in the markets is due to such enzyme action. Quick transport which cuts down the time and transport at low temperatures, which slow down the rate of enzymes action helps in minimizing such deterioration. Fortunately, these enzymes can also be rendered inactive by heat, chemicals and radiation.

3) Insects and rodents: They are particularly destructive to cereals grains and to fruits and vegetables. Worms, bugs, weevils, and moths may damage food items both in the field, as well as, in storage at home. In addition to eating away the food, they damage it and thereby expose it to bacterial, yeast and mould infections. A small insect hole in a mango can result in the total decay of that mango from bacterial invasion.

The problem with rodents involves not only the quantity of food they may consume but also the filth with which they contaminate food. Rodent urine and droppings harbour several kinds of disease producing bacteria, which infect human beings.

Of the almost 10 per cent losses in grains at the farm level in our country insects, rodents and birds are responsible for almost 6 per cent.

Check Your Progress Exercise 1

1) List properties or qualities of food that you can detect with either of your five senses.

.....

.....

.....

2) Indicate if the following statements are true or false. Correct the false statements.

a) Lowering of the nutritive value of food is a kind of deterioration. (True/False)

.....

.....

b) Deterioration does not always make a food unsafe to eat. (True/False)

.....

.....

c) Moulds generally do not produce harmful substances in the food they grow on. (True/False)

.....

.....

d) Enzymes action in plant stops as soon as they are harvested. (True/False)

.....

.....

e) Fermentation always leads to spoilage of food. (True/False)

.....

.....

14.2.2 Factors Affecting Food Spoilage

Some factors like temperature, moisture affect the growth of microorganisms action of enzymes and hence effect food spoilage. Let us now study about these factors.

Temperature: Each microorganism has an optimum growth temperature i.e. the temperature at which it grows best and multiplies most rapidly. Similarly, enzymes are almost active at an optimum temperature. Microbial growth/enzyme action may be prevented by either decreasing or increasing the optimum temperature. Normally, freezing and chilling are adapted for storing foods at low temperature. Freezing process has a killing effect and bacteria continue to die during storage. Food can also be stored in refrigerator which has lower temperature, however not for a long time.

However, remember that excessive heat, as well as, cold can cause deterioration of food. Excessive heat can destroy proteins and vitamins and dry out food by removing moisture. Similarly excessive cold, if not controlled during freezing breaks the cell walls and membrane of food. Such a food during thawing allows microorganisms to get in and spoil the food.

Moisture and dryness: Excessive moisture or dryness plays a very significant role in maintaining optimal quality in stored foods. Foods that are best when moist deteriorate on drying and those that should be kept in a dry state deteriorate when moist. Moisture is necessary for the growth of microorganisms, as well as for enzyme action. Therefore, moisture on the surface of any food encourages multiplication of bacteria and growth of moluds. If temperature is also conducive to such multiplication and growth. Moisture need not be present in equal proportions throughout the food to have an effect on it. The surface moisture need not only come form the outside of atmosphere, the fruits and vegetables give off moisture from respiration and t nspiration. When they are kept in a moisture-proof package like a

plastic bag, this moisture gets trapped inside and can support the growth of microorganisms.

Air and oxygen: Vitamins, particularly A and C as well as food colours and flavours get destroyed when exposed to air and oxygen. Oxygen also helps growth of moulds. In packaged foods effort is made to remove oxygen by vaccum or by flushing the food containers with nitrogen or carbon dioxide, in order to prevent such deterioration. Air also dries up food items and dryness in turn can cause deterioration in some foods as mentioned.

Light: Some vitamins, particularly riboflavin, vitamin A and vitamin C, and many food colours are destroyed by light. Sensitive foods are often protected from light by using containers that keep light out, for example dark coloured bottles and glazed pottery jars used for keeping pickles.

Time: Any food is at its peak quality for a certain time after it is harvested, slaughtered or manufactured, and this period is very short, from just a few hours after harvest as in the case of fresh peas and fresh corn, to may be a day or two. It generally depends on the time spent in the field itself after harvesting in view of the inadequate transport facilities in our country. All deteriorating factors like growth of microorganisms, destruction by insects, action of food enzymes, loss of flavour, effects of heat, cold, oxygen, light and moisture progress with time. The longer the time the greater the destructive influences. It is, however, also true that some food items improve with time, for example certain cheeses, wines and pickles, but the majority of foods decrease in quality with time.

14.3 CLASSIFICATION OF FOOD BASED ON PERISHABILITY

The techniques we need to adopt for preventing spoilage depend upon the quickness with which different foods undergo such spoilage as we have just discussed. Let us, therefore, classify food accordingly before we talk about storage.

Let us give a quick look at the purchasing habits of people. People generally buy milk, egg, fruits etc. daily or once in two/three days or at most once a week. While other foodstuffs like atta, ghee, pulses etc. are bought in bulk once in a week/fortnight/ month. Can you give the reason for this? Some food items deteriorate/spoil easily as compared to others and need to be consumed in a day or two after the purchase. While others can be kept for a longer time without being spoilt. In fact, on the basis of the quickness with which a food item gets spoilt, we can place them into three categories:

i) perishable foods
ii) semi-perishable foods
iii) non-perishable foods.

Perishable foods: These are foods *which spoil easily* unless special methods are used to prevent such spoilage. *All animal foods like meat, fish, poultry, eggs, milk and milk products and most vegetables and fruits come* in this category. The speed with which some of these spoil varies with the temperature, moisture and/or dryness of the environment; for example while in the cold season milk can remain at room temperature for a whole day without spoiling, in the hot season it would not last more than 3 to 4 hours. Fresh eggs, meats and fish spoil very fast in the hot weather unless refrigerated. As for vegetables and fruits, they spoil faster as the day progresses. Fresh coriander, lettuce and spinach plucked from the garden wilt within a matter of minutes unless stored adequately.

Semi-perishable foods: These are foods *that can survive without any perceptible signs of spoilage for a couple of weeks* or for a few months. Here again, the temperature and humidity of the environment makes a big difference. *Example of this category are all cereal and pulse products like wheat flour, refined wheat flour, semolina, vermicilli, broken wheat, bengal gram flour, onions, potatoes, garlic, apples, citrus fruits, fats and oils.* If properly handled and stored these will remain unspoiled for a fairly long

period. In the cold climate like in most of the western countries these food items are considered non-perishable, but during the hot and humid seasons in our country they also perish unless we take special care.

Non-perishable foods: *Cereals, pulses, sugar come in this category. They do not spoil unless handled and stored carelessly.* Here again, we do need to take special care to make sure that they do not develop insects in storage. In the case of peanuts we have to worry about moulds in the monsoon season.

With the diverse environmental temperatures and levels of humidity prevailing in India, there can be no absolute classification of foods into these categories. With the exception of sugar and salt; there is nothing which would not spoil unless taken special care of. Even sugar and salt absorb moisture and become soggy during the rainy season unless we are careful. This makes the problem of storage even more significant for us, specially in the context of our population, what we produce, our transport facilities, and the low buying power of a large section of our population. Whatever we can produce needs to be looked after carefully till it is ready for use. As a nation and as a people we cannot afford to allow our food to get spoilt. We need to utilize every bit.

Check Your Progress Exercise 2

1) Fill in the blanks

a) ..... and ..... are perishable foods.

b) Moisture on the surface of food encourages the growth of ..... and .....

c) Each microorganism has ..... temperature at which it grows best.

d) The food which can survive without any perceptible signs of spoilage for a couple of weeks are known as ..... foods.

e) When foods are exposed to air, vitamin ..... and ..... are destroyed.

2) Explain the effect of temperature on spoilage of food by microorganisms?

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14.4 FOOD STORAGE

Proper storage of food is the first major step in assuring adequate food supply not only at the level of the small individual family but at the level of the nation as well.

A loss of grain crop at the harvest point to the extent of 5 to 10 per cent of production in almost all developed countries, to 50 per cent or more in the case of some of the developing countries, is a collossal waste of valuable food resources. The losses in grains at the farm level in our country are approximately 10 per cent. We loose almost 17 million tonnes of grains because of improper storage at the farm level.

14.4.1 Methods of Food Storage

For our discussion here we shall limit ourselves to storage facilities at the household level and we shall look at it from the point of view of non-perishable foods, semi-perishable foods and perishable foods, since the requirements of storage for each of these classes of foods are different.

Storage of non-perishable foods: Cereals, pulses, sugar, salt and also tamarind and some spices are often stored for a year by people in rural areas, generally from one harvest to another. In town and cities where the consumer buys all his food from the markets the trend is different. The limitation of space, facilities, finance to purchase large quantities at one time, and the fairly dependable marketing facilities, encourage most people to go in for just monthly buying. However, even this amount of food items need to be stored adequately to prevent deterioration.

You must observe the following precautions while storing non-perishable foods like cereals and pulses:

- You should carefully clean them to remove gravel, husk and other foreign matter (if possible wash), and dry thoroughly in the sun.
- You need to store them in clean containers which have tightfitting lids. These containers can be of tin, aluminium, plastic or glass. Clay pots or gunny bags also used in case of large quantities.
- These containers should be put either in the store room or in the storage cupboard in your kitchen.
- It is better to have a storage space away from the kitchen because the temperatures in the kitchen are higher than what is ideal for storage.

Storage of semi-perishables: Some of the cereal products, roots and tubers, nuts and oilseeds and fruits come in this category. Let us discuss storage of each one of these.

Cereal products: Cereal products like different flours, semolina, vermicilli, or broker wheat develop an off-flavour, or are infested by insects very easily. They should be sieved and cleaned of all such contamination, exposed to the sun for a few hours, allowed to cool, and then stored in tightly covered bottles or other containers.

Roots and Tubers: Specially onions and potatoes should be stored in a cool, dry and airy place to prevent them from developing moulds or growing shoots. They are best hung up from the ceiling in a wire or plastic-mesh basket, or kept in mesh containers which keep them exposed to air circulation. Do not keep them in the kitchen. They need a cool place.

Nuts: Nuts become rancid and infested with insects very easily, and you should buy them in large quantities only if you can store them, shelled in plastic bags inside a refrigerator. You can also freeze them to make them last for a year or even more.

Fruits: Like apples, oranges and semi-ripe mangoes do last for a few weeks and should be put in a basket lined and covered with paper to prevent them from drying up. Ready-to eat oranges and mangoes are best kept in a plastic bag in the refrigerator. They need a cool environment to last long.

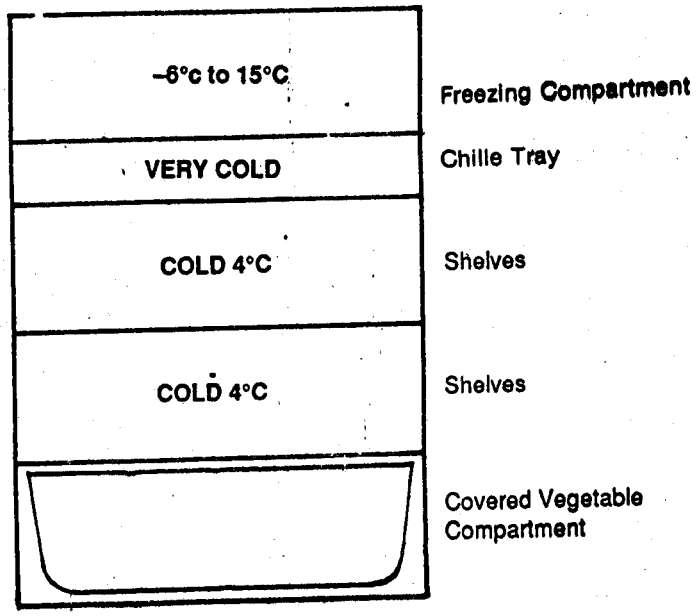
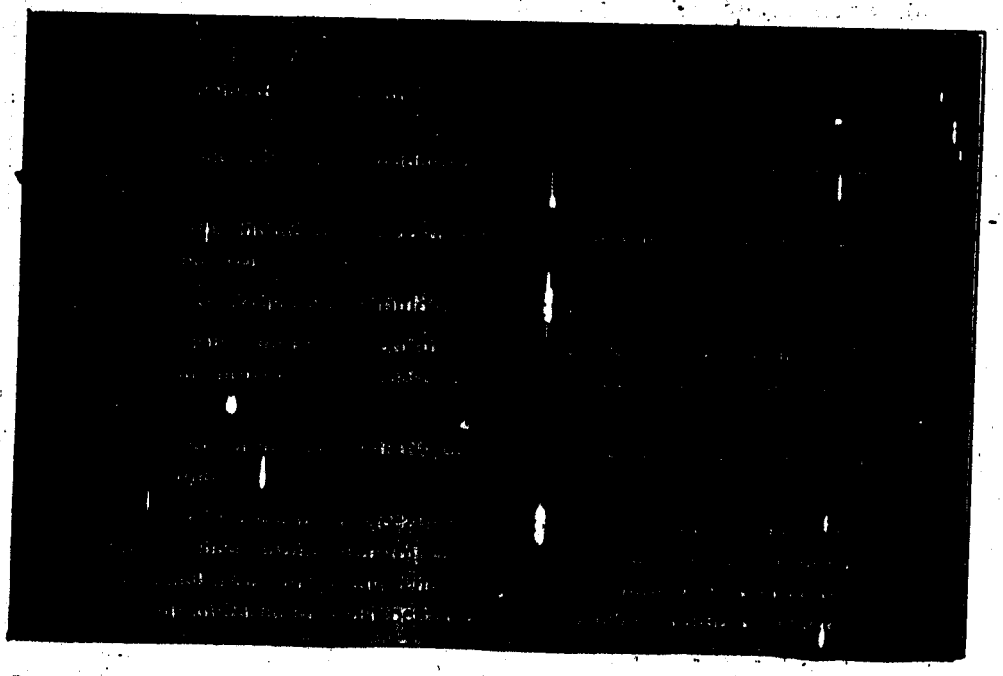


Fig. 14.2 : Various compartments of a domestic refrigerator

Storage of perishables: Low temperatures slow down spoilage in perishable foods — both enzymatic, as well as, that caused by microorganisms. Normally, a domestic refrigerator is used at home for storage of perishable foods. The level of temperatures prevailing inside a refrigerator keeps these in check only for a short while.

A domestic refrigerator is normally maintained at a temperature which varies between 6° C and 10°C. Fig 14.2 indicates the various shelves of a referigerator and the temperature prevailing in them.

Foods can be kept for a longer time in freezing unit than on the shelves. Highlight 3 presents an interesting discussion on care of a domestic refrigerator.



Let us now study about storage of some of perishable foods:

Meat, fish, poultry: For longer period storage, foods like meat, chicken and fish need to be kept frozen at -6° C in a deep freeze. These foods should not be kept at room temperature for more than an hour or two. They should be cooked immediately if you do not have refrigeration facilities. Organ meats like liver, kidney and brain spoil faster than meat. Ground meats also spoil faster because a higher surface area is exposed to contamination, and the opportunities of contamination are also more by way of equipment and handling.

Eggs: should not be kept at room temperature for more than two days or so even in cool weather. They are best kept in a refrigerator.

Milk: The practice of boiling milk destroys the microorganisms as well as the enzymes present in it, and therefore boiled milk can be kept at room temperature for 6 to 12 hours. Giving it a second boil after 6 hours or so during hot weather makes it last longer. It is better to cover it with a netting of some kind to allow for ventilation when kept at room temperature. Inside a refrigerator milk can last 3 to 4 days or even more. The cold temperature of the refrigerator does disturb the emulsified state of the milk allowing the cream to separate and collect at the top.

Vegetables: The keeping quality of a vegetable depends upon its nature. Leafy vegetables wilt and deteriorate within minutes of buying unless they are kept wraped in a damp cloth or inside a plastic bag in the refrigerator. Even here they do not last for more than a day or two. All other vegetables keep well in a cool place with relatively high humidity — in a basket covered with a damp cloth. They last longer in a refrigerator but must be kept in plastic bags to prevent drying by evaporation. Vegetables do continue to ripen even in the cold environment of a refrigerator. Fresh peas and fresh corn lose their sweetness after a couple of days even inside a refrigerator unless they are properly frozen.

So far, we have discussed low temperature or refrigeration for vegetables and fruits.

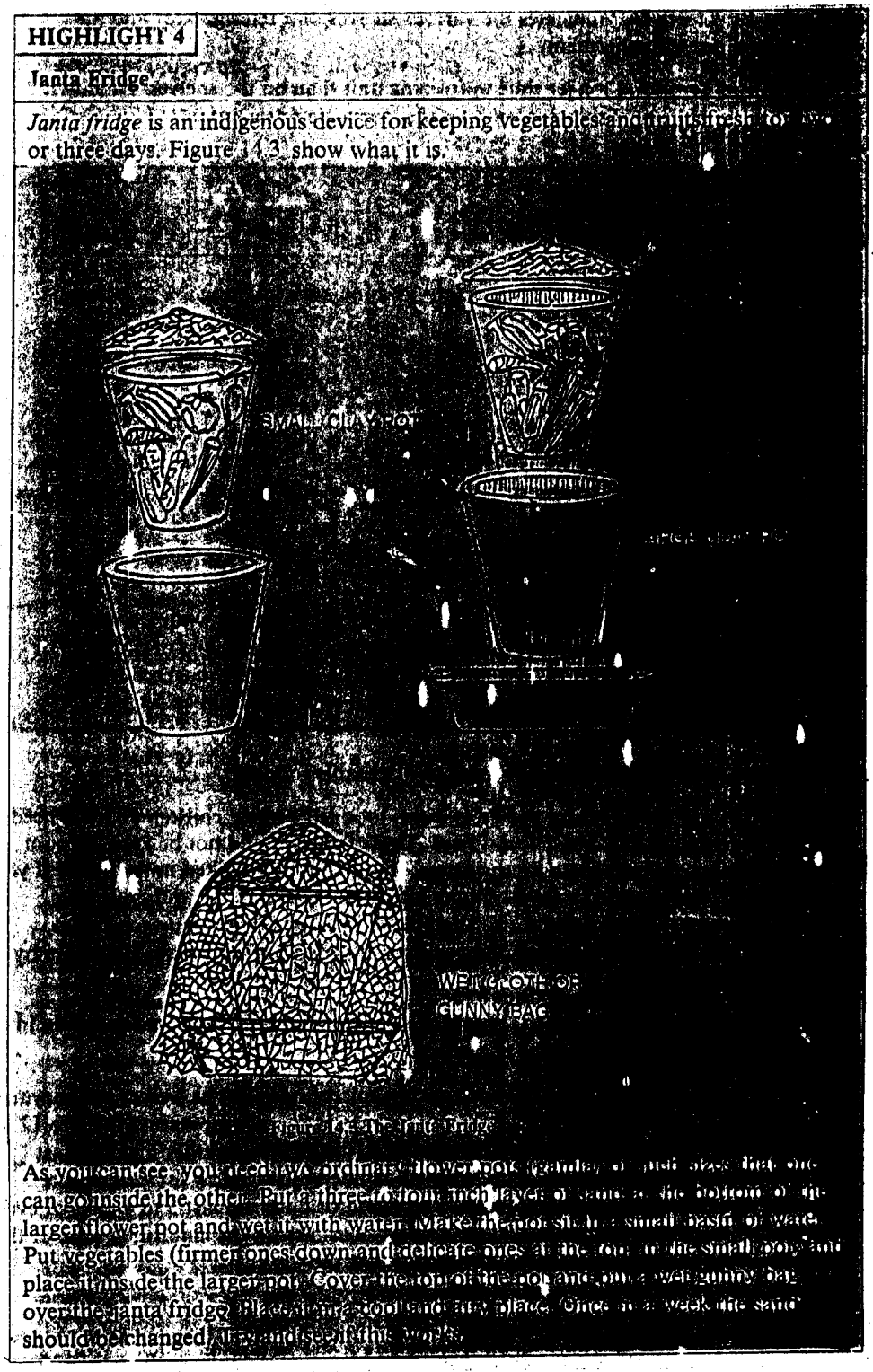
However, some of you may not have refrigeration facilities at home. In such a situation, one can try Janta fridge.

What is a Janta fridge and how can it help in storing of fruits and vegetables? Read Highlight 4 to find answer to these questions.

HIGHLIGHT 4

Janta Fridge

Janta fridge is an indigenous device for keeping vegetables and fruits fresh for two or three days. Figure 14.3 show what it is.



As you can see, you need two ordinary flower pots (earthen) of such size that one can go inside the other. Put a three to four inch layer of sand at the bottom of the larger flower pot and wet it with water. Make the pot stand in a small basin of water. Put vegetables (firmer ones down and delicate ones at the top) in the small pot and place it inside the larger pot. Cover the top of the pot and put a wet gunny bag over the Janta fridge. Place it in a cool and dry place. Once in a week the sand should be changed. Try and see if this works.

So far we have discussed storage of food with reference to natural enzymes and microorganisms. You have read that insects and rodents or pests also play a role in spoilage of food. You need to keep a check on them as well. The most common insect which needs to be kept out from our houses is the fly. Flies are carriers of harmful microorganisms and are the major cause of almost all food borne diseases and infections. The other source of contamination of food is cockroach. They generally live in dark corners and are known to cause infections leading to diarrhoea and dysentry. Apart from these there are innumerable others which cause serious damage

to food. Of course, we cannot forget rodents when we talk about food storage. Some of the household methods of pest control are discussed in Highlight 5.

HIGHLIGHT 5

Household methods of pest control

Keeping the house clean, particularly the store room and the kitchen is the first step towards controlling pests. Keeping all containers tightly shut, and not allowing food items to spill and remain spilled in the store room or in the kitchen is also essential for keeping pests under control. Keeping a closed container for collecting kitchen garbage is essential. This garbage container should be lined with paper or preferably a plastic bag which can be thrown with the garbage thus keeping the container relatively clean. It should be emptied, if possible twice a day.

To prevent entry of these pests into our house and into our food, some of the following steps would be helpful:

i) At the time of buying make sure the food item is not infested with any of the pests. The soft drink bottle cases generally have cockroaches in their crevices. Gunny bags from the shops often have insects in them.

ii) Clean all the grain, pulses and spices, expose them to the sun and cool them before storing them (note that rice should be put in the sun).

iii) Clean the storage containers regularly, dry them in the sun and cool them before filling up with food items. Containers should have tight fitting lids.

iv) Make sure all crevices and cracks in the walls and in the windows and doors are sealed. These are favourite places for the insects to breed and multiply.

v) Can you think of some other method of pest control? You might have seen commercial advertisements for chemical pesticides. These advertisements show beautiful women spraying chemical pesticides in their kitchen without wearing a face mask and gloves. What is your opinion about the chemical pesticides or these advertisements?

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We don't know about your opinion, however, remember that these advertisements are misleading. As a matter of fact, chemical pesticides should never be sprayed in your kitchen. It is not only harmful and dangerous for the person spraying these pesticides but also for all those who are eating the food from the kitchen. Of course, harmful effects are much more serious for the person who is spraying these pesticides. In case, it is very essential to use the pesticides, you should take the help of pest control professionals. Never try to do it yourself.

In case you want, you can use baits of food mixed with poisonous chemicals, to get rid of rodents and cockroaches. However, use of baits also demands caution in their use to prevent any accident. You should take the following precautions while using baits:

— Baits of food mixed with chemicals should be kept out of reach of children.

— In no circumstances shall it get mixed with food consumed by family.

— Best time to use baits in the kitchen is when work is over and kitchen can be left undisturbed for 6 to 8 hours at a stretch. After 6 to 8 hours of putting the bait, you should clean the kitchen properly. Check every corner or crevices for dead bodies of pest. After removing all the filth, kitchen should be washed and mopped properly.

vi) As an alternative to chemical pesticides you can try household items like turmeric, neem leaves or oil. It is a common practice in certain houses to mix turmeric in rice or put neem leaves in wheat or rice or rub oil on pulses. If you talk to your old grandmother or elders in the house you will get more ideas about such household methods of pest control.

14.4.2 Organizing Storage Space

Facilities for storage vary tremendously from house to house. The following perhaps

are possibilities to choose from:

a) *A separate store room which should be on the side of the house which gets the least sun:* The room should have good ventilation. It should also be close to the kitchen. Inside the room you should have shelves for storing food containers (with facilities to store large containers on the bottom shelf). The height of each shelf should be such that you can open each container where it is placed. For ease of cleaning, the lowest shelf should be 6 to 8 inches above the floor. If the shelves are wide tall containers should be stored at the back and smaller ones in the front. If the room does not have built-in shelves, wooden or steel ones can be used.

b) *A cupboard with shelves in the kitchen:* This is becoming fairly common in the modern day flats in big cities. You may just have open shelf space without any doors. In either case the shelves should be as far away from the cooking area as possible as the hot air around the cooking area would keep the storage space warm and encourage growth of moths and weevils in the food. Hot air also causes condensation of moisture from the air, increasing humidity which hastens spoilage.

c) *A cellar or an underground room:* This is an ideal storage facility if you are building an independent house. It should be surrounded by a well-insulated wall to prevent dampness, and have good ventilation facilities. Such a room would be best for storage of roots and tubers, bulbs and fruits as well. Being underground, if well insulated and aired, the room would be cooler than any other part of the house. Store should be organized in such a way that you have access to each container, and are able to check its contents periodically.

Check Your Progress Exercise 3

1) a) List the methods of storage of perishable, non-perishable and semi-perishable foods adopted in your house.

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b) Based on the information given in Section 14.4, do you think some modification is needed in your methods of food storage at home?

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2) What measures do you adopt for control of pests in your house? Comment.

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14.7 LET US SUM UP

In this unit you have learnt processes of change in the quality of food items generally leading to spoilage.

- Spoilage begins immediately after food is harvested, manufactured or slaughtered.
- To minimize or prevent this spoilage, it is important to take proper care of food, as soon as, it is harvested, manufactured or slaughtered.
- The spoilage changes in food are brought about by one or more of the following:- microorganisms (principally bacteria, yeast and moulds), insects and rodents, natural food enzymes.
- Certain factors like temperature, moisture or dryness, time, air and oxygen do effect spoilage of food by either of these methods. Methods of preventing or minimizing spoilage of foods vary with the ease and speed with which different foods get spoilt.
- Different methods and facilities are available to store foods that perish very quickly, that perish not so quickly and that can stay for relatively longer period without perishing.
- Careful attention should be paid to requirements for storage of food, and the facilities for storage should be planned keeping in mind the kind of foods one needs to store.

14.8 GLOSSARY

Aesthetically substandard : Unpalatable to look at.
Aroma : A distinctive agreeable fragrance or odour.
Condensation : Water vapour in the air turning into ice.
Cultivate : To grow.
Humidity : Moisture in the atmosphere.
Nutritionally substandard : With markedly reduced nutritive values.
Perceptible : Which can be seen.
Rodents : Rats, mice, squirrels,
Soggy : Wet with moisture.
Thawing : Process of bringing frozen food to room temperature.
Transpiration : The loss of water in the form of vapours from the plants.

14.9 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) Appearance, texture, flavour and aroma
2) a) True
   b) True
   c) True
   d) False; enzyme action continues even after harvesting.
   e) False; fermentation does not always lead to spoilage. The extent to which fermentation can harm the food depending on the amount of alcohol produced.

Check Your Progress Exercise 2

1) a) Milk, milk products b) mould, bacteria c) optimum d) semi-perishable e) A, vitamin C

2) Answer with respect to effect of low and high temperature on spoilage of food. You will find hints for answering this question in Sub-section 14.2.2.

Check Your Progress Exercise 3

1) a) Answer on your own experience.
   b) Answer on your own experience.

2) Answer on your own experience

UNIT 15 FOOD PRESERVATION AND MAXIMIZATION OF NUTRITIONAL BENEFITS

Structure

15.1 INTRODUCTION

In the preceding unit we have talked about how and why foods get spoilt and the methods we can adopt to prevent or minimize such spoilage. In this context, our discussion was mainly directed to measures that are necessary to keep food in healthy and normal conditions for short periods i.e. between the time of harvesting, manufacture or slaughtering to the time of consumption. We shall now, in this unit, direct our attention to measures we can adopt to keep food healthy and normal, or as nearly so as possible, for longer periods of time. The term used for such measures is preservation. We shall discuss the different principles and methods of food preservation with examples of home scale food preservation. We shall also talk about how one can get maximum food value from the foods we consume, prevent loss of nutrients and avoid wastage of food.

Objectives

After going through this unit, you will be able to:

- list the principles of food preservation
- identify the various methods of preservation of food
- preserve the foods you need to or would like to for future use and
- get the maximum nutritional value from the foods you buy

15.2 PRINCIPLES AND METHODS OF FOOD PRESERVATION

The basic principles of food preservation are to either kill or to inactivate or control factors which are the main causes of food spoilage. These factors, as you know, are the growth of microorganisms and activity of natural enzymes. We can either destroy these microorganisms and natural enzymes or keep their activity and growth under our control. We shall discuss each of these under the following headings.

- Prevention or delay of decomposition by microorganisms
- Prevention or delay of self decomposition of food by enzymes

15.2.1 Prevention or Delay of Decomposition by Microorganisms

This essentially involves controlling bacteria, yeasts and moulds by either inhibiting their growth and activity or by destroying them. Creating an environment in which microorganisms are not able to grow and function although they are not dead is called a *bacteriostatic method.* Dehydration, pickling, salting, use of sugar, smoking, freezing are examples of this method. The other in which you kill the microorganisms is called a *bactericidal method.* Use of chemicals and irradiation are methods by which bacteria are killed. You shall learn about these methods in Section 15.3. Each one of these techniques can also cause spoilage of foods from the point of view of appearance and/or nutritive value. Therefore, it is a matter of balance. There should be enough heat to kill microorganisms but not destroy the food value and alter its appearance drastically. Similarly, if chemicals are used as preservatives, there should be enough chemicals to inhibit microbial growth but have minimum adverse effects upon nutrients in the foods or on human health. You have to strike a balance between rendering food safe, preserving nutritional value of food and minimizing hazards to human health. The methods and the degree to which it is applied, must accomplish all the three. Let us look at some of the common techniques used for preservation by this method.

A) **High temperatures:** Most bacteria, yeasts and moulds grow best in the temperature range of 16° – 38° C (60° F – 100° F). Most bacteria are killed in the range of 82°–93° C (130°F–200°F) but in the form of spores many bacteria are not destroyed even by boiling water at 100° C (212°F) for 30 minutes. You need to use higher temperatures under pressure to destroy bacterial spores. Foods high in acid content like tomatoes or orange juice need not be heated as severely because acid increases the killing power of heat. A temperature of 93° C (200°F) for 15 minutes for example may be enough to sterilize food in the presence of sufficient acid.

We must also keep in mind that it is not always necessary to destroy all microorganisms and produce a sterile product. A sterile product means a product which is free of microorganisms. You may need to use only enough heat to destroy disease producing organisms in food. This is the case with pasteurized milk. The term 'pasteurization' refers to the process of heating the milk at 62.8°C (145°F) to kill the microorganisms. Most of the bacteria and all of the disease producing organisms present in the milk are destroyed by pasteurization for 30 minutes. However, the milk does not become sterile nor is it necessary for it to become so, since it will be stored in a refrigerator till distributed and consumed within a few days. In the case of condensed milk which remains inside a tin for perhaps years, a much greater heat treatment is applied to ensure total sterility. This, however, also changes its appearance.

B) **Low temperatures:** Although most bacteria, yeasts and moulds grow best between 16°–38° C (60°–100°F), there are some that will grow at 0°C (32°F) or even below. However, below 10°C (50°F) the growth of most microorganisms is slow and becomes slower as the temperature gets colder and colder. This is the reason why most foods stay in refrigerator for longer than they do at room temperatures without getting spoilt. This is also the reason why one can keep certain food items for months by freezing them. It is, however, important to realize that while cold temperatures slow down bacterial growth and activities and may kill some bacteria; cold including severe freezing, cannot be depended upon to destroy all bacteria. Cold storage and freezing do not sterilize foods and when the frozen food is thawed the surviving organisms often start growing very rapidly. Why? This is because the food structure may have been somewhat weakened by the cold or frozen storage. Thawing as you know refers to the process of bringing the frozen food to room temperature.

C) **Drying:** Normal growing microorganisms contain more than 80 per cent water. They get this water from the food they grow upon. Removing water from the food will cause the water from the bacterial cells also to come out, bringing bacterial multiplication to a stop. Bacteria and yeast generally require more water than moulds. Therefore, moulds often grow on semi-dry foods where bacteria and yeasts cannot grow. Examples are moulds growing on stale bread and partially dried fruits. Drying therefore, protects food from spoilage by microorganisms. However, like freezing even complete drying of food does not cause the destruction of all microorganisms. It may actually preserve some microorganisms like it preserves the food. Dried food, therefore, is generally not always sterile. While bacteria will not grow in dried food,

the moment moisture is intentionally or unintentionally added bacteria starts to grow.

D) Acids: Microorganisms are sensitive to acid. Some are much more sensitive than others. The acid produced by one organism during fermentation will inhibit the growth of another. This is the principle of using controlled fermentation; the acid produced by fermentation will not allow the growth of other organisms. Acids may be added directly to foods as chemicals, for example, citric acid and phosphoric acid added to beverages like carbonated drinks, or may be produced in foods like we do in making curds. Several foods such as tomatoes, citrus juices and apples contain natural acids. In each case the acid has varying degrees of preservative power. As mentioned earlier acid combined with heat makes the heat even more destructive to microorganisms.

E) Sugar and salt in high concentrations: Bacteria, yeasts and moulds have cell membranes. These cell membranes allow water to pass in and out of the cells. Do you remember reading about principle of osmosis in school. Let us recall the principle of osmosis here. It says water always move from the side where it is present in high concentration to side where it is in low concentration (Figure 15.1). Active microorganisms may contain more than 80 per cent water. When they are put in a heavy sugar syrup or in strong salt water, the water from inside the cells moves out into the concentrated syrup causing partial dehydration of the cells. It interferes with the growth and multiplication of the microorganism. Yeasts and moulds, however, can tolerate this dehydration much more than bacteria can. Hence, you sometimes find yeasts and moulds growing on high sugar or salt products where bacteria cannot grow, for example on jams and pickles.

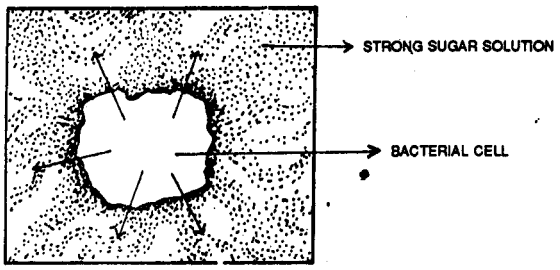

Fig. 15.1 : Principle of Osmosis

Dry salting is used in India for preserving many foods like tamarind, lime, amla, fish and meat. Our pickles also owe their keeping quality partly to the large amounts of salt added. Large amounts of sugar used in making jams and jellies is responsible for the keeping quality of these products.

F) Smoke: Smoke contains preservative chemicals such as small amounts of formaldehyde and other materials from the burning of wood, which are unfavourable to the growth of microorganisms. It is also the heat associated with the smoke which kills the microorganisms and at the time dries out the food, further contributing to preservation. Smoking over a fire is quite effective in preserving certain foods such as meats and fish.

G) Air: Certain microorganisms require air for growth (aerobes) and certain others grow better in the absence of air (anaerobes). It is easier to remove air from aerobes like moulds by wax coating of cheese or by wrapping the food in skin tight plastic sheets inside which air (oxygen) cannot enter.

H) Chemicals: There are many chemicals that kill microorganisms or stop their growth but most of them are not permitted in foods since they are dangerous for health. Even those that are permitted to be used as preservatives are regulated by law as to the amounts in which they can be used. This is because higher concentrations can be a health hazard. Sodium benzoate is one that effectively inhibits the growth of moulds and is used in preserving jams and jellies. Some of the other chemical preservatives used are potassium metabisulphite, sorbic acid, and calcium propionate.

I) Radiation: Preserving food by radiation is the latest technique which is receiving attention all over the world. Microorganisms are inactivated to various degrees by different kinds of radiations, X-rays, microwaves, ultraviolet light radiations and ionizing radiations are different kinds that have been used to preserve food. A great deal more work/research is necessary as of now to make this technique universally applicable and acceptable.

Check Your Progress Exercise 1

1) Fill in the blanks.

a) Most bacteria, yeasts, moulds grow best between 16° C to ..... °C.

b) Bacteria and yeasts require ..... moisture for growth than moulds.

c) Dried food get ....., if moisture is added because ..... start growing in it.

d) ..... combined with heat is an effective method of food preservation as it makes the heat even more destructive to microorganisms.

e) Microorganisms which require air for their growth are known as .....

2) Explain the principle of food preservation involved in the following methods.

a) Addition of large amount of sugar in jams

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b) Placing meat and fish over the fire smoke

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c) Wax coating of cheese

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d) Addition of sodium benzoate to jelly

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e) Blanching of vegetables before freezing

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f) Sun drying of raw mangoes

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3) Match the following

a) Pasteurization	i) Removing water from the food to stop bacterial growth
b) Sterilization	ii) Heating of milk at 62.8°C for 30 minutes
c) Thawing	iii) Putting vegetables and fruits in boiling water for 3 to 5 minutes
d) Blanching	iv) Smoking foodstuff over fire
	v) Complete removal of microorganisms from a food product
	vi) Bringing frozen foods at room temperature

15.3 HOME-SCALE FOOD PRESERVATION

All of the process used for preserving food at home are based on the principles of preservation just discussed. The ones commonly used are preserving by drying and by adding sugar, salt and chemicals. These can be done at home with facilities and equipment normally available in our kitchens. Canning and freezing are possible in the western homes but not in an average Indian home because the equipment and facilities required are not grenerally available with us.

Preserving by drying: This natural means of preserving foods is available to us in plenty most of the year. There are a large variety of items we preserve at home by sun

drying. Some of the very common ones are vegetables, raw mango pieces for making mango powder, papads of all varieties, mango juice, red chillies, and potato chips. The best time of year to sun-dry food items is the summer, when the sun is hottest.

Preserving by pickling: Most of the pickles rely upon salt and the acids of lime, vinegar or tamarind as a preservative. Oil also acts as a preservative by not allowing air to come in contact with the pickle. Several of the spices we use also preserve as well as give flavour to the pickles. The most favourite fruits for pickling are raw mangoes and limes. Most mango pickles are oil-based. However, there are some which are dependent only on salt and spices for preservation. Lime pickles may be preserved in oil or just in lime juice with salt and spices. The strong acid of lime coupled with salt acts as a preservative (see Appendix 2 for recipes).

Preserving with sugar: As discussed earlier sugar in high concentrations acts as a preservative. Some of the most popular preserves with sugar which can be made at home are jelly, jam and marmalade. The concentration of sugar in these is 68 per cent or more, which does not allow microorganisms to grow.

Jelly is made only from the juice of the fruit. A clear juice extract which contains pectin (complex carbohydrate present in some fruits) is boiled with a certain proportion of sugar (0.75 to 1.0 kg sugar for 1.0 kg extract) to a consistency at which it will set on cooling. A perfect jelly should have a beautiful colour, should be transparent and firm, and on touching should quiver; it should not be syrupy like honey, or sticky; you should be able to cut it with a spoon and the spoon should come out clean. To get this for jelly making, the fruit should contain a substance called pectin (in enough amount) and a certain amount of acidity.

Jams are usually made from the whole fruit — the pulp as well as the juice and quite often the skin as well. The whole fruit (strawberry, gooseberry) or the chopped pulp (mangoes, peaches, apples) of the fruit is cooked with a certain quantity of sugar (0.75 to 1.0 kg sugar for 1.0 kg fruit) to a setting consistency. If the fruit is not acidic enough, citric acid or lime juice is added to improve the flavour and the setting property. Fruits good for making jams in India are pineapples, mango (both ripe as well as raw), peach, apricot, apple, strawberry and gooseberry (rasbhari).

Marmalade is made with the juice extract of a fruit with thin slices of the skin or the fruit suspended in the clear jelly-like mixture. Citrus fruits like oranges are good for making marmalades. Pectin and acid are both essential for the jelly-like consistency of marmalades. The proportion of sugar to juice is the same in a jelly.

Preserves or murabbas are made either with the whole fruit, particularly if the fruit is small in size like the Indian gooseberry or with uniformly cut pieces of the fruit like in the case of apple. Special care is taken to preserve the shape of the fruit or the pieces. The fruit is preserved in a heavy syrup but the flavour of the fruit is not masked by an excess of sugar. The murabba should be plump, glistering, firm and clear (Recipes for some of these preserves are given in Appendix 2).

Preserving by use of chemicals: As discussed earlier, certain chemicals are permitted for preserving foods. The quantities to be used are also regulated by law. *Tomato sauce* is an example of preserving by heat and chemicals, other being *squashes.*

Squashes are fruit juices preserved by the addition of sugar as well as chemicals. Juices which are sour make good squashes, for example, grape juice, orange juice, lime juice and pineapple juice. When the acid is not enough you add some, either citric acid or lime juice. Generally, the chemical preservative protects squashes from the action of microorganisms except in the case of the lemon squash. In this recipe the amount of sugar is so high that no microorganism can grow in it, and, therefore, you do not require either a chemical preservative or boiling.

15.4 MAXIMIZATION OF NUTRITIONAL BENEFITS AT LOW COST

With increasing population and limited food resources it is important for us to get maximum food value out of every bit of food we can buy. You can accomplish this by enhancing the nutritive value of foods, by preventing or minimizing the loss of

nutrients in food preperations and by avoiding wastage of food. Let us see how each of these measures operates.

15.4.1 Measures to Enhance Nutritive Value of Foods

Sprouting, fermentation and combining different foods in a meal are ways to get the maximum nutritional value from some of our foods. You are already familiar with these processes. Let us talk about each of these in some more detail.

Sprouting: Dry pulses and grains do not normally contain vitamin C, but when they are allowed to sprout or germinate vitamin C is formed in the grain and in the growing sprout. Sprouting also increases the content of B vitamins present. As you know, sprouting involves soaking the pulse or grain in water for 24 hours and then wrapping them in a damp cloth. In two or three days the grains germinate and the sprout grows to a size of 3/4th of an inch. You must keep the wrap damp all the time. The germinated grain can be eaten raw or after cooking for a very short time so as not to destroy the vitamin formed in it. The grain commonly used to sprout is bengal gram. Even better than bengal gram is the whole green gram (moong dal). Sprouted green gram contains three times more vitamin C than sprouted bengal gram. This is an excellent example of how one can get maximum nutritional benefit from a food item using very simple and inexpensive techniques.

Fermentation: Natural fermentation in food occurs when environmental conditions permit interaction between microorganisms and the food substance. Fermented whole wheat flour is used to make bathura or nan (deep fried small rounds made from fermented wheat dough) and the fermented dosa and idli mixtures are examples of natural fermentation. The process of fermentation encourages the multiplication of specific microorganisms and their metabolic activity in food. This is what we do when we turn milk into curds; we encourage the multiplication of the lactic acid bacteria in the milk. If you see curds under a powerful microscope you will find it crawling with these bacteria. The significant point is that several of the end-products of such food fermentation, particularly the acids and alcohols produced, do not permit the growth of pathogenic (disease producing) microorganisms that may find their way into foods.

Fermented foods often are more nutritious than their unfermented counterparts. This is because of three reasons. One is that microorganisms not only break-down more complex compounds, they also synthesize several complex vitamins e.g. riboflavin, vitamin B_{12} and vitamin C. Therefore, the content of these vitamins in fermented food is higher than in their unfermented counterparts.

The second way in which fermentation enhances the nutritional quality of a food is by liberating nutrients locked inside the plant structures and cells by indigestible materials. Tnis is especially so in the case of grains and seeds. The milling processes do release some of the carbohydrates and proteins by rupturing the outer hard covering of the grain. However, coarse milling as practiced in the villages is not enough to release the full nutritional value of such plant products; even after cooking, some of the entrapped nutrients may remain unavailable to the human digestive processes. Fermentation breaks down the indigestible protective coating and cell walls both physically and chemically, making the structures more permeable to the water of cooking as well as to man's digestive juices.

A third mechanism by which fermentation enhances nutritional value, especially of plant material is by splitting cellulose and hemicellulose (i.e. fibre which man cannot digest into simple sugars) which can then be utilized in the human digestive tract.

A large variety of fermented food products are made use of by people of different nations the world over. Some of the ones we are familiar with are curd, butter-milk and coffee beans, all made with the help of lactic acid bacteria; wines and vinegar made by bacteria producing acetic acid; beer, rum, whisky, brandy and bread made with yeast fermentation; cocoa made by yeast along with acetic acid producing bacteria.

Food combinations: You have already studied about the importance of proteins to the human body, and about the fact that cereals or pulses taken by themselves cannot provide our body with adequate proteins — one or the other essential amino acids would be lacking (Unit 3, Block 1). If, however, we consume a judicious combination of pulse, cereal and other plant foods, the net quality of proteins we receive would

have the desirable pattern of essential amino acids. The proteins of cereals and pulses have a natural supplementary effect, and a deficiency of an amino acid in one food item can be made good by an excess of the same in another, if both foods are consumed at about the same time.

Some of our traditional dishes like idli-sambar, rice dal, chola-bhatura, khichri, dal-roti, pulihora, bisi-bella-hulliyana are some of the examples of such nutritionally beneficial combinations of foods. You can find some more in the area you live. Many nutritionally beneficial combinations for infants, growing children and pregnant and lactating mothers have been worked out by agencies and organizations interested in improving their nutritional status (You have read about some of these ideas in Block 3).

Fortification: As you know, fortification is a technique to add nutrients to a particular food item. Nutrients chosen for fortification are those that are likely to run into short supply because of either dietary habits and prejudices, or due to the inability of the people to purchase foods that contain them, or because the foods that are supposed to contain them do not do so in a particular area. Other criteria of selection is to be able to mix a nutrient with a food without affecting its acceptability, and the overall cost of such fortification. Food items selected to be fortified are those that are consumed by the largest, cross-section of the population. Examples of fortification in our country are vitamins A and D in hydrogenated fats, iodine in common salt.

15.4.2 Minimizing and Preventing Nutrient Losses in Food Preparation

The food that we prepare should be palatable as well as nutritive. Neither of these qualities can be sacrificed at the cost of the other. However, to accomplish a correct balance is not an easy task. There are certain facts we must keep in mind, and certain general rules that we must follow to come as close to a perfect balance of nutritional quality and palatability as we can.

Some of the vitamins — the water soluble ones are easy to loose. They get lost in the water we use for preparing or cooking, by exposure to sunlight and air, and by prolonged heating. Some of the rules to observe in processing and cooking food so that there is minimum loss, if any at all, of the nutrients in our foods are as follows:

a) Wash vegetables before cutting

b) Cook vegetables on low flames with as far as possible no water and keep them covered while cooking

c) Do not overcook

d) Cook rice in just as much water as it needs to cook. Do not use extra water which needs to be thrown away

e) Cut fruits just when you are ready to eat them

f) Use acid foods, such as lime juice, tomatoes, vinegar, or curds in salads. It helps to retain the vitamin C value of the salad item.

For more details on this aspect, you can refer to the practical Manual — I, Section 3.

Figure 15.2 shows various preparation and preparation methods generally adopted while cooking meals. Some of them are wrong and others are right. Tick mark on the right methods.

15.4.3 Measures to Avoid Food Wastage

Wastage of food can occur at any stage of operation from harvesting of food material to its consumption. As already mentioned almost 10 per cent of our cereal crop in this country is wasted at the farm level. If this is so with non-perishable crops, the wastage must be very much higher in the case of semi-perishables and perishable food items.

There can be wastage of food at two-stages — at the level of producer and at the level of consumer.

The following flow charts explain possible points of wastage in both of these stages.

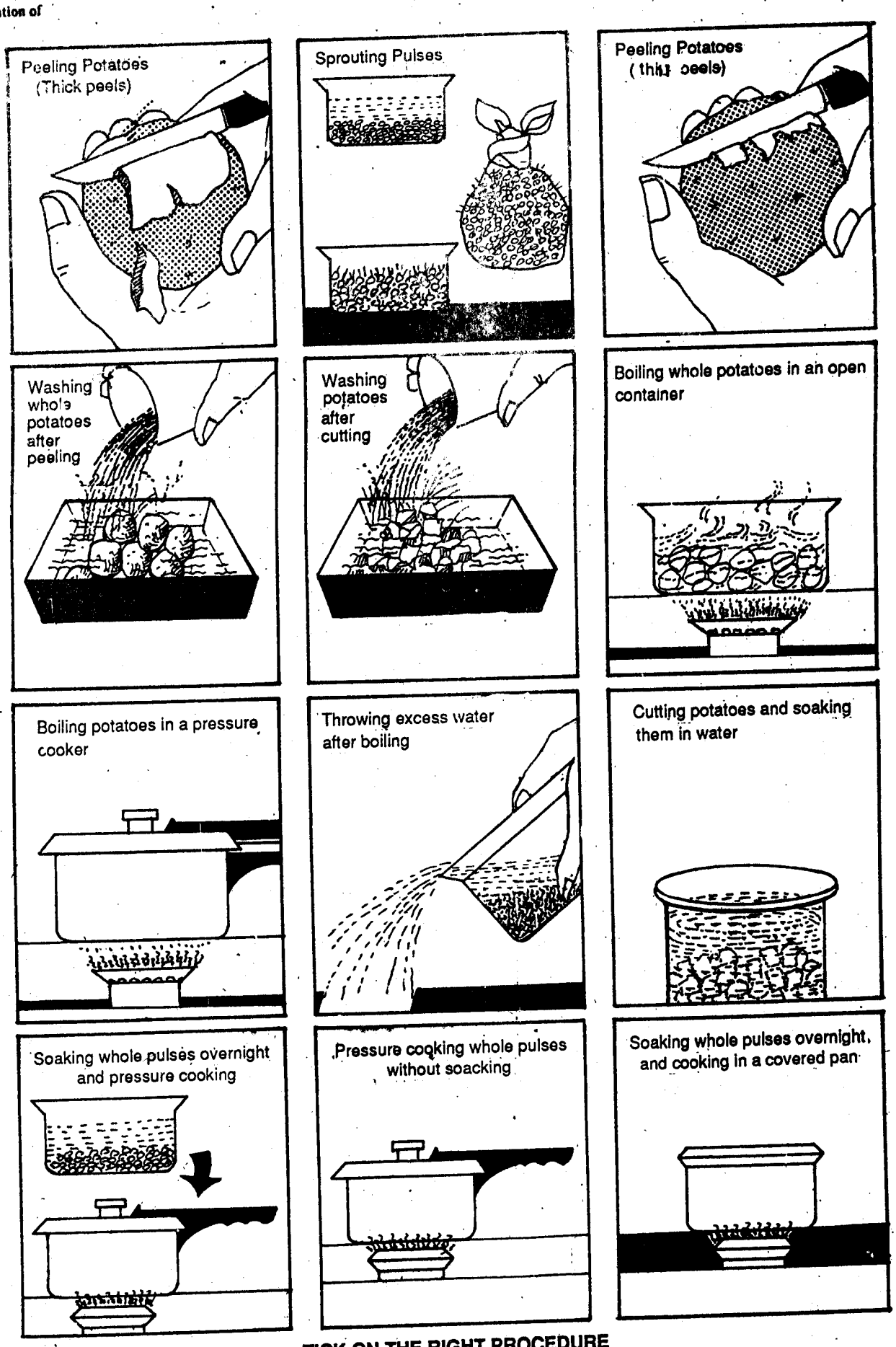


Figure 15.2 : Find the right procedure of cooking meals

Points of Wastage at the level of producer

Farm → transportation → sale → distribution → godowns/markets (where the food item to be stored sold or distributed).

Points of Wastage at the level of consumer

Preparing the food items for processing/cooking → serving the food to family members → use of stored leftover food items.

We as consumers have very little control over methods adopted to eliminate or minimize wastage before the food comes to us as a commodity we have purchased. However, from that point onwards, it is in our hands to prevent any further wastage. Let us dwell on these points.

In Block 3, (Unit 7), you have learnt how to make judicious use of leftovers in order to avoid wastage of food. Can you think of some other measures which you would like to adopt in order to avoid wastage of food at home? You may find the following suggestions useful:

a) Plan meals in advance for at least one week's meals. Plan your meal preparation for the week keeping the meal plan in mind and vice-versa. For example, if you have srikhand on the menu one day, you can plan to serve lassi (curd whipped with a little water) the same day or the next, making use of the liquid that will drain out from the srikhand, thus utilizing a nutritious by-product.

b) Use the leftovers as early as possible.

c) Check your store to see what is already there before you make the market list. Use food items that are likely to spoil first.

d) Buy the correct amount needed, thus being assured of enough food for meals and no food wastage. Particular attention must be given in this respect to foods that cannot be stored adequately by you and must, therefore, be consumed.

e) Review your next day's meal plans at the end of the previous day so that, if necessary, you can alter them to take care of any new developments in your family's plans or to use the leftover foods you had not expected to be there.

Check Your Progress Exercise 2

1) Give the name of the preservative commonly used in making the following products –

   a) Orange squash .....

   b) Mango pickle .....

   c) Guava jelly .....

   d) Tomato sauce .....

   e) Mango powder .....

2) How is fermentation of food products beneficial?

   .....

   .....

   .....

   .....

3) Comment on the following statements:

   a) Sprouted green gram dal is more nutritious than green gram dal itself.

      .....

      .....

   b) Some of traditional food combinations like idli-sambar, rice-dal, roti-dal are nutritious than individual dishes like idli, sambar, rice, dal.

      .....

      .....

   c) Iodine is added to salt.

      .....

d) Rice should be cooked in just as much water as it needs to cook.

.....

.....

15.5 LET US SUM UP

In this unit you have learnt that:

- Preserving food is an important aspect of making available food last longer.
- Food can be made to last longer by either slowing down or completely stopping the growth and activity of microorganisms and the naturally inherent enzymes in the foods, or by completely destroying them.
- Every method of preserving food also has harmful effects on the quality of food particularly on its appearance and nutritive value.
- Methods are available by which the nutritive value of certain foods can be enhanced without any or much cost.

15.6 GLOSSARY

Bacterial spore : Spores are hard resistant bodies which are formed by some kind of bacteria when conditions become adverse for surviving.

Canning : Canning here refers to the method of preservation of fruits, vegetables, meat and meat products in sealable cans. The process involves placing of blanched fruits and vegetables in the can, closing, heating of the can and then cooling.

Carbonated : Addition of carbon dioxide.

Cellulose : A complex carbohydrate that cannot be digested by man.

Decomposition : A process of decay or spoiling.

Inactive : To put out of action.

Palatability : Ability to stimulate desire to eat.

Pathogenic : Disease producing.

Pectin : A class of complex carbohydrate present in some fruits; these help in the setting of jellies and jams.

Sterile : Totally free of microorganisms.

15.7 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) a) 38°C b) more c) spoiled, bacteria d) acid e) aerobes.

2) a) High concentration of sugar in the juice causes the water from inside the bacteria to move out. This results in dehydration of the bacterial cells and interfere with their growth and multiplication.

b) Heat associated with the smoke kills the microorganisms.

c) Wax coating prevents air from coming in contact with the cheese. So, some microorganisms which require air for the growth cannot grow.

d) Sodium benzoate inhibits growth of mould in jelly.

e) Blanching of vegetable before freezing destroys natural enzymes present in them and hence prevents self decomposition of food.

f) Sun drying of raw mangoes removes the moisture present in mangoes.

Removal of moisture from food products inhibit the growth of microorganisms.

3) a) ii b) v c) vi d) iii

Check Your Progress Exercise 2

1) a) Sugar and chemicals

b) Salt and oil

c) Sugar and pectin

d) Heat and chemicals

e) Sunlight for removal of moisture.

2) a) Fermentation makes the food lighter and more digestible

b) Fermentation improves the keeping quality of foods as the several end-products particularly the acids and alcohols do prevent the growth of disease producing microorganisms.

c) Fermented food is more nutritious.

3) a) Sprouting results in formation of vitamin C and increase the content of B vitamin, already present in the dal.

b) These cereal-pulse combinations improve the protein quality of the meals and hence are nutritious.

c) Addition of iodine to salt is an example of food fortification. Salt does not have iodine. Iodine is added to it.

d) If excess water is taken for cooking and it is thrown away; most of the water soluble nutrients will be lost in the water thrown away.

UNIT 16 FOOD SAFETY

Structure

16.1 INTRODUCTION

While food contains all the nutrients that the body requires and benefits from it can also be a carrier of substances and microorganisms (living or otherwise) which cause harm to the body. Foods that we need for our sustenance and growth, also provide material for the sustenance and growth of a host of microorganisms. Some of these microorganisms can cause a great deal of harm to the human body. Therefore, it is imperative that through all the stages of producing, handling, storage, preparation and serving, food is kept safe from such contamination. In this unit we will talk about the types of contamination and how to protect our foods from them. We will also discuss the problem of accidental or deliberate addition of undesirable material to food. This is called adulteration. How do we detect this? You will find some answers in this unit. Finally, we talk about measures that have been taken to protect and ensure supply of safe food to consumers.

Objectives

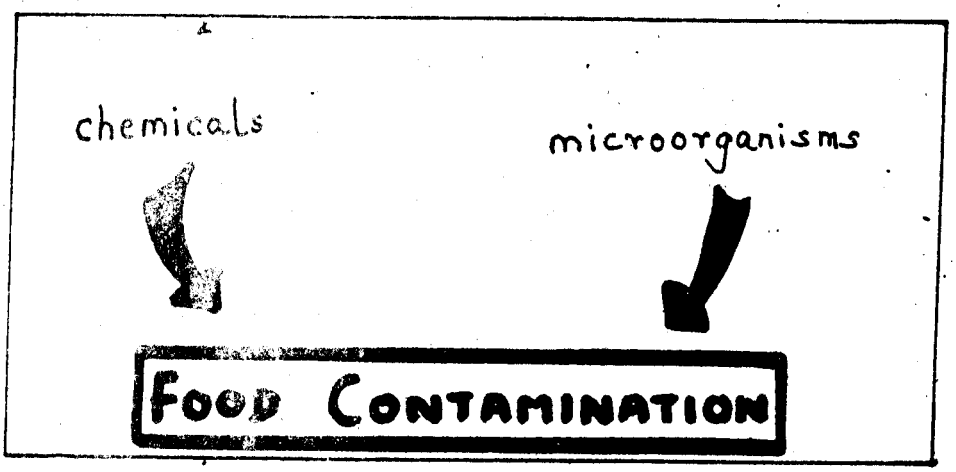
After studying this unit, you will be able to:

- identify ways in which you can protect your food from different types of food contamination,
- list substances that are accidentally or intentionally added to food items,
- describe the hazards of food adulteration, and
- apply laws and standards regarding food quality and safety that have been promulgated in our country, to protect your interests.

16.2 FOOD CONTAMINATION

Food can get contaminated by the water used for washing and cooking, by the soil in which it is grown, by the containers used for storage, preparation and serving and by the personnel handling the food at various stages, particularly at the stage of dishing it out and serving.

Food contaminants can be of two distinct types — *chemical contaminants* and *microorganisms.* Let us discuss these two types of contamination in a little detail.



16.2.1 Chemical Contaminants

You may know that we add chemicals to food when we salt fish and meat, ferment plant and animal substances or add spices to improve the taste of our food. These are just a few examples of the large variety of chemicals we add to foods not only to preserve them but also to improve their appearance, texture and flavour. Some are added to improve nutritional value and some to help in the processing of certain food items. But are these contaminants? No, they are in fact *additives*. They are added intentionally. However, in excess amounts they are harmful for human health. These quantities are prescribed by laws which protect the interests of the consumer. A permitted chemical in quantities higher than prescribed becomes a case of adulteration as you will see in sub-section 16.4.1.

Now let us come back to the question of contaminants. There are many instances of chemicals that are not supposed to be present in food, but get into it by accident. These cause injury to human health. Such substances can be called *contaminants*. Pesticides are an example of such toxic chemicals. As time goes on more and more pesticides get accumulated in our bodies due to their presence in food. Such accumulation can cause abnormalities in the functioning of vital organs and body systems such as the kidney, circulatory system (blood) and brain. Some pesticides have been linked to cancer.

Besides pesticides, chemicals that may leach into food from packing material, or trace amounts of lubricants that can get into the food from processing machinery are all unintentional contaminants in our food.

Poisons like lead and cadmium can enter the food through improperly coated utensils. These poisons are also called industrial contaminants of food. This is because factories and industries release many of these chemicals into rivers and lakes as part of their wastes. This then gets into the soil and plants. Their hazards are described in Table 16.1.

Table 16.1: Major Industrial Contaminants of Food

Contaminant	Foods Involved	Health Effects
1) Polychlorinated Biphenyls (PCBs)	Fish, milk including human milk, poultry, eggs, meat, processed and packaged food.	Eye discharges, eye inflammation, severe skin problems, hair loss, reproductive problems, liver tumours, liver damage; may cause cancer, male sterility, learning problems and other abnormalities in children when mothers are exposed to PCBs.
2) Mercury	Fresh water fish from polluted waters (not salt water fish), seeds treated with mercury fungicides, plants, foodstuffs grown close to polluted waters, milk from cattle grazing on contaminated plants.	*Acute*: Severe abdominal pains with nausea, vomiting, diarrhoea accompanied in some cases by severe damage to kidneys and liver. *Cumulative*: Damage to brain and central nervous system, manifested as mental and emotional disturbances, loss of concentration, memory, general weakness, tremors in the extremities of limbs, loss of vision, hearing, paralysis, insanity.

Contaminant	Foods Involved	Health Effects
3) Cadmium	Shell fish, aquatic plants and animals, liver and kidneys of mammals, foodstuffs from soil where sewage and industrial wastes are dumped or treated with phosphate fertilizers, processed food, cigarettes (1 cigarette may have 2 micrograms of cadmium, 10 per cent of which may be inhaled as smoke).	Kidney stones, increased excretion in urine of calcium and amino acids (from proteins), kidney damage, multiple fractures.
4) Lead	Water, liver and kidney of animals, agricultural produce from orchards treated with a pesticide-lead arsenate or from places close to roads with heavy traffic, canned food especially acidic food, canned milk and milk products.	Nausea, sleeplessness, constipation, fatigue, abdominal pain, anaemia, abortions, still births, neonatal deaths, irreversible changes in the kidneys and brain, paralysis, convulsions, mental disorders and permanent retardation in children.

Source: Poisons in Our Food by Thankamma Jacob, Publication Division (1987).

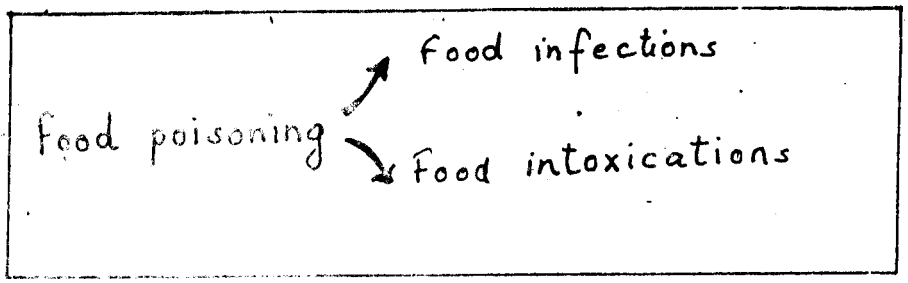
This table includes several terms you may not be familiar with. To help you along here is a Box which lists difficult terms with their meaning:

Box 16.1: Understanding the Technical [illegible]

Pollutant	Harmful substance entering water, soil [illegible]
Pollution (Polluted)	The contamination of [illegible] soil, air [illegible] other substance [illegible]
Fungicide	Chemical [illegible]
Acute	Immediate effects that appear [illegible]
Cumulative	Long-term effects that appear over a period [illegible]
Anaemia	Low level of haemoglobin in blood.
Abortion	[illegible] baby.
Still birth	Baby born dead.
Irreversible Changes	Changes that cannot be reversed on [illegible] changes.
Paralysis	Condition [illegible] or control its functions.
Convulsions	Fits wherein the person shakes violently, [illegible] movement. Saliva usually [illegible] may even choke on his tongue.
Neonatal deaths	Deaths of newborn infants.

16.2.2 Contamination by Microorganisms

You are probably already familiar with the term 'microorganism'. Microorganisms are tiny, living cells. Bacteria and viruses are microorganisms as you studied in Unit 14. Certain microorganisms contaminate food and cause disease in individuals who consume this food i.e. they cause food poisoning. *Food poisoning*, in other words, is the term used to refer to *the harmful effects of consuming food contaminated by microorganisms.* Food poisoning is classified into two categories: (a) food infections; and (b) food intoxications.



Food infections generally involve microorganisms present in the food at the time it is consumed. Once inside the human being they begin to grow and cause disease. Diseases like cholera, dysentery, typhoid are examples of infectious diseases caused by eating contaminated food. A number of *viral infections* also may be contracted by man through contaminated food that has not been processed or handled adequately. These are infectious hepatitis, poliomyelitis, and various respiratory and intestinal disorders.

Food intoxications involve toxic substances produced in the food by microorganisms, before it is consumed. When such food is eaten the person becomes sick because of the toxin. *Staphylococcus aureus* and *Clostridium botulinum* cause bacterial food poisoning because of the toxins they give rise to in the food. Poisons produced by staphylococci cause severe nausea, vomiting and abdominal pain. The toxin produced by Clostridium botulinum can kill. It causes dizziness, difficulty in swallowing, speaking and breathing and finally paralyzes the neck, arm and leg muscles as well as the respiratory system.

Certain moulds also produce toxins in the food they attack. These toxins are called *mycotoxins.* The ones commonly known are the aflatoxins found in peanuts and sometimes maize, wheat, rice, sorghum and soyabeans as well, which have been attacked by a particular mould. They cause liver diseases among those who consume such infected foods. The ergot fungus is associated with bajra, wheat, jowar and rye. This fungus produces toxins which result in ergotism. The toxin causes gastrointestinal disturbances, painful cramps in the legs, gangrene in fingers and toes, depression, weakness and convulsions. Gangrene is a condition where body parts begin to get destroyed due to infection. Such parts often have to be cut off otherwise it can spread to other parts of the body.

Appendix 3 gives some food infections and intoxications along with the causes and the types of foods usually involved in our country. After going through this table, we hope you will realize how absolutely imperative it is to implement the strictest possible standards of cleanliness in our food-related activities. It is important to mention here that food vendors that are always present around schools and offices selling sugarcane juice, coloured sherbats, pani-puri, bhelpuri, chat or cut and sliced fruits are responsible for gastrointestinal bacterial infections as well as chemical poisoning by using non-permitted food colours.

Highlight 6 gives you the main precautions to keep in mind so as to avoid contamination by bacteria and moulds i.e. to avoid food poisoning.

HIGHLIGHT 6

How to get the better of bacteria and moulds

Bacteria

1) Observe the rules of food hygiene at every stage in the handling of food. People known to be harbouring infections should not be allowed to handle foodstuffs at the critical stages of preparation and distribution.

2) Keep perishable foods under deep freeze or refrigeration in a clean condition immediately after purchase to prevent multiplication of bacteria already present. The refrigerator should be kept clean and foodstuffs must be placed in it in such a way that cold air can freely circulate around different items. This is to make sure that the foodstuffs kept in the refrigerator are cooled rapidly and kept cold. No spoilt food should be placed in a refrigerator, lest it spoils other foods too.

3) Cook foods for a sufficient length of time and at temperatures high enough to destroy the bacteria. Meat should be cut into small pieces to ensure thorough penetration of heat. If required in large chunks, meat should be roasted or pressure-cooked.

4) Do not keep foods exposed, especially after cooking. If the food is to be consumed later, it should be promptly cooled and then put in the refrigerator.

5) If the food has been refrigerated for a long time, it should be reheated before consumption.

6) Foodstuffs such as custard-filled bakery products should be reheated in an oven at 200° C for 20-30 minutes before consumption.

7) Storage, cooking and service areas should be kept clean and free from insects and rats.

Moulds (Fungi)

1) Never buy any food in a poor condition. Over-ripe, discoloured, bruised or cut vegetables and fruits, for example, should not be purchased. Even cheese showing cottony spots on the surface must be discarded because there is no way of knowing whether the mould is good or bad. When buying fruits to last for several days, it is advisable to stagger the ripeness, so that at the time of consumption, the fruit is just ripe and not overripe. In other words don't buy all at the same stage of ripeness. Buy fruits which are slightly under-ripe.

2) If mould growth is noticed on any food, never scrape it off and eat the remaining food, as is normally done with coconut. It is just not [illegible] example, the stem area of a ripe and healthy looking tomato or plum [illegible] mould growth, it must be rejected. For the 'fuzz' or 'fluff' is merely the [illegible] of the mould and there will be roots which may have spread throughout [illegible] food. Cooking does not always destroy fungal toxins in foods and hence do not rely on getting rid of the poisons by boiling or cooking.

3) Store perishable foods carefully so that moulds are not permitted to grow. Refrigeration generally inhibits mould growth but does not arrest it completely. In fact, some refrigerators show black spots due to mould growth which must be removed by washing and subsequent drying. Drying is essential if drying is omitted, the mould will remain because, of all the factors favouring mould growth, moisture availability is the most important.

4) Foodgrains and nuts must be dried immediately after harvesting and only when sufficiently dry should be stored in clean, dry air-tight containers in a cool place. The stored goods must be periodically inspected for [illegible] clumping together forming small or large lumps. If the grain [illegible] must be dried again and then stored.

5) Mould-contaminated foods must always be burnt or buried and not simply discarded lest the mould spreads and contaminates other human or animal foods.

c) Lead Poisoning
d) Moulds
e) Intestinal parasites
iii) Pesticides
iv) Viral infection through food
v) Pests

16.3 FOOD ADULTERATION

We have just discussed various aspects of food contamination. We did differentiate between food contaminants and additives in the last section. Let us now move on to a study of food adulteration.

Adulteration is an act by which

- something is added to a food item which is inferior in quality or makes it impure with the intention of making more profit *or*
- something is removed from a food item which reduces its quality.

The commonest examples are adding water to milk in order to increase volume, and removing part of the cream from the milk without the consumer's knowledge. Mixing green cardamoms from which essential oils have been removed with good quality green cardamoms is also an example of adulteration. ***Any substance which is used to adulterate a particular item of food is called an adulterant.*** Water is an adulterant for milk and semolina is an adulterant for fine grained sugar. Metanil yellow which is used to give a bright, yellow colour to turmeric is an adulterant. Papaya seeds are adulterants for black pepper.

Adulterated food may only make us undergo a monetary loss by making us pay partly for the rubbish that is added to the food. However, it may actually endanger health like in the case of metanil yellow as you will see in the following discussion.

16.3.1 Common Adulterants and their Health Hazards

Adulterants need not always be harmful. Unscrupulous shopkeepers mix poorer quality rice in better quality rice (such as basmati). This is a good example. The poor quality rice would not harm us. However, this does mean not getting full value for our money. There are, however, several adulterants that can cause harm. We have listed these here:

- **Sand, marble chips, gravel and earth** — mostly added to grains, pulses, coriander seeds, rice, etc. If ingested they can upset the digestive system besides being carriers of infection. They are extremely unpleasant in the mouth and can hurt the teeth and the gums.
- **Water** — mostly used to adulterate milk. Generally the source of the water is not clean and therefore it also carries infections.
- **Petroleum oils** — used for adulterating edible oils. Used motor oils are an example. These oils are toxic and cancer-causing.
- **Mineral oil** — used for coating black pepper to prevent fungal growth. These can be serious health hazards as some mineral oils are toxic for human beings and contain compounds capable of causing cancer.
- **Argemone seeds and oil** — Argemone is a ye low-flowered plant that looks like the poppy with bluish, silver-veined prickly leaves. Argemone seeds resemble mustard seeds and they are mixed with them during extraction of mustard oil. Both the seeds and oil are highly toxic and the consumer can lose his eye sight and develop a condition called *epidemic dropsy*. When such adulteration takes place we have an epidemic of these symptoms. Dropsy is a disease in which watery fluid collects in cavities or tissues of the body causing swelling. The disease starts with gastrointestinal disturbances and irregular fever with a rash on exposed parts of the body. Death can occur due to cardiac arrest (i.e., heart stops beating).
- **Lathyrus sativus (Kesari dal)** — Kesari is a very hardy plant and the pulse derived from it is used to mix with bengal gram which is more expensive, in order to make bengal gram flour. In villages of Madhya Pradesh and Uttar Pradesh, it is also used as wages for farm labour. It can cause a form of crippling paralysis in boys and men 5 to 45 years old. The disease is called *lathyrism*. The disease starts with

stiffness of the knee joints and legs with pain around the knee and ankle joints, as well as in the back thighs. You can read more on this aspect in Unit 19 of Block 5.

- **Papaya seeds** — are used to adulterate black pepper.
- **Talc** — used to polish pulses. Talc has been linked to stomach cancer.
- **Washing soda or maida** — used to adulterate icing sugar.
- **Metanil yellow and lead chromate** — used to give colour to turmeric and to jalebies. These are highly poisonous. Metanil yellow affects the reproductive organs and can cause sterility. It has also been associated with stomach trouble and cancer. The possible health hazards of lead chromate include anaemia (low haemoglobin levels in blood), paralysis and brain damage especially in children.
- **Used tea leaves** — dried, powdered and coloured, are used to adulterate tea leaves. Used tea leaves can be the cause of infection and food poisoning depending on the source from which they are collected.
- **Malachite green** — used to colour dried peas a bright green so that they look like fresh peas. This can be poisonous and can cause cancer and abnormalities in vital organs such as the kidney, spleen and liver. The colour has also been known to cause abnormalities in the foetus in experiments conducted on animals.
- **Coloured saw dust** — is used to adulterate red chilli powder. This can upset digestion and cause infection.

16.3.2 Simple Tests to Detect Adulteration

Tests are available by which one can detect adulteration in quite a few of our commonly adulterated foods. Some of them do require a few simple reagents and chemicals or tools which can be easily purchased without too much cost, and it is worth going to the trouble of keeping a stock of these for ready testing. Let us talk about the simplest of these tests.

Detecting the presence of excess water in milk — This can be done by measuring the specific gravity of the milk with a small gadget called a lactometer. You can buy it in the market. Try the scientific equipment shops. A specific gravity reading of less than 4 is an indication of excess water in milk.

Detecting fine sand or semolina in fine-grained sugar or salt — Stir a little of the sample into a glass of clean water. The sugar or salt will dissolve leaving a residue of the sand or semolina at the bottom of the glass.

Detecting sand or dirt in jaggery — Boil a little jaggery in water. Jaggery will dissolve leaving sand and dirt at the bottom.

Detecting adulteration of black pepper with papaya seeds — Put a sample in a glass of water. Papaya seeds will float and the pepper corns will settle at the bottom.

You would have noticed that these tests did not require you to use any special equipment or chemical reagents. Appendix 5 gives you some simple tests that do require special equipment and chemicals. For your convenience these have also been listed (Appendix 4).

Highlight 7 lists the major precautions you can take to protect yourself against adulteration.

HIGHLIGHT 7

What you can do to fight adulteration

Caution is the watchword. If you are careful and you take sufficient precaution you can protect yourself from the hazards of adulteration. Keep the following points in mind:

1) Buy food items in packed form. Don't buy loose oils or spices and particularly
2) Buy from familiar shops and cooperative stores.
3) Look for quality marks such as ISI, Agmark, FPO.
4) Reject artifically coloured rice, pulses, sweets, spices.
5) Use natural coloured foods to brighten up meals and teach others to do the

6) Grind your own spices, besan, cereal flours if possible.

16.4 PROTECTING THE CONSUMER

Most of us in India spend the highest percentage of our income on food. We would like to get the maximum returns for the money we spend without compromising on quality unless we do so as a matter of choice. In Unit 13 we discussed what food quality means. It would be worth repeating here that among other attributes, it includes nutritional quality, absence of toxicity as well as microbial safety. These attributes must be evaluated before declaring any food as wholesome. Food products must be produced under strict hygienic conditions, free from contaminants, processed without much loss of nutritive value, packaged under sanitary conditions and marked with suitable labels. As buyers and consumers it is our right to know what we are consuming. We should also be able to protect our right of acquiring clean and wholesome food. Several laws have been promulgated to protect the interests of consumers in various countries. We, in India, also have certain food laws and minimum standards of quality laid down for a large number of food items.

16.4.1 Food Laws

Food laws are extremely important for providing wholesome, nutritious, poison-free food to the public. Food laws encourage the production and handling of food under hygienic conditions, and also prevent the chemical and microbiological contaminations which are responsible for the outbreak of food-borne diseases and other health hazards affecting large segments of the population. The main objectives of food laws can be briefly summarized as follows:

1) To protect the consumer against any health hazards arising out of adulteration.
2) To protect the consumer from unfair trade practices.
3) To ensure and enforce fair trade practices.

The Government of our country has passed a number of laws to protect the interest of the consumers in this regard. We shall discuss some of these which concern us directly.

Prevention of Food Adulteration Act: Referred to as the PFA Act in short, it came into effect from June 1, 1955. It pertains to food sold, and defines in specific words what is meant by a food adulterant, and what shall be considered to be an adulterated food. According to it, food can deemed to be adulterated when any one of the following acts are resorted to:

— Admixture of inferior or cheap substances

— Extraction of certain quality ingredients from the food

— Preparing and packing under unsanitary conditions

— Sale of insect-infested food

— Obtaining food from a diseased animal

— Incorporation of a poisonous component

— Use of colouring matter or preservatives other than, or in quantities greater than that approved for the food

— Sale of substandard products which may or may not be injurious to health.

These are the prohibited practices under the P.F.A. Act. Persons found guilty of selling such adulterated food can be punished, the severity of punishment depending upon the gravity of the offence. The Act is implemented by the State governments and the local authorities. They provide laboratory facilities for dependable and quick analysis in addition to management facilities for implementing the PFA Act. The local Health or Food Authorities are invested with executive powers to inspect, collect and analyze stored and marketed foodstuffs and finally prohibit the sale of foods found to be adulterated.

The PFA Act provides guidelines for the minimum basic requirements of food quality. The guidelines are primarily intended to protect consumers from the health hazards of poisonous food. The Act also covers requirements for labelling of food products.

You may have come across labels which try to trick you into thinking that it is the label for a well-known product. The name is usually slightly different or the design of the package imitates that of another product. The PFA Act calls this ***misbranding*** and provides for measures to tackle this malpractice.

Your Progress Exercise 3

Which of the following would be considered cases of adulteration according to the PFA Act? Indicate by marking a tick (√).

i) Mixture of parmal rice in basmati

ii) Mixture of broken basmati grains in basmati rice of better quality.

iii) Mustard oil showing traces of argemone oil.

iv) Permitted preservatives within amount prescribed.

v) Banned colour in jalebis.

vi) Permitted colour in amounts over that prescribed.

vii) Insect infested dal.

viii) Meat packed in a dirty slaughter house.

ix) Meat packed in transparent polythene.

x) Mixture of used tea leaves in fresh.

The Fruit Products Order: With the exception of traditional items like pickles, chutneys, the fruit and vegetable preservation industry in India started in the early thirties. It gained strength during the Second World War to meet the needs of the defence forces, and a number of units got started all over the country. It was, therefore, felt that there was need to discipline these units and exercise checks on the quality of fruit products they produced. For this purpose the Fruit Products Order (FPO) was promulgated in 1955. It came under the Essential Commodities Act. For export purposes the fruit products are further subjected to preshipment inspection

under the provisions of the Export Act of 1963.

Under the provisions of FPO, it is obligatory to obtain a licence for manufacture of fruit products. The FPO lays down hygienic and sanitary requirements for setting up factories for the manufacture of fruit products, which include: (1) suitable location; (2) minimum fly-proof requirement and adequa e storage space; (3) construction and maintenance of factory premises; and (4) worker's amenities, and personal hygiene.

The order lays down statutory minimum standards in respect of the quality of various fruit and vegetable products, and processing facilities. Packing fruits and vegetables of a standard below that prescribed by this Order is an offence punishable by law.

Meat Products Control Order: This makes it illegal to transport meat unless it has been prepared and processed according to the provisions of the order, and carries the mark of inspection. It provides for means to:

- detect and destroy meat of diseased animals
- ensure that the preparation and handling of meat and meat products be conducted in a clean and sanitary manner
- prevent the use of harmful substances in meat foods
- see that every piece of meat is inspected before sale to ensure its wholesomeness.

The order also lays down rules and conditions for procedures to be adopted for the selection of disease-free animals, slaughter house practices and further treatment of the meat so as to maintain the meat in a wholesome manner, devoid of harmful microorganisms.

Besides these, there are several other orders promulgated under the Essential Commodities Act of 1946 which provide, in the interest of the general public, for the control of production, supply and distribution of, and trade and commerce in, certain commodities.

16.4.2 Food Standards and Certification for Quality Control

In general, quality is commonly thought of as degree of excellence — 'A' quality perhaps being the top degree of excellence, 'B' quality being a little less than 'A' in excellence, and 'C' quality being even lesser in excellence. In the broader sense quality is considered as a specification or set of specifications which are to be met. Quality characteristics include those relating to general appearance, size and shape, gloss, colour, consistency, etc. We have two organizations that are empowered to lay down standards of quality for food items, and to certify that these standards are met. These are the Bureau of Indian Standards (BIS) and the Directorate of Marketing and Inspection. The Indian Standards Institution (ISI) now called Bureau of Indian Standards (BIS), is the national standards body of our country. It operates the voluntary ISI (Certification Marks) Act of 1952 which has laid down standards of quality of processed food items supported by precise methods of testing these standards. The ISI Act 1952 empowers the Bureau of Indian Standards to establish and publish Indian Standards in relation to any article or process, recognise other standards as Indian Standards, specify the ISI Certification Mark, and grant, renew, suspend, or cancel the licence for the use of certification under the conditions prescribed by BIS. It covers almost all consumer goods from electrical equipment, utensils and cosmetics to processed food products. As regards food items, ISI mark is granted to a food processing unit only if the prc per hygienic conditions are maintained, in addition to the availability of testing facilities for quality checking of the products. Food items such as biscuits, baby foods, canned foods are ISI marked. The ISI certification scheme though voluntary, becomes mandatory under certain other Acts and statutes. Food colours, for example, cannot be sold under the provisions of the PFA Act if they are not ISI marked. The list of items under mandatory requirements is increasing day by day as the government is going ahead with enforcing minimum standards of quality in consumer goods. Look out for ISI markings!

The Agmark Standard: This was set up by the Directorate of Marketing and Inspection of the Government of India by introducing an Agriculture Produce Act in 1937. Rules under this Act enable the government to lay down grade specifications of quality for *raw food items*. grade designations, and also methods of marking to indicate various

grades. Any one willing to grade and pack in accordance with the provisions of the Act and Rules is authorised to use AGMARK in addition to his own trade brands. The very first standards laid down were for pure ghee, and the AGMARK Label No. 1 (special grade) was first affixed by an authorized packer in Calcutta in February 1938. This heralded an era of food quality control and quality certification under AGMARK, for the first time in India.

For the domestic market, grading and quality control under AGMARK is voluntary but for export purposes it has been made compulsory under the provisions of the Export Act of 1963. The commodities for export with mandatory AGMARK certification include food items as well as non-food items (like wool, tobacco, cotton, etc.). A total of 41 or so different commodities are certified with the Agmark. Some food items in this list are major spices like black pepper, cardamom, chillies, garlic, onion, ginger and turmeric, minor spices like coriander seeds and cumin seeds, vegetable oils like groundnut oil and safflower oil. Examples of non-food items on this list are sandalwood oil, wool, goat hair, castor oil, tobacco and sunhemp.

16.4.3 Agencies Involved in Consumer Protection

The Provisions of the PFA Act are drafted with the main purpose of protecting the consumer from adulterated foods which are injurious to him. The drafting of these rules has been the function of the Central Committee for Food Standards. The Bureau of Indian Standards (BIS) formulates standards for food, and these standards are complementary to those adopted by the PFA. These standards apply to the raw materials, the processed foods, the packing material, and even the premises where the food is processed.

There are four regulatory bodies which determine and control the quality of processed foods. In order of importance these are: (1) the consumer, (2) the research and development (R & D) or the Quality Control (QC) scientists in the country, (3) the Government organizations like the Central Committee for Food Standards (CCFS), the Prevention of Food Adulteration Act (PFA) and the Enforcement Directorate for it, Bureau of Indian Standards (BIS), and (4) the Parliament. The Parliament which has the people's representatives enacts the laws, generally on the recommendations of the CCFS, though it is not bound by such recommendations.

Governmental agencies: The PFA Departments in Central and State Governments and BIS enforce their regulations and/or keep a check on the standards and quality through various central and state laboratories as mentioned earlier. These include Municipal Laboratories in big cities, the Food and Drug Administration Laboratories of the State Governments, the Central Food Testing Laboratories of the Government of India, and Laboratories of the Export Inspection Council.

Voluntary agencies: Several voluntary agencies have programmes of educating the consumer so that he can safeguard himself from eating adulterated food. Private food testing laboratories are also available for carrying out food analysis. Most progressive companies have their own quality control laboratories.

A number of consumer protection organizations have sprung up in urban centres to protect consumers. The Consumer Guidance Society of India is one example of a voluntary consumer protection organization. It was started with Bombay as its headquarters, and branches in major cities. The society tries to create consumer awareness of the various forms of adulteration and develops consumer resistance to such adulterated food products by giving talks over the radio and using other mass media like putting up exhibitions in educational institutions. Enlightened consumers are on the executive of this Society. The Society gets food samples tested and brings out a publication 'Keemat' in which consumers are kept informed about the measures taken to combat malpractices in respect of food. They also try to educate the consumer about simple methods of detecting adulteration in foods.

Many other consumer organizations focus on helping the consumer in securing legal redress. If a person buys food, how does he or she know it is adulterated? What measures can be taken to protect the interest of the consumer who has been cheated of his money's worth? It is issues such as this which are taken up by local consumer organizations who advise the consumer on the best course of action.

Check Your Progress Exercise 4

1) Name the

i) Indian law that provides protection against adulteration of foods.

.....

ii) Indian law that ensures hygienic and safe manufacture of fruit products.

.....

iii) Indian law that ensures supply of safe and hygienic meats.

.....

iv) Indian organizations that prescribe and certify standards of quality in food items.

.....

16.5 LET US SUM UP

In this unit you have learnt that:

- food can get contaminated between the time it is harvested, slaughtered or manufactured and the time it is consumed
- contaminated food can be harmful for health
- food can be adulterated by either adding something undesirable to it or by removing something desirable from it
- there are laws to protect us from adulterated foods and to ensure safe and hygienic food items in the market
- there are organizations that prescribe desirable standards of food quality and
- consumers have formed consumer organizations to protect themselves against unfair trade practices.

16.6 GLOSSARY

Contamination	: To be infected with harmful substances.
Density	: The mass of a given substance per unit volume.
Intoxication	: Poisoning.
Leach	: The movement of substances present in a food into a surrounding liquid.
Lubricant	: That which lubricates.
Pesticides	: That which kills pests.
Preshipment	: Prior to shipping.
Promulgated	: To make known by declaration.
Sanitary	: Hygienic.
Specific gravity	: The ratio of the density of a material to the density of some standard material such as water as a specific temperature e.g. 4 degree C.
Specific gravity hydrometer	: A hydrometer which indicates the specific gravity of a liquid with reference to water at a particular temperature.
Standards	: A definite measure.
Substandard	: Below the measure prescribed.
Sustenance	: Nourishment.
Toxic	: Harmful to health.

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Appendix 1

SPICES AND THEIR USE IN FOODS

Name of the spice	Main source of supply	Description	Common usage	Tips on buying
Omam (Ajwain)	Uttar Pradesh, Bihar, Punjab, Madhya Pradesh, Rajasthan, Bengal, Tamil Nadu, Andhra Pradesh	Tiny greyish-brown seeds with a rough appearance. Strong aroma on crushing between fingers	As baghar for vegetables	Make sure it is clean. It is often adulterated with earth
Allspice (pimento)	Bengal, Bihar, Orissa, hilly districts of Karnataka state, and Kerala	Nearly ripe berries of pimento trees. May be obtained either whole or ground. Flavour considered to resemble mixture of spices, especially cinnamon, nutmeg, cloves	Seasoning meats, soups, cakes, cookies, puddings, pickles, preserves	Buy whole, not ground. Good to grow in your kitchen garden.
Amchur (whole or powder)	Uttar Pradesh, Bihar, Bengal, Orissa and Andhra Pradesh	Dried pieces or dehydrated powder made from unripe mango flesh. Sour in taste.	To impart sourness to dry vegetables, chutneys, or curries, particularly potatoes and dals.	Preferable to buy whole pieces. If buying powder, look for light colour.
Dalimb (Anardana)	Valleys and outer hills of the Himalayas, Jammu, Punjab, Himachal Pradesh	Dried seeds of a small sour variety of pomegranate	To impart sourness to certain curries and chutneys. Very popular ingredient of cholas.	Buy whole, dry in the sun and powder at home.
Asafoetida (heeng)	Kashmir. Also imported from Iran and Afghanistan	Root exhudate collected and formed into balls, mass or paste	Flavouring curries, sauces and pickles	Hedda heeng is the strongest and most priced.
Caraway seed (siahzeera)	North Himalayan regions of Kashmir and Kunoor	Fruit-like seeds of the caraway plant, which has delicate white flowers	Seasoning bread and cakes. Added to boiled cabbage, beef stock, and soft cheeses. Sprinkled over meats like pork, liver and kidneys before cooking.	Look out for adulteration by spent or drawn caraway seeds, cumin seeds, stem and gravel. Do not buy powdered.
Small cardamom (choti ilaichi green cardamom)	Kerala, Tamil Nadu and Karnataka	Greenish pods filled with black aromatic seeds. Fruit of a small tree or reedlike plant. Seeds possess an aromatic and agreeably pungent flavour	Flavouring for curries, kheers and other Indian sweets and Kashmiri tea. Used for chewing after meals	Buy Agmark graded cardamom. Natural green cardamoms are better than bleached or half-bleached which look white
Large cardamom (bari ilaichi)	Sikkim and Assam	Dark reddish-brown spherical capsule with several small blackish seeds held together by a visoid sweetish pulp	Important component of garam masala. Used for its aroma in both vegetarian as well as non-vegetarian savoury preparations	The cardamoms should be plump and filled with seeds. Adulterated with underdeveloped and empty capsules.
Chilli (mirch)	Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu, Jammu and Kashmir, Madhya Pradesh, Punjab and Bihar	Dried ripe fruits of the chilli plant. May be obtained either whole or ground	Used for its pungency in Indian savoury dishes, pickles and chutneys. Milder varieties are used for imparting red colour to curries.	Selection depends on colour size and pungency, and the purpose for which you are buying
Cinnamon (dalchini)	China, Sumatra, Anjarakkandi in Cannanore district, Kerala, and the Western ghats	Two species of about the same flavour used interchangeably but coming from different species of tree. Bark of cinnamon or cassia tree.	Used for its delicate fragrance in both sweet and savoury dishes	Often adulterated with cassia bark which is inferior. Preferable to buy whole and powder as needed.
Cloves (lawang)	Kerala and Tamil Nadu. Also imported from Zanzibar, hence it is expensive	Dried unopened flower buds of the clove tree, a handsome evergreen	Used for its aroma and flavour in both sweet as well as savoury dishes	Should be brownish black in colour, with full and plump crown. Clove should readily exude oil when stem is pressed with finger nail. Often adulterated with headless clove and clove stems or cloves from which essential oil has been removed.

Name of the spice	Main source of supply	Description	Common usage	Tips on buying
Coriander (dhania)	Grown almost throughout India	Dried fruit of a small plant	Used ground in curries	Preferable to buy whole and powder when needed. Often adulterated with stems, dirt, methi and some cereals. Small seed variety is preferable. Ground coriander is more prone to adulteration.
Cumin (zeera or safeid zeera)	All states except Assam, Kerala and Bengal	Small dried yellowish to greyish brown seeds	Used in curries and vegetables	Heavily adulterated with stems. Insist on cleaned zeera.
Fenugreek (methi)	India is one of the world's major producers and exporters of fenugreek	Small yellowish brown seed which is smooth and oblong and has a groove across	Used for its pleasantly bitter taste and distinctive flavour and odour in curries, particularly fish curries. Used in pickles and as a baghar (seasoning)	Buy whole seeds.
Fennel (sonph) (commonly called Aniseed in India which is not correct)	Maharashtra, Karnataka, Uttar Pradesh, Punjab, Rajasthan	Dried greyish green coloured seeds of the fennel plant. Lucknow variety is slim while others are plumpish with yellow tinges.	Used for chewing as such and in curries, vegetables and pulses for flavour.	Lucknow variety is best. Other good ones are from Bombay and Bihar.
Garlic (Lahsun)	Grown practically throughout India	Bulb of small vegetable plant similar to the onion but with bulb divided into 10 or 12 sections known as 'cloves'	Used for flavour in preparing vegetables, meats, poultry, fish, pickles. In the West also used in making special breads. Those not used to it, find the flavour objectionable. The strong odour remains in the mouth after the meal.	Buy dry bulbs with big plump cloves. Lasts quite sometime at room temperature if not peeled
Ginger (adrak)	Kerala, Assam, Himachal Pradesh	Rhizome or root of the ginger plant. Available as fresh or dried root.	Used in vegetarian as well as non-vegetarian curries, as baghar for dry vegetables or just as a relish with salt and limejuice. Also used in preparing soft drinks and murabbas.	Make sure it is not stringy and does not have too much mud clinging to it.
Mace (javitri)	Dutch East Indies, West Indies, Tamil Nadu, Kerala, Assam	Crimson net-like arillus or covering of the nutmeg kernel. Flavour similar to nutmeg but considered by many to be more delicate. May be obtained whole or ground. On drying the crimson colour changes to pale yellow brown or reddish brown.	Used for flavouring a number of sweet as well as savoury dishes, and also beverages	Available as whole, broken or ground. Adulterated with wild mace. Buy whole.
Mustard (rai or rye)	Punjab, Uttar Pradesh, Tamil Nadu, Bihar and Bengal	Small, round, reddish-brown or purplish-black seed. Another variety with yellow seeds is called sarson.	Used for meat and fish preparations and as baghar for vegetables. Also used as mustard paste with certain dishes.	The purplish black ones called Banarsi rai, and the small reddish brown one called rai is used as spice and baghar. Rai is an efficient substitute for Banarsi rai. Yellow sarson is rarely used as a spice.
Nutmeg (Jaiphal)	Nilgiri Hills, Tamil Nadu, Kerala, Assam, we also import some	Kernel of the fruit of the nutmeg tree. Available as a whole or broken nut or as a powder.	Used for its aroma in both sweet and savoury dishes.	The nut is difficult to powder; hence, advisable to buy in powdered form.

Name of the spice or herb	Main source of supply	Description	Common usage	Tips on buying
Black Pepper (kali or gol mirchi)	Kerala, Karnataka, Tamil Nadu	Berries (peppercorns) of pepper vine. Black and white pepper comes from same vine. White pepper obtained by allowing the peppercorns to mature and removing black outer skin of dried fruit. Black pepper is much stronger. Used whole or ground.	Whole pepper corn is used as a baghar. Powdered is used as a spice for its aroma and flavour	Buy whole and powder as and when you use. Look out for papaya seeds as adulterants. You can identify the papaya seed under a hand magnifying glass — it will show a line while pepper will show a central hole.
Poppy seed (khus-khus)	Neemuch in Rajasthan	White seed of the poppy plant, which produces brilliant flowers. Carry no morphine narcotics	Used as topping for breads, rolls, cookies and some Indian sweets. Also used for making curries.	Look out for fine gravel as adulterant.
Saffron (zafran)	Kashmir	Stigma of the saffron flower. About 3 to each flower and 225.000 stigmas to 500 gms.	Used for its flavour and colouring in rice, meat and chicken dishes and also in Indian sweets.	Frequently adulterated with styles, anthers and parts of corolla of saffron. Exhausted saffron, corn silk and various material coloured with coal-tar dyes are also used as adulterants.
Tejpat (tezpat, cassia leaf; also called cinnamon leaf)	Khasi and Jaintia hills, Garo hills, Mikir hills, Manipur and Arunachal Pradesh	Dried leaf. Available as small dried branches with leaves or as separate leaves — whole or cracked.	Used for its flavour in rice and non-vegetarian curries particularly in the North.	
Turmeric (haldi)	Andhra Pradesh, Maharashtra, Orissa, Tamil Nadu, Karnataka and Kerala.	Rhizome of perennial plant.. Contains a yellow colouring matter and has a warm bitterish, somewhat aromatic taste.	Used for colouring and flavouring both vegetarian and non-vegetarian savoury dishes and pickles.	Buy only Agmark grades. Alleppey turmeric is the best.

Recipes for home-scale food preservation

A) Potato chips (grated variety)

Make these in summer when the sun is very hot. Select large sized potatoes. Wash them well to get rid of the dirt. Bring water to boil, in a large vessel, put the potatoes in and allow to boil for 5 minutes. Throw the hot water away and pour cold water to cool the potatoes. When cold, take them out of water, allow them to drain and cool further. You should do this bit of processing at night and leave the potatoes to drain and cool till the morning.

Early in the morning, peel the potatoes — you might need a knife to do so. Spread a chatai (mat) on the floor and with the help of a grater (the one with 4 legs is most convenient) grate the potatoes on to the chatai. The grated potato will fall in a heap in one place. Do not touch it. Just move the grater to another point and grate another pile and so on. When the mat is full pick it up carefully and put it in the sun. Dry them for 2 or 3 days, taking them in at nights. When totally dry store them in a tin with closed lid.

B) Onion preserved in vinegar

Buy small size onions. Peel them and remove the top of the core with a sharp knife. Wash them and soak them in a 2 per cent salt solution for 24 hours. Remove onions and an additional 2 per cent salt to the water and put the onions back into it for another 24 hours. Repeat for the next two more days. On the fifth day remove the onions and soak them in a fresh 8 per cent salt solution. Leave them in for 10-15 days. Take them out and wash them with hot water and allow to dry at room temperature till all moisture disappears from the surface of the onions. Put them in a bottle and pour in vinegar to cover the onions. Screw the cap on and let it remain at room temperature. They will be ready to eat in a week's time.

C) Lime pickle with salt and spices

25 fresh limes, 2 level cups powdered salt, 20 two inch long dried red chillies, 1-1/2 teaspoonfuls fenugreek seeds, a big pea-sized lump of asafoetida, 1 teaspoonful turmeric powder

Keep the dired red chillies in the sun for one or two hours. Roast them in a dry hot kadai over low heat till they feel hot to touch. Next, roast the fenugreek seeds over low heat to a light reddish brown colour. Roast the asafoetida, crush into powder, till it looks crunchy. Grind the roasted asafoetida and fenugreek seeds to a fine powder. Pound the roasted dried red chillies separately to a powder. Mix together the powdered salt, dried red chilly powder, turmeric powder, fenugreek seeds powder and the asafoetida powder. If there is any suspicion of dampness, spread the masala powder on a plate to dry in the sun. Clean your pickle jar with hot water and detergent; rinse well and dry in the hot sun.

Wash the limes well in running water. Wipe dry with a clean soft cloth. With a stainless steel knife, cut each lime into 8 quarters. Collect and retain the juice when drips while cutting.

Now sprinkle the bottom of the jar with a thin layer of the masala powder. Take a handful of the cut limes and scatter in a layer over the layer of masala powder. Do this till all the limes and powder are used up, letting the topmost layer be of the masala powder

Cover the jar with a thin clean dry muslin cloth, then with a tight-fitting lid. Keep aside in a dry place for three days without touching it. On the morning of the fourth day, open the pickle jar and stir its contents thoroughly with the handle end of a wooden ladle, then again cover with its lid. Stir every alternate day, for a month. You should keep the jar, whenever possible, underneath the hot sun, covered with only a thin muslin cloth. This will help the pickle season sooner.

D) Kanchi (Preservation by fermentation)

1 kg red carrots (any carrots will do. Red give a lovely colour to the drink)

5 L water

25 g salt (adjust it to taste later on)

100 g powdered rai

Get an earthenware pitcher (ghara). Put water, salt and rai into it. Clean, wash and cut carrots into small bite size pieces and put into the ghara. Tie a cloth around the mouth of the ghara and let it sit in the sun for about 7 days. When fermentation has set in to the right degree you can start using it. The water should be slightly sour to taste and deep magenta in colour. The carrot pieces would taste salty and sourish. Kanchi is the liquid part which is a very refreshing drink when taken cold. The carrot pieces are also eaten.

E) Fresh ginger and green chilly preserve with lime juice

Fresh ginger
Green chillies
Lime juice
Powdered salt

Scrape the ginger clean, wash it thoroughly and grate it. Wash, wipe and dry. Chop the chillies into small bits. Mix the two and add salt to taste — it should be on the salty side. Put in a jar with a wide mouth. Pour in the lime juice till it almost covers it. Stir well and leave it. It is ready to eat and will remain unspoiled for 2 to 3 weeks at room temperature and much longer in the refrigerator.

F) Avakai (Mango pickle with oil)

25-30 raw sour mangoes (with the hard kernel formed and with slightly stringiness in the flesh)

1 kg powdered salt
1 kg freshly powdered rai
1 kg freshly powdered red chilly powder — a special variety is available for pickles which gives colour but is not very pungent.
200 g peeled garlic pods (optional)
200 g Kabuli chana (optional)
1 tsp powdered heeng
2 kg til oil

Wash and dry mangoes thoroughly. Chop each mango into small serving size pieces along with central kernel. Throw the seed portion away. Wipe each piece clean with a damp cloth taking care to remove the thin membrane that sticks to the inside surface of the kernel. Spread all the pieces to dry inside the room, *not in the sun.*

Mix all the spices together with the oil in a large vessel. Then mix in the mango pieces, chana and garlic. Put into a jar and cover. On the third day turn the pickle out into a vessel, mix well and put back into the jar and store it. This pickle is not put into the sun. The mango pieces should remain firm. Make sure the oil always covers the surface of the pickle.

G) Guava jelly (Preserving juice extract with sugar)

Guavas (just ripe and firm)- 1 kg
Citric acid - 2 g
Sugar - see recipe

Wash and slice guavas in round thin chips. This way you get all the pectin out which is there around the seeds of the guava. Put the pieces along with citric acid to boil in just enough water to cover. Cook till the pieces are just done. You should be able to crush them with your fingers. Cool for convenience in handling. Put into a muslin cloth or old cotton saree piece to hang for dripping. Collect the juice in a pan. Do not apply any pressure on the cloth to press the juice out. To save time hang it overnight. It takes time to get the last drops out which contain quite a bit of pectin. Collet the juice.

Put the solid mass to boil again with just enough water to cover. Give one boil and strain this as well.

Put together both the extracts and test for pectin. To a spoonful of the juice add two spoonfuls of methylated spirit or alcohol. If one big clot forms you have a high pectin

content; if several small clots form you have a medium pectin content; if the precipitate is thin and gelatinous then you have a low pectin content.

Weigh the extract. If pectin is high, add equal weight of sugar; if medium add 75% sugar by weight. If low, add only 50% sugar by weight.

Put on the flame. Give one boil and strain through cloth to get rid of all sugar impurities. Then allow to boil on high flame. Make sure it does not over boil. Keep checking for readiness by dropping from a spoon. It will begin by coming down in a steady stream. When it comes down in flakes or sheets it is time to stop cooking. Put a little in a saucer and cool to see if it sets. Add some lime juice or more citric acid to make the jelly tart enough to suit your taste. Remove all the white foam that collects on top. Pour into sterilized bottles right to the top. Pour in liquid candle wax to seal. Screw the bottle cover on. This should keep for as long as you want if unopened.

The colour should be anywhere from golden orange to amber-red due to caramelization of the sugar.

H) Mango jam (preserving fruit pulp and juice with sugar)
1 kg chopped ripe mangoes
750 g of sugar
lime juice or citric acid to taste

Cook mangoes and sugar together in a heavy-bottom vessel. Keep stirring frequently to prevent charring at the bottom. When the mixture becomes thick, check to see if it is ready. The test is to put some in a thali or saucer and allow it to cool a little. Push the mass gently from one side. If wrinkles form on the surface like they do on your skin, the jam is ready.

I) Ash gourd (petha) murabba (preserving pieces of fruit with sugar)
Cubed ash gourd — 500 g
Quick lime — 60 g
Sugar — as required.

Dice the firm flesh, discarding skin and seeds. Pick them up with a fork. To firm the fruit, immerse in fresh lime water solution (60 g quick-lime to one litre water, allow to settle, and use clear decanted solution) for 3 to 4 hours (a soft fruit will require longer). Drain, wash well with water. Soften the pieces by placing in boiling water for 15 to 30 minutes. Remove, drain moisture on a cloth. Prepare a syrup of one kg sugar in 1.5 litre water. Boil syrup, remove scum and add the pieces. Continue heating to 2 to 3-thread consistency.

Leave overnight. Drain syrup, dry on a wire tray or cloth till no longer sticky. Store in a dry shallow covered container.

J) Lemon squash (with no water)
(This is a very simple method of making lemon squash.)

Take a bottle with a narow mouth — any size you want (the usual squash type bottle would be alright). Wash and dry it in the sun. Fill it to the top with crystalline sugar. Then pour in fresh strained lime juice till it comes to the top. When you pour the juice in, the sugar will settle down to about two third of the height of the bottle. It needs a lot of patience to pour the juice. Then, tightly put the cap on and keep it in the sun. Shake it twice or thrice a day to help dissolve the sugar. After 2 to 3 days store it in a cool place. Eventually all the sugar will dissolve and the sugar impurities will rise to the top leaving a transparently clear squash. Because of the high percentage of sugar it does not need any chemical preservative and will last for more than a year.

K) Orange squash (with no water)
1 kg orange juice
3/4 kg sugar
20 g citric acid — this will depend upon how you would like the squash to taste

Potassium-metabisulphite — Use 0.7 g per kg of finished product
Orange essence

Mix juice and sugar in a large vessel and stir till all sugar dissolves. Add citric acid to taste, orange essence and potassium metabisulphite. Pour into clean bottles and store. You need very little to make a glass of drink with water or soda. Since no colour is added the colour of the prepared drink will be pale. However, the flavour will be that of fresh orange.

Appendix 3

SOME FOOD-BORNE ILLNESSES

Name of Illness	Causative Agent	Foods Usually Involved	How Introduced into Food	Preventive or Corrective Procedures
Staphylococcus food poisoning	Staphylococcus toxin a poison developed by staphylococcus when it grows in food	Cooked ham or other meat, chopped or ground food, dairy products, "warmed over" food	Usually food handlers through nasal discharges or local skin infections (acne, pimples, boils, scratches and cuts)	Refrigerate moist foods during storage periods, minimize use of hands in preparation. Exclude unhealthy food handlers (having pimples, boils and other obvious infections)
Perfringens food poisoning	Clostridium perfringens	Meat which has been boiled, steamed, or partially roasted, allowed to cool several hours and subsequently either cooled or reheated	Natural contaminant of meat	Rapidly refrigerate meat between cooking and use
Salmonellosis	Over 800 types of Salmonella bacteria, capable of producing gastro-intestinal illness	Meat and poultry, ground foods, egg products, shell fish, "warmed over" foods	Faecal contamination by food handlers. Raw contaminated meat and poultry, liquid eggs and unboiled milk	By good personal habits of food handlers, sufficient cooking and refrigeration of perishable foods. Eliminate rodents and flies.
Salmonellosis a) Typhoid Fever b) Para-typhoid A	Salmonella typhosa S. Paratyphi A	Moist foods, dairy products, shell fish, raw vegetables and water	By food handlers and other carriers	Prohibit carriers from handling food; require strict personal cleanliness in food preparation, eliminate flies.
Streptococcus food infection (throat)	Beta haemolytic Streptococci	Food contaminated with nasal or oral discharges from a person suffering from the disease or someone who carries the germs without showing symptoms (a carrier)	Coughing, sneezing or handling	Exclude food handlers with known streptococcal infections
Streptococcus Infection (intestinal)	Enterococcus group; Pyogenic group	Foods contaminated with excreta on unclean hands	By unsanitary food handling	Same as above; thorough cooking of food and refrigeration of moist food during storage periods.
Botulism	Toxins of Clostridium botulinum	Improperly processed or unrefrigerated foods of low acidity	Soil and dirt; Spores not killed in inadequately heated foods	Cook canned foods thoroughly after removing before serving, discard all foods in swollen unopened cans.
Bacillary Dysentery (Shigellosis)	Shigella bacteria	Foods contaminated with excreta on unclean hands	By unsanitary food handling	Strict personal cleanliness in food preparation; refrigeration of moist foods. Exclude carriers.
Amoebic Dysentery	Entamoeba histolytica	Foods contaminated with excreta on unclean hands	By unsanitary food handlers	Protect water supplies, ensure strict personal cleanliness with food handlers. Exclude carriers.
Pork Tape Worm	Taenia solium	Raw or insufficiently cooked pork or pork products	Raw pork from hogs fed uncooked infected garbage	Thoroughly cooked pork and pork products

Appendix 4

DETECTING ADULTERATION IN FOOD-EQUIPMENT AND CHEMICALS REQUIRED

Equipment	Chemicals
• Dropper	• Tincture iodine (iodine crystals; Potassium iodide crystals)
• Test tube	• Resorcin; Resorcinol in concentrated hydrochloric acid
• Water bath	• Concentrated hydrochloric acid
• Glass-stoppered test tube	• Dilute hydrochloric acid
• Beaker	• Ether
• Volumetric flask (100 ml)	• Ferric chloride solution
• Measuring flask (10 ml)	• Alcoholic potassium hydroxide
• Filter paper	• Petroleum ether
• Magnet	• Metanil yellow
• Mortar & pestle	• Acidified potassium permanganate
• China dish	• Sodium hydroxide
• Magnifying glass	• Common salt
	• Sugar
	• Carbon tetrachloride

Appendix 5
SIMPLE TESTS FOR COMMON ADULTERANTS IN FOOD

	Foodstuff	Adulterant	Test
1)	Milk, curd, khoa, ghee butter	Starch	Add a drop of tincture iodine to a little of the sample. Blue colour shows added starch in any form. (Iodine solution may be prepared by dissolving 2.5 g of iodine crystals and 3 g of potassium iodide in sufficient water to make the volume 100 ml.)
2)	Milk or curd	Cane sugar	Add 0.1 g resorcin and 1 ml concentrated hydrochloric acid to 10 ml of the sample and boil. A rose red colour shows sugar.
3)	Butter	Coal tar dye	Melt the butter in a test tube kept in a hot water bath and continue heating until the fat and water layers completely separate out. Decant off the butter fat from the top into a clean dry test tube. In another test tube, dissolve about 2 ml of clear fat in ether, add to it 1 to 2 ml of 50% hydrochloric acid, shake and allow to settle. Formation of a pink to wine red colour in the lower acid layer shows coal tar dye.
4)	Ghee or butter	Vanaspati	Dissolve a pinch of cane sugar in 10 ml concentrated hydrochloric acid taken in a glass-stoppered test tube. Add 10 ml of the melted ghee, stopper the bottle and shake vigorously for two minutes. Let it stand till 2 layers separate. If the lower layer turns pink or red, the ghee contains vanaspati.
5)	Edible oils	Argemone oil	Shake up 5 ml of the filtered oil with 2 ml of concentrated hydrochloric acid in a test tube and warm the mixture for 5 minutes in a water bath with occasional shaking. Decant off the oil from the top and add to the remaining acid layer 1 ml of 10% ferric chloride solution, gently. Rotate the tube between the palms of the hands to mix the solutions and heat the mixture in a boiling water bath for 10 minutes. Formation of reddish brown precipitate or crystals shows argemone oil.
		Mineral oil	Mix 2 ml with 2 ml of 3% alcoholic potassium hydroxide, heat in boiling water bath for 15 minutes, add 10 ml water. Any turbidity shows mineral oil.
		Castor oil	Dissolve oil in petroleum ether in a test tube and cool the test tube in ice-salt mixture. Turbidity within 5 minutes shows castor oil.
6)	Aerated water	Mineral acid other than phosphoric acid	Soak a strip of filter paper in a dilute (0.1%) water solution of metanil yellow and then dry. Dip one end of the paper into the aerated water. The wetted portion turns violet.
7)	Coffee powder	a) Starch (toasted bread crumbs, rye, wheat, peas etc.)	Make a decoction of the coffee, decolourise it by adding acidified potassium permanganate and then add a drop of iodine solution. Blue colour shows starch.
		b) Roasted dates and tamarind seeds	Shake powder with 2% sodium hydroxide (or washing soda) solution. Formation of reddish colour shows tamarind seeds.
8)	Tea (dust/leaves)	a) Artificially coloured foreign matter or exhausted tea leaves	Sprinkle the tea on a sheet of wet white paper. Pink or red spots appearing on the paper shows added colour.
		b) Iron filings	Draw a magnet through tea. Iron filings will cling to the magnet.
9)	Cane sugar	a) Iron filings	Pass a magnet through the sugar. Iron filings will cling to the magnet.
		b) Fine white sand, dirt, semolina (suji), chalk powder	Stir one teaspoon of the sugar into a glass of clear water. Only the sugar will dissolve leaving a residue of the sand, dirt, semolina or chalk.

10)	Gur (Jaggery)	a) sand, dirt, chalk	Boil a portion with excess water. Gur will dissolve but sand and dirt will not.
		b) Metanil Yellow (coal tar dye)	Dissolve a little gur in water. Filter and dilute the solution and then add a drop of concentrated hydrochloric acid. A magenta red colour shows the presence of metanil yellow.
		c) Washing soda	Add some hydrochloric acid. Bubbling gas shows washing soda.
11)	Honey	Commercial invert sugar (mixture of glucose and fructose)	Fiehe's Test: Mix about 5 g of the honey with 10 ml of ether in a mortar, using a pestle. Decant off the ether extract into a china dish. Repeat twice with more ether and collect all the extract in the same dish. Allow the ether to evaporate off at room temperature. To the remaining residues in the dish, add a large drop of a 1% solution of freshly sublimed resorcinol in concentrated hydrochloric acid. Immediate appearance of a cherry red colour indicates commercial sugar.
12)	Sweetmeats	Aluminium foil for decoration (instead of silver)	Treat the foil with a little warm dilute hydrochloric acid. Bubbles of hydrogen gas will be evolved from the foil (silver foil does not react)
	Sweatmeats, Icecream sherbet etc.	Metanil yellow	Shake with warm water and add to separated water, conc. hydrochloric acid. Red colour indicates the presence of the forbidden dye.
13)	Foodgrains and nuts (e.g. groundnuts)	Mould	The grains and nuts will appear discoloured and shrunken and will usually have an off taste and float on water.
14)	Wheat, bajra and other foodgrains	Ergot (a poisonous fungus)	Long irregular black grains show ergot. Treat with 20% salt solution. Ergot will float and sound grains will sink.
		Datura seeds	Brown black seeds resembling chilli seeds which can be easily identified.
15)	Foodgrains and pulses (whole and ground)	Insect, larvae	Visual examination. Excessive infestation results in unpleasant odour and taste and the grains will float on water.
16)	Wheat flour, semolina (suji), Bengal gram flour (Besan)	Sand, grit	To a little of the sample add 5 ml of carbon tetrachloride in a dry test tube and shake well. Sand and grit will settle at the bottom leaving flour on top.
		Iron filings	Pass a magnet through material. Iron will cling to magnet.
		Chalk powder	Treat sample with hot hydrochloric acid. Bubbling of gas shows carbon dioxide gas from chalk or other carbonates.
	Wheat flour	Resultant atta from which maida, suji have already been extracted	More water needed to make dough-chapatis blow out and are insipid.
17)	Whole black masoor and Bengal gram	Kesari pulse (whole)	Visual examination (wedge-like shape). Also gives brown colour with hydrochloric acid in 15 to 30 minutes.
18)	Split and dehusked pulses	a) Kesari dal	Visual examination (usually present in arhar dal and bengal gram)
		b) Metanil yellow	Shake a portion with cold water. The water becomes yellowish and on treatment with hydrochloric acid turns magenta red in colour.
19)	Common salt	Sand, dirt, chalk	Stir a little of the sample with excess water; sand and dirt will sink but the salt will dissolve, chalk will float giving a whitish solution.
20)	Red chilli whole	Polished with red dye	Soak some cotton in mineral oil (liquid paraffin) and rub the outside of the red chilli with the cotton. If the cotton becomes red, the sample has added colour.

21)	Turmeric (whole and powdered) and mixed spices (powdered)	Metanil yellow	Shake up with some water, dilute till it is almost colourless and then add a few drops of conc. hydrochloric acid. Magenta red colour shows artificial colouring with metanil yellow.
22)	Powdered spices (turmeric, chilli, coriander, garam masala, curry powder etc.)	Sand, grit, talc	Shake up a little of the sample with about 5 ml carbon tetrachloride in a dry test tube. Allow to settle. Sand, talc and grit will sink to the bottom, leaving spice on top.
23)	Saffron	Dyed tendrils of maize cob	Shake with water several times, pouring away the water each time. Only pure saffron gives colour as long as it lasts; also does not break easily like the artifical.
24)	Cinnamon (dalchini)	Cassia bark (chini dal)	Thick bark with less aroma than pure cinnamon (thin bark) shows adulteration.
25)	Cardamom, cloves	Exhausted (a ready extracted) spice	If dry, shrunken in appearance. If not dried well, soggy, with fungus infestation. In either case deficiency of aromatic taste.
26)	Mustard and Rai seeds	Argemone seeds	Small seeds resembling mustard but blacker more rough and not uniformly smooth and round. Can be seen under a magnifying glass.
27)	Mustard, Rai, Cumin Seeds, Khus-Khus etc.	Stones and foreign matter	Visual examination.

Note: Adulteration detected as above needs to be confirmed by analysis in a recognized food testing laboratory: the tests in no way replace the prescribed laboratory tests.

NOTES

NOTES

DHEN-04

Utter Pradesh
Rajarshi Tandon Open University

Nutrition for the Community

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February, 1993
© *Indira Gandhi National Open University, 1993*
ISBN-81-7263-289-4

Further information on the Indira Gandhi National Open University courses may be obtained from the University's Office at Maidan Garhi, New Delhi-110068.

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Reprinted by : Nitin Printers, 1 Old Katra, Manmohan Park, Allahabad.

BLOCK INTRODUCTION

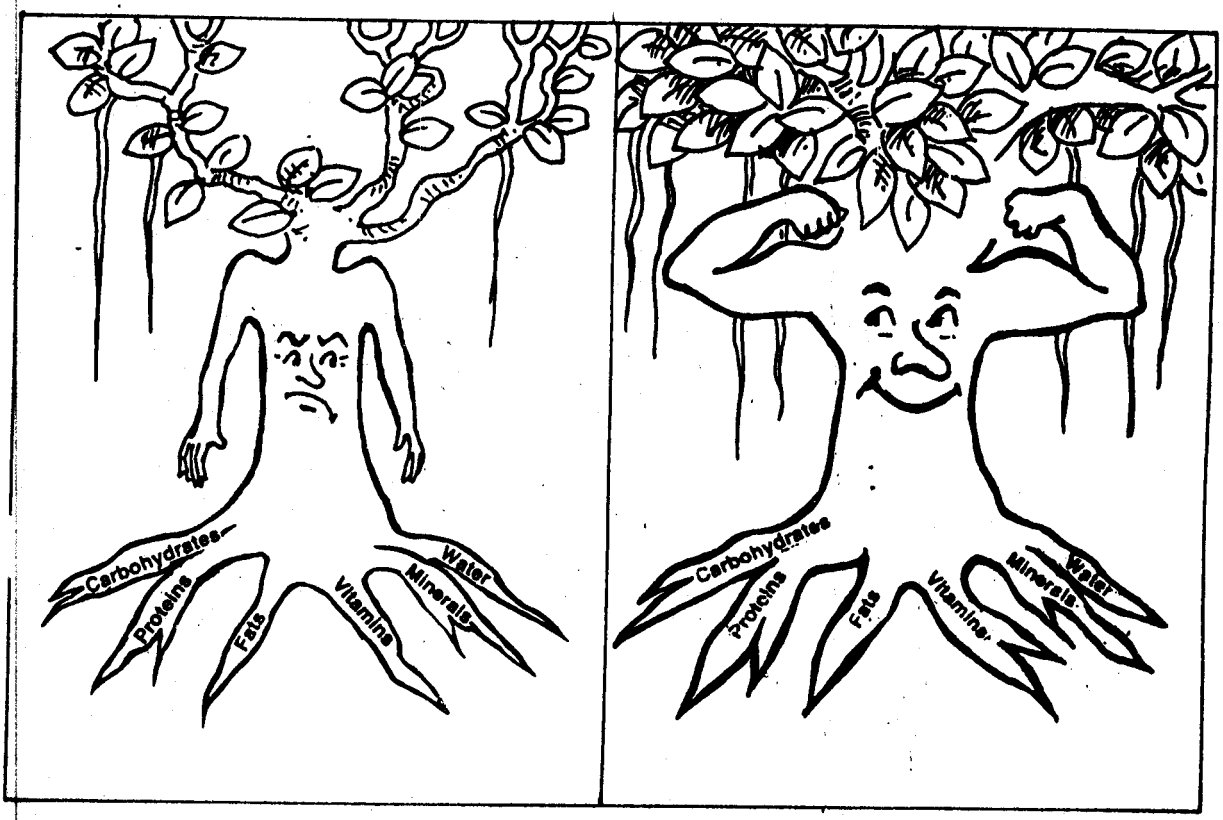
You were introduced to the major nutrients and their functions in Blocks 1 and 2. What would happen if the diet provides too much or too little of these nutrients? Read this block to find out. At this stage we'll just give you a hint. We have earlier talked about malnutrition and its two forms—undernutrition and overnutrition.

We begin with the problem of undernutrition. Units 17 to 19 of this block focus on disorders caused by deficiency of energy and protein, vitamins and minerals. These units talk about the clinical features, prevention and treatment of the more important deficiency diseases. You will also be introduced to fluorosis (caused by an excessive intake of fluoride) and lathyrism (caused by intake of a toxin).

Malnutrition and infection are intimately related. Malnutrition predisposes a person to infection. On the other hand, infections lead to malnutrition. You will learn more about this and the dietary management of some infectious diseases in Unit 20.

In Unit 21 our attention shifts to the diseases of affluence. These diseases such as obesity, diabetes and heart disease are related to eating too much food and certain nutrients in particular. In this tale of overnutrition, who are the villains? The unit reveals the secret and also tells you the major features of these diseases and their dietary management.

Unit 22 returns to the theme of undernutrition. We talk about the crucial aspect of maternal malnutrition and its relationship to the health of the mother and child.



PREVENT DEFICIENCY

- ENSURE HEALTH

STUDY GUIDE

You will come across several facts in Block 5 which you will be expected to remember.

The following points would help you to grasp the material more easily.

1) This block deals with both disorders of undernutrition and overnutrition. The emphasis is on understanding the causes of these disorders and being able to identify them. Information on treatment is also given as a rough guide to how doctors, nurses and field level workers would handle the problem.

2) Prevention is a vital aspect because this is a task we can attempt as individuals and groups. You could think of strategies whereby you can involve yourself in communicating this information to others around you.

3) As in the previous blocks, *Highlights* are included to draw your attention to important aspects.

4) Read the text carefully and look at the photographs of various disorders so that you can recognize their major features.

5) Appendix 1 lists the features of the nutrition-related disorders we have talked about in the block as well as their treatment and prevention. Use this to revise and to check out how much you have grasped.

UNIT 17 MAJOR DEFICIENCY DISEASES-I: PROTEIN ENERGY MALNUTRITION AND XEROPHTHALMIA

Structure

17.1 INTRODUCTION

This unit will deal with two of the major deficiency diseases, namely Protein energy malnutrition (PEM) and Xerophthalmia (Vitamin A deficiency).

You learnt earlier that the human body requires energy to carry out the different activities and proteins are necessary for growth and repair. In this unit we shall learn as to what happens when there is deficiency of energy and protein in the diet. The deficiency of these two basic nutrients in our body leads to protein energy malnutrition. Similarly due to lack of Vitamin A rich foods in the diet, vitamin A deficiency or xerophthalmia results. These two deficiency disorders have very serious consequences and are major nutritional problems in India.

Which section of the population group is more vulnerable to these diseases? What are the major features, causes, clinical features of these two widespread disorders? How can we prevent them? What treatment can be prescribed? These are some of the issues which are discussed in this unit.

Objectives

After studying this unit, you will be able to:

- describe the nature and causes of PEM and xerophthalmia,
- enumerate the clinical features of PEM and xerophthalmia and
- discuss the treatment and prevention of these disorders.

17.2 PROTEIN ENERGY MALNUTRITION

Protein energy malnutrition (PEM) is widely prevalent among young children (0-6 years) but is also observed as starvation in adolescents and adults, mostly lactating women, especially during periods of famine or other emergencies. PEM has serious consequences for the health of individuals particularly children and can even result in death.

Let us first define PEM. *PEM can be defined as a range of pathological conditions arising from a deficiency of protein and energy, and is commonly associated with infections.* What kind of adverse changes take place in the body as a result of PEM? The adverse changes which are externally noticeable are referred to as clinical features about which we will read as we go through this section.

In Unit 1 of Block 1, you may recall reading about signs of good health related to different body parts like the eyes, the skin, the teeth, etc. Many diseases result in adverse changes in the appearance and functions of one or more body parts. For example a healthy person has clear eyes. But in a person with severe vitamin A deficiency, eyes lose their clarity and become muddy or cloudy. Similarly, a child suffering from PEM is shorter than other children of the same age. Such changes in appearance relating to the body as a whole or its parts are referred to as *clinical features* of a disease. The clinical features can be easily detected by trained individuals. Let us now study about the clinical features of PEM.

Clinical features of PEM

PEM is a condition characterized chiefly by the following two forms:

a) Marasmus
b) Kwashiorkor

Marasmus is a condition characterized by very low body weight for age, loss of subcutaneous fat (fat under the skin), gross muscle wasting. It is observed more frequently *in infants and very young children.*

Kwashiorkor on the other hand is a condition characterized by oedema (excessive accumulation of fluid in the intercellular spaces of tissue) and very low body weight for age. The syndrome is most frequently observed in *children aged 1-3 years* and is precipitated by an infection or more commonly by a series of infections.

However, there are also children who show some of the characteristic signs of both marasmus and kwashiorkor. Such children are said to suffer from *Marasmic Kwashiorkor.* Then there are children whose heights and weights are considerably below that of healthy children of the same age. These children may not show any typical clinical signs of either kwashiorkor or marasmus, and as such they are placed in the category of *subclinical forms of PEM* which forms a large proportion of the disease in the community. Subclinical condition means that we do not see the clinical features of the disease. These forms of the disease can be identified only on special investigations or tests. In the case of PEM, we can detect subclinical status by measuring body weight.

In all the forms of PEM, remember, growth failure or low body weight is a common sign. So then, how are these forms different from each other? The description below presents a clear picture of the different forms of PEM and lists signs and symptoms specific to each form, which will help us identify individuals suffering from different forms of PEM. We begin our study by identifying signs and symptoms of marasmus.

A) How to identify a child suffering from Marasmus?

Some common clinical features of marasmus include :

i) **Muscle Wasting :** The characteristic sign of marasmus is the extensive wasting of muscle with little or no fat under the skin. We use the term *wasting to mean emaciation or thinness of the body.* The ribs become very prominent. Because of the absence of fat, the skin will develop a number of folds, particularly on the buttocks. The child with marasmus, thus, can be described as skin and bones. You can see this clearly in Figure 17.1.

ii) **Failure to thrive :** There is failure to thrive and the child suffering from marasmus usually is irritable and fretful. In fact, the child is often so weak that the cry of the child cannot even be heard.

iii) **Growth failure :** Failure to grow is another important feature of the disease. The children often weigh about 50 per cent or less of normal children for the age. For example, a healthy normal one year old child weighs about 10 kg, whereas, a marasmic child would weigh only about 5 to 6 kg.

In addition to these clinical features there is usually watery diarrhoea associated often with dehydration (loss of fluids). The child may also have other deficiencies, particularly, vitamin A deficiency (details of which are given in Section 17.3 of this unit).

Fig. 17.1 Child with Marasmus (Photo Courtesy : National Institute of Nutrition, Hyderabad.)

B. How to identify a child suffering from Kwashiorkor?

Some common clinical features of Kwashiorkor include:

i) **Oedema :** Oedema is the excessive accumulation of fluid in the intercellular spaces of the tissues. Oedema is usually observed on the lower limbs, but it may also be distributed all over the body including the face. *Remember kwashiorkor should not be diagnosed without the presence of oedema.* But how can we detect oedema? We can detect oedema by pressing the skin over the shin of the leg with your fingers. Because of accumulation of fluid under the skin, when you press there will be a depression at the place where the pressure is applied.

ii) **Failure of growth :** Growth failure is an early sign and we can notice this by taking body weight. *Children with kwashiorkor weigh only about 60 per cent of the weight of normal children for their age.* For example, a three year old healthy normal boy weighs about 13.5 kgs. whereas, another boy of same age but suffering from kwashiorkor may only weigh 60 per cent of 13.5 kg i.e about 8 kg. In other words, they are very much lighter than healthy normal children of their age.

iii) **Irritability :** The child suffering from kwashiorkor is generally irritable and has no interest in his/her surroundings.

iv) **Skin changes :** In addition to the above manifestations, there may be characteristic skin changes. The skin becomes thick and appears as though it has been varnished. The skin of the child may peel off easily leaving behind cracks or sores.

v) **Hair Changes :** The hair may become sparse and can be easily pulled off. The hair usually loses its black colour and appears reddish brown.

vi) **Moon Face:** The face of the child suffering from kwashiorkor may appear puffy with the cheeks sagging. This sign is normally known as moon face.

Fig. 17.2 shows some of the clinical features like oedema, moon face and skin changes clearly.

Fig.17.2 Child with kwashiorkor (Photo Courtesy : National Institute of Nutrition, Hyderabad)

vii) **Associated deficiencies :** The children may have signs of other deficiencies like those of vitamin A and B-complex deficiencies. What are these signs and symptoms? You will learn about these deficiencies in the subsequent units of this block.

viii) **Associated diseases :** The child is often brought to the hospital with watery diarrhoea (frequent loose motions) or severe respiratory infection (cough). The children often will be recovering from measles, a childhood disease, which is characterized by skin rash and fever.

Our study of the clinical features of kwashiorkor and marasmus, reveal that growth failure is characteristic of both these conditions. However, it is much more pronounced in marasmus. Can you now identify what exactly is the difference between these two conditions? Make a checklist and tally your responses with principal features of PEM given in Table 17.1.

Table 17.1 : Principal features of PEM

Features	Marasmus	Kwashiorkor
Essential features	• extensive muscle wasting (prominent ribs, skin) • total loss of subcutaneous fat • growth retardation in terms of body weight (low body weight for age)	• oedema • low body weight for age • mental changes

Variable features	• diarrhoea (often)	• poor appetite • skin changes (scars, cracks, peeling of the skin) • hair changes (dyspigmentation) • moon face (often) • diarrhoea (often) • liver enlargement

C. How to identify Marasmic kwashiorkor in children?

In India, particularly among poorer families, we also come across patients who present a mixture of both kwashiorkor and marasmus. You have earlier learnt that these are referred to as marasmic kwashiorkor. The children are not only *extremely wasted like in marasmus but also have signs of kwashiorkor i.e. have swelling of feet (oedema).*

D. How to identify subclinical forms of kwashiorkor?

Subclinical forms of a disease, as you know, refer to the condition where external medical examination may not show any signs of the disease. However, when we examine in detail by body measurements like weight or examination of blood, we can detect changes. In the case of PEM, we can see a large number of subclinical forms. Kwashiorkor and marasmus are actually considered as the tip of an iceberg. In our country only 2-3 children out of a hundred, in the age group of 1-5 years, exhibit these clinical forms of PEM. However, many more subclinical cases of PEM—which cannot be easily detected by simple clinical examination, are widely prevalent in the community. For each case of kwashiorkor or marasmus, there may usually be 10 to 15 subclinical cases of PEM. For prevention of PEM, we have to take steps by identifying such cases so that prompt treatment or rehabilitation (helping child to recover his normal health) can be provided. How do we diagnose these? We have already learnt that children with kwashiorkor or marasmus have very low body weights. Similarly, by taking body weights we can also identify subclinical forms of PEM.

A child's body weight is compared with that of a well fed, healthy normal child of the same age. The weights of normal children used for such a comparison are known as reference standards. These tables of normal weights and heights of healthy normal children provide weights and heights according to age. In India and elsewhere, the reference standards developed by the National Centre for Health Statistics (NCHS) of the USA are extensively used. The reason is that the growth pattern of well-to-do Indian children (atleast until adolescence) is comparable with that of American children.

Table 17.2 gives the weights of healthy American children which are recommended to be used as standards.

Table 17.2 Average Weights of Healthy American Children (NCHS)*

Age (Months)	Weight (Kg.)	
	Boys	Girls
Birth	3.3	3.2
6	7.8	7.2
12	10.2	9.5
18	11.5	10.8
24	12.3	11.8
30	13.5	13.0
36	14.6	14.1
42	15.7	15.1
48	16.7	16.0
54	17.7	16.8
60	18.7	17.7
66	19.7	18.6
72	20.7	19.5

* National Centre for Health Statistics

By comparing the weights of children with those of healthy normals we can classify the children into different forms of malnutrition. The Indian Academy of Pediatrics (IAP) recommended the following classification (Table 17.3) for detecting different forms of PEM using weight for age:

Table 17.3: Simple Classification of PEM

STATUS	CRITERIA
Normal	More than 80% NCHS weight for age
Mild Malnutrition	70-80% NCHS weight for age
Moderate Malnutrition	60-70% NCHS weight for age
Moderately Severe Malnutrition	50-60% NCHS weight for age
Severe Malnutrition	Less than 50% NCHS weight for age

For example, let us consider a child of one year age. A normal healthy male child of this age should have a weight of 10.2 kg as indicated in Table 17.2. You know that children weighing more than 80 per cent of healthy children are considered as normal as per the IAP classification. Eighty per cent of 10.2 kg is 8.16 kg or 8.2 kg. So a child weighing more than 8.2 kg is a normal child. Similarly, you can calculate 70 per cent of the weight of 1 year old children. In this case it is equivalent to 7.1 kg or 7.1 kg. So, children with weights between 7.1 and 8.2 kg are considered as suffering from mild malnutrition. You can calculate the other grades in a similar way.

You may be wondering what is the use of such a classification. Information given in Highlight 1 will draw your attention to this crucial aspect.

HIGHLIGHT 1

Supplementary Feeding Programmes

Malnutrition is the major problem facing the country. [illegible] malnutrition need special attention. Those in moderate [illegible] require additional food in order to bring their weight [illegible] children suffering from a severe degree of malnutrition [illegible] health functionary as they usually suffer from diarrh[illegible] other diseases. The crucial aspect, however, is how do [illegible] malnutrition. We can make use of the classification given [illegible] cases of malnutrition. Based on this information we [illegible] participate in feeding programmes. Generally, those children [illegible] severe malnutrition, based on weight for age, are included in the supplementary feeding programmes. What are these supplementary feeding programmes? ***Supplementary feeding programmes are simple nutrition intervention [illegible] initiated by the government to help meet the nutrient needs of the vulnerable [illegible] the society (specially children and pregnant/lactating women).*** **[illegible] them in Unit 24 of Block 6. The main objectives of the feeding programmes [illegible]**

- **to supplement the diets of the weaker sections of the community [illegible] undernutrition and**
- **to educate the community for combating and preventing malnutrition.**

From our discussion so far we have got an idea of how to identify the different forms of PEM. The next question which comes to our mind is what are the causes [illegible] this widespread disorder? The discussion which follows presents a detailed review of some of the causes of PEM.

Check Your Progress Exercise 1

1) What are the differences in the clinical features of kwashiorkor and marasmus?

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2) Fill in the blanks.

a) A male child of one year weighs 4.7 kg as against the normal of 9.5 kg. The child is suffering from.....form of PEM.

b) A child who has extensive wasting of muscle is suffering from.....

c) In the case of PEM, subclinical forms can be identified by using.....

d) .....is the condition characterized by sagging cheeks and puffy face.

e) .....is the condition, where external medical examination may not show any sign of the disease.

What are the causative factors of PEM?

Some of the causes of PEM are :

a) **Poverty :** PEM occurs in poor Indian communities. It is commonly seen in families of landless agricultural labourers, and tribal communities without any regular earnings among others. In India, PEM is seen in backward communities of Harijans, nomadic tribes and children in urban slums. These communities are poor, illiterate and generally have large families.

b) **Maternal malnutrition :** Do you recall the discussion we had in Unit 8 of Block 3 on nutritional status of the mother and its impact on pregnancy? We learnt that the nutritional status of the mother determines the state of nutrition of the child to be born. If the nutritional status of the mother is poor, the chances of the offspring being malnourished are higher. Maternal malnutrition results in low birth weight of offspring. A poor Indian infant starts life with a handicap. The weight at birth of such an Indian child is lower than the normal children. You are aware that a normal infant is about 3 kg at birth. Infants with birth weights lower than 2500 grams (2.5 kg) are considered as low birth weight babies. In rural areas (villages) among poorer groups for every 100 children about 30-35 have low birth weight. In well fed, normal and healthy children this is noticed only in less than ten out of 100 children. Children who develop PEM often begin life with a low birth weight. You will find a detailed discussion on maternal malnutrition in Unit 22.

c) **Infections and poor hygiene :** Generally, kwashiorkor follows attacks of diarrhoea (frequent loose motions) or an attack of measles. You will learn the reasons for this in Unit 20 of this block. In the urban slum areas, artificial feeding with commercial milk foods is common. The mothers may follow unsound and unhygienic methods of feeding the child. Feeding bottles may not be properly sterilized. Flies may be allowed to sit on the nipple of the feeding bottle. This may lead to frequent diarrhoea and lead to marasmus.

d) **Ignorance :** Both the forms of PEM occur as a result of ignorance of the mother, in addition to poverty. The mother, due to ignorance, delays the introduction of supplementary food (in addition to breast milk), even upto the age of 1 year. This has serious consequences because mother's milk alone is not enough for the child by the age of 6 months. The infant should be given supplementary foods in addition to breast milk. In addition, mothers restrict the diet when the child is suffering from infections such as diarrhoea, measles and common fevers. This practice is not good since such a dietary restriction leads to PEM in children who are underfed.

e) **Wrong child feeding practices :** You have learnt that supplementary foods in addition to breast milk are introduced quite late. The child is usually given the same

diet taken by adults. The typical Indian diet is based on cereals and is quite bulky for a small child. This would mean that the child can consume only smaller amounts of the food at one time. But you remember reading in Unit 9 of Block 3 that the child should be given frequent meals atleast five to six times a day to meet the daily requirement of nutrients. However, traditionally an Indian child is fed thrice a day. As a result, the child does not get adequate food. Consequently, the child cannot get enough energy, protein which is the major cause of PEM in India. *It may be mentioned here that the protein intake is, however, just a little less than what is required. It is the intake of energy which is largely deficit.*

What is the treatment for PEM?

Now that you are aware of the causative factors of PEM, let us move on to discuss the prevention and treatment of this disorder.

You know PEM is caused due to deficiency of energy and protein in the diet or in other words, due to lack of food. So one of the major objectives of the treatment is to feed the child energy and protein-rich foods, so that his requirements are met and there is adequate weight gain. This treatment can be very well done at home with judicious selection of energy and protein-rich foods. However the children with severe malnutrition most often, require hospitalization since they may also have associated infections like severe gastroenteritis (infection of digestive tract) and severe respiratory infections. If you come across such a case, ask the mother to take the child to a health centre where treatment for these infections is given first priority. In the initial stages it will be difficult to feed such children. They may require feeding through a rubber tube passed through the nose into the stomach till they are able to take the food by mouth. Initially only high calorie liquid foods are given. We can also treat some of these cases at the homes of the children with proper supervision, if they do not have any severe infections like diarrhoea etc. ***The main principle in the treatment of the severe forms of PEM is to provide adequate energy and protein through dietary means.*** This can be provided through the foodstuffs usually consumed by the community at their homes like cereals, pulses, nuts and sugar/jaggery. Addition of milk is not compulsory but, if added, will improve the quality of the diet. Remember that there is no need to give high protein commercial preparations. A nutritious preparation used in treatment of PEM is discussed in Highlight 2.

HIGHLIGHT 2

Hyderabad Mix

A preparation based on local foods which was developed by the National Institute of Nutrition, Hyderabad and successfully used in the treatment of kwashiorkor and marasmus is the ***Hyderabad Mix***. This Hyderabad mix which is not a commercial food, can be prepared even in rural households belonging to poorer families. It consists of roasted wheat (40 grams), roasted bengal gram dal (15 grams), roasted groundnut (10 grams) and sugar/jaggery (30 grams). We can prepare ladoos, or sweet kheer with this mix or it can be cooked with milk to improve the taste and quality.

In about 4-6 weeks, the children with kwashiorkor recover fully with dietary treatment though cases of marasmus take longer periods. It is important to remember that during the first week the child requires persuasion for feeding. After this, once the child recovers appetite, feeding becomes easier. In young children of 6-24 months, who also have a problem in swallowing solid food, one can make a thin gruel of the Hyderabad mix by adding water and 1 teaspoon) of ARF powder (germinated wheat flour powder). You have learnt how to make the ARF powder in Unit 9 of Block 3. Addition of ARF to the mix would help make it thin but at the same time retain its nutritive value. Children with PEM can easily drink this up.

Simultaneously other deficiencies like those of vitamin A and B-complex should also be treated with vitamin A capsules and tablets of B-complex. In addition, associated

infections should be controlled with appropriate antibiotics. The mother should be educated to continue feeding of additional food by increasing the quantities of the home diet even after discharge from the hospital so that the child may not get PEM once again.

Mild and moderate cases of PEM can be treated at home by giving energy and protein rich diets as mentioned earlier. They do not require hospitalization.

How to prevent PEM?

You know that "prevention is better than cure". Few measures, which when followed will prevent PEM are listed in the following discussion :

i) Prevention of PEM should start with the mother of the child. You have learnt that children with low birth weights often develop PEM. As you have already learnt, the main reason for low birth weight is maternal malnutrition i.e. the mother of the child consumes inadequate quantities of energy and protein during her pregnancy. We have to, therefore, ensure that a pregnant woman consumes extra food to meet the additional needs of pregnancy. A simple thumb-rule is *to ensure that pregnant women consume additional amounts of foods equal to one normal meal every day during pregnancy.* In the case of poorer families, supplementary food (food in addition to home diet) can be given to the pregnant women during the last three months of pregnancy under government's feeding programmes. These steps would help in improving the birth weights of the children.

ii) Mother's milk is the best food for an infant. *Lactating mothers should be encouraged to breast feed their children as long as possible.* By the age of about 6 months, however, mother's milk alone is not adequate for the child. *Supplementary food should be provided to the children by the age of six months,* in addition to breast milk. These can be cereal—pulse and nut mixes (for eg. wheat, bengal gram and groundnut mix) and can be prepared at home by the mother. You could refer to Annexures 3 and 4 of Block 3 for more ideas on supplementary foods for infants and Annexure 5 for nutritious snacks for preschoolers.

iii) *Children should be fed 5-6 times a day.* We have already learnt that cereal-based Indian diets are quite bulky and unless the child is fed frequently it cannot meet the energy and protein requirements.

iv) Infections like diarrhoea and respiratory infections increase the risk of PEM. *Prompt treatment of these infections would, therefore, help to prevent PEM.* In addition, during diarrhoea and any other infection, *food should not be restricted.* The child should be fed as usual.

v) Protection of *children against diseases like tuberculosis or measles, whooping cough by immunization is another important aspect in the prevention of PEM.* Under the universal immunization programme all the infants receive immunization against all these diseases which are important contributory factors in child malnutrition. Mothers should be educated to avail of these services.

Check Your Progress Exercise 2

1) List any three measures which you would like to adopt to prevent PEM in a village community.

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2) List the main causes of PEM in infants.

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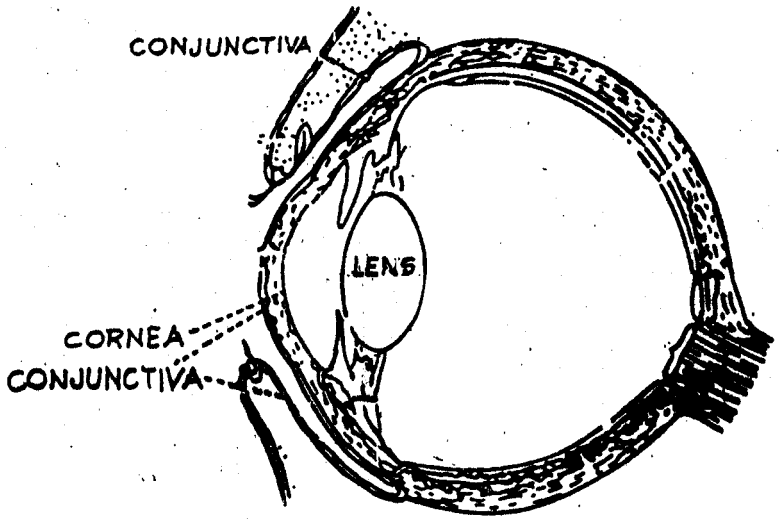
17.3 XEROPHTHALMIA

Xerophthalmia refers to the eye manifestations (signs) arising due to vitamin A deficiency. Blindness, resulting as a result of xerophthalmia, is an important public health problem in India. It is estimated that about a quarter of the 15 million blind persons in the country are due to xerophthalmia. Although vitamin A deficiency may become apparent at all ages, the preschool child (in the third or fourth year of life) is the most frequent victim of this debilitating disorder. What are the signs and symptoms of this disorder? On reading through the subsequent section you will be introduced to the various eye changes (clinical features) common to Vitamin A deficiency.

Clinical features of Xerophthalmia

The clinical manifestations in xerophthalmia pertain to changes in the eye. Do you recall the figure of the eye given in Unit 4 of Block 2? The figure represents the structure of an eye. Once again for your convenience this figure is given here. In this figure you can see the various parts of the eye. It is the conjunctiva and the cornea—the two parts of the eye which are most often affected by the deficency.



Let us now look at the clinical manifestations of xerophthalmia.

a) **Night Blindness :** One of the earliest manifestations of xerophthalmia is night blindness. *Individuals suffering from night blindness cannot see in dim light or around dusk.* The child will be unable to see even the meal plate kept in front of him/her in dim light. This condition is known by different names in different regions. For example, in the rural areas of the North (Hindi belt) this condition is commonly known as rathoundi.

b) **Conjunctival Xerosis :** Xerosis in Greek means dryness. *Conjunctival xerosis, therefore, means dryness of the conjunctiva* (thin transparent membrane that covers the cornea and lines the inside of the eyelid). In the normal eyes, the membrane covering the white portion of the eye (i.e.conjunctiva) is bright, white and moist

the case of xerophthalmia, it becomes discoloured (muddy coloured), dry and loses its brightness. This is known as conjunctival xerosis. Even when there are tears in the eyes the conjunctiva cannot be wetted.

c) **Bitot spots :** In addition to xerosis, *dry foamy, triangular spots may appear on the conjunctiva. These are known as Bitot's spots* (Figure 17.3). Usually these are more common on the temporal side (towards the ear) of the eye rather than the nasal (towards the nose) side. In our country there is a practice among girls to apply 'kajal' (eyetex kohl) to their eyes. In such cases, Bitot spots also take up the black colour of the 'kajal' and can be seen even from a distance. Though conjunctival changes in xerophthalmia do not lead to blindness they should be considered as warning signs. If neglected, the changes may progress affecting the cornea and may lead to irreversible blindness.

d) **Corneal xerosis :** As in the case of the conjunctiva, the normal cornea (the anterior, transparent portion of the outermost layer of the eye) is moist and shining. When vitamin A deficiency becomes severe, the cornea becomes dry and dull and appears like ground glass. This condition is called corneal xerosis *which means dryness of the cornea.* This condition should be treated as an emergency. If it is not treated immediately with vitamin A, the child can develop ulcers (sores) in the cornea. Corneal ulcers (corneal sores) when healed leave white scars known as leucoma. Such white scars on the black of the eye can interfere with normal vision.

Fig. 17.3 Child with Bitot's spots (Photo courtesy:National Institute of Nutrition, Hyderabad)

e) **Keratomalacia :** The most dangerous form of xerophthalmia is known as keratomalacia. In this condition, *the cornea becomes very soft and raw and easily infected. It leads to destruction of the eye. In other words, the eye gets completely melted and destroyed* (Figure 17.4). This condition inevitably leads to irreversible blindness. Generally, this condition is seen in both the eyes and is common in children between the ages of 1-5 years. Sixty to sixty-five per cent of these children die. In addition, the prevalence of infections is also high in these children. About 95-96 per cent of the children with keratomalacia also have either kwashiorkor or marasmus.

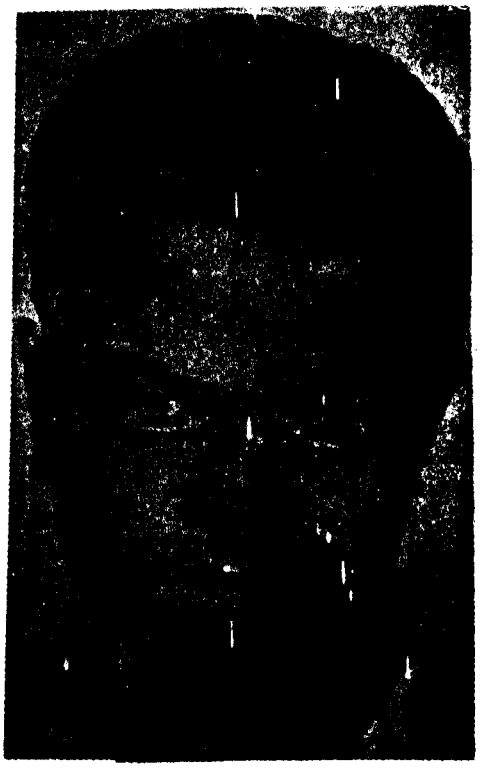


Fig. 17.4 A child who became blind due to Keratomalacia (Photo courtesy : National Institute of Nutrition, Hyderabad).

The study of this section would have given you an idea of how to identify clinical manifestations of vitamin A deficiency. But, what is equally important for us is to know what are the causative factors of this disorder? Let us now learn about them.

What are the causative factors of Xerophthalmia?

Xerophthalmia is common in the families of low socio-economic group living in rural areas and urban slums. In India, the disease is more common among the poorer sections of the community. Vitamin A deficiency may become apparent at all ages the most common, predominantly nutritional, variety occurs in the third and fourth years of life, at least in countries where breast feeding is prolonged. The younger the child, the more serious the manifestations and the greater the mortality rate. The cornea is rarely affected in children beyond the age of five years. In fact, the prevalence of corneal xerophthalmia is maximum between the ages of 1 and 3 years. The disease is relatively more frequent among males. The causes being:

a) **Dietary inadequacy of vitamin A :** The primary cause of xerophthalmia is dietary inadequacy of vitamin A. In the villages and urban slums, among the low income groups, the intake of vitamin A is less than a quarter of the Recommended Dietary Intakes (RDI). Do you recall the RDI for vitamin A for different ages? For your reference the RDIs for different ages are given below:

Table 17.4 : Vitamin A requirement

Category	Retinol (µg)
Adult Man/Woman	600
Lactating Woman	950
Infants (1 year)	300
1-6 years	400
7 years and above	600

(Note : 1 µg = 1/1000 mg)

b) **Maternal Malnutrition :** Indian children of very poor rural families are born with low liver stores of vitamin A because their mothers are also deficient in vitamin A. You have already learnt that vitamin A is fat-soluble and can be stored for longer period in the liver. The women during pregnancy consume very low amounts of vitamin A either due to poverty or ignorance. As a result, the children born to such

women have low vitamin A reserves in the body. As long as the child is breast fed, the vitamin A status of the infants is apparently adequate because the infant gets reasonable amounts of vitamin A through breast milk. Once the child is taken off the breast, the child is put on the family diet which is deficient in vitamin A. *Due to inadequate consumption of vitamin A, the child develops vitamin A deficiency manifesting as xerophthalmia.*

c) **Infections and Infestations :** Diarrhoea and *respiratory infections and worm infestations like round worm disease are very common in children.* These are known to decrease the absorption of vitamin A and lead to deficiency.

Measles, one of the childhood infections, is another important cause of xerophthalmia leading particularly to corneal sores and blindness.

Few of the most common causes of xerophthalmia have been discussed above. What preventive measures and treatment can be prescribed to overcome this disorder is the next point of discussion.

What is the treatment for Vitamin A deficiency ?

For the purpose of treatment we have to first distinguish between milder forms and severe forms of vitamin A deficiency. You have already learnt that the involvement of the cornea should be considered as the most severe form since it can lead to blindness. These should be treated without any delay. Such cases need vitamin A injections into the muscle (intramuscularly) in the dose of 100,000 IU*. On the next day 200,000 IU of vitamin A is given by mouth.

(* About 3 International Units (IU) of Vitamin A is equivalent to 1 microgram (μg) of Vitamin A.)

Children with night blindness, conjuctival xerosis and Bitot spots are treated with a massive oral (by mouth) dose of 200,000 IU of vitamin A.

How to prevent Vitamin A deficiency?

Few measures to prevent Vitamin A deficiency are listed below:

i) **Consume Vitamin A rich diet ;** We know that xerophthalmia is primarily due to dietary inadequacy of vitamin A. Therefore, the most rational method of prevention of vitamin A deficiency *is to make sure that communities consume foods rich in vitamin A regularly.* Inexpensive foods like green leafy vegetables (palak, amaranth, etc.), yellow vegetables (yellow pumpkin and carrots) and fruits (papaya and mango) are good sources of beta carotene which, as you know is the precursor of vitamin A. Consumption of as little as 40 grams of green leafy vegetables daily is enough to maintain the normal vitamin A status in children. However, improvement of Indian diets requires extensive and continuous nutrition education programmes.

ii) **Periodic administration of Vitamin A :** Blindness due to xerophthalmia is a serious problem and requires the most urgent measures. We have already learnt that vitamin A can be stored in the liver for prolonged periods and will be available to the body. It is possible to build up sufficient vitamin A stores in a child by giving large doses of vitamin A periodically. Using this principle, a national programme of prevention of blindness due to xerophthalmia has been developed by the National Institute of Nutrition (NIN) and is operated by the Government of India in the different States of the country. Under the programme, the *children between the ages of one and five years are given a massive oral dose of vitamin A (200,000 IU) once every six months.* The distribution of vitamin A is carried out by the village level health workers like multipurpose health workers of the State Governments. Such a programme, when properly carried out, can bring down the blindness due to xerophthalmia in 80 per cent of young children. *Simultaneous nutrition education is also important for the success of the programme.* You will learn more about this programme in Unit 23 of Block 6.

Check Your Progress Exercise 3

1) Fill in the blanks :

   a) Xerophthalmia is due to the deficiency of.....in the diet.

   b) Conjunctival xerosis means.....of conjunctiva.

c) The most dangerous consequence of xerophthalmia is irreversible.....

d) Dry, foamy, triangular spots appearing on the conjunctiva are called.....

2) The clinical features of xerophthalmia relating to the cornea are:

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3) List the main causes of xerophthalmia in India.

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4) What advice will you give to a mother of a preschool child in a village to prevent xerophthalmia?

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17.4 LET US SUM UP

In this unit we studied about the two major nutritional deficiency disorders—PEM and Xerophthalmia.

PEM is very common in our country and kwashiorkor and marasmus are the severe forms. Oedema is present only in kwashiorkor and there is extreme muscular wasting in marasmus. PEM is due to dietary deficiency of energy and protein. Maternal ignorance, childhood infections, and low birth weight are the contributory causes. These can be treated by foods prepared from cereal, pulse, nuts, jaggery or sugar and other such energy, protein-rich foods. Improvement of the nutritional status of pregnant women, breast feeding the baby, supplementation at about 6 months of age, immunization and prompt treatment of minor diseases like respiratory infections and diarrhoea can help in the prevention of PEM.

Xerophthalmia is due to vitamin A deficiency. It leads to irreversible blindness particularly in young children. The clinical manifestations are seen in the eyes. These are night blindness, conjunctival xerosis, Bitot spots, corneal xerosis, corneal ulcer and keratomalacia. Dietary inadequacy, infections, infestations and ignorance on the part of mothers are the contributory factors for vitamin A deficiency. It can be easily prevented by consumption of inexpensive Vitamin A-rich foods like green leafy vegetables, carrot, yellow pumpkin, papaya and mango. Blindness due to xerophthalmia can be prevented by administration of massive dose of vitamin A (i.e 200,000 IU of Vitamin A) every six months to the children between 1 and 5 years of age.

17.5 GLOSSARY

International Standards for weight : Body weights of normal and well fed children, usually obtained on American children used as the ideal standard for comparison.

Intramuscular injection : Injection of medicines into muscle for treatment of disease(s).

Malnutrition : Condition occuring due to deficient or excessive intake of nutrients.

Microgram (μg) : 1/1000th of a miligram

Precursor : It refers to any substance which can be converted to a vitamin in the body. For example, carotene is the precursor of Vitamin A.

Subclinical : Disease condition which occurs before clinical signs/symptoms of a disease occur.

17.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1)

Features	Kwashiorkor	Marasmus
Oedema	Present	Absent
Muscle wasting	Moderate	Severe
Hair changes	Present	Absent
Body weight	60% of normal	50% of normal
Moon face	Present	Absent

2) a) Severe (i.e. $\frac{4.7}{9.5} \times 100 = 49.5\%$ which is less than 50% of the normal weight for age.)

b) marasmus
c) body weight
d) Moon face
e) Subclinical forms

Check Your Progress Exercise 2

1) Any three of the following :

a) Improve maternal nutrition by ensuring adequate intake of energy-rich foods by pregnent women to increase birth weight of their offsprings.

b) Breast feed the child as long as possible.

c) Introducing supplementary food in addition to breast milk by the age of 6 months.

d) Children should be fed 5-6 times a day.

e) Prompt treatment of minor ailments like diarrhoea and respiratory infection.

f) Immunization of children against diseases.

2) Poverty, Maternal malnutrition, Infections and poor hygiene, Ignorance, Wrong child feeding practices.

Check Your Progress Exercise 3

1) a) vitamin A
b) dryness
c) blindness
d) Bitot spots

2) Corneal xerosis, corneal ulceration and keratomalacia.

3) a) Maternal malnutrition
b) Deficiency of vitamin A in the diets
c) Infections like diarrhoea, measles and respiratory infections
d) Infestations like round worm disease
e) Ignorance leading to avoidance of vitamin A-rich foods

4) ● Give daily one of the inexpensive local foods like green leafy vegetables, carrots, yellow pumpkin, papaya or mango.

● Provide massive oral dose of Vitamin A (200,000 IU) once every six months.

UNIT 18 MAJOR DEFICIENCY DISEASES-II: ANAEMIA AND IODINE DEFICIENCY DISORDERS

Structure

18.1 INTRODUCTION

In the previous unit, you have learnt about protein energy malnutrition and xerophthalmia (the two major nutrition-related disorders) which are common among young children in the rural areas as well as urban slums of our country. In this unit, you will be introduced to another two major deficiency diseases or nutrition-related disorders—Anaemia and Iodine deficiency disorders. These nutrition-related disorders affect a large section of the population particularly women and children (anaemia due to iron deficiency) and pockets of population (iodine deficiency disorders).

This unit deals with various aspects of these deficiency diseases i.e. nature, clinical features, causes and control.

Objectives

After studying this unit, you will be able to

- describe the nature and causes of nutritional anaemias and iodine deficiency disorders
- identify the clinical features of anaemias and iodine deficiency disorders and
- list measures for control of anaemias and iodine deficiency disorders

18.2 NUTRITIONAL ANAEMIAS

Anaemia is a nutritional disorder commonly seen among Indian women of low socio-economic group. It is also observed even among women of higher income group. It is estimated that about 60-70% of pregnant women in the rural areas and urban slums suffer from anaemia. Anaemia is also common in preschool children (1-5 years), school age children and women in the reproductive age group (15-45 years of age).

Anaemia is a condition where haemoglobin levels in blood fall below the normal levels. Haemoglobin, you know, is a pigment present in the blood which gives red colour to the blood and is important for carrying oxygen to the different body tissues in the body.

Haemoglobin is a substance containing iron and protein.

Iron (Haem) + Protein (Globin) → Haemoglobin

In the case of normal and healthy individuals the haemoglobin in blood is about 15 g per decilitre (100 ml). However, for detecting anaemia, the World Health Organization (WHO) has recommended certain cut-off levels of haemoglobin for different ages below which the individual is considered anaemic. The cut-off level refers to the level of haemoglobin in the blood of an individual (of particular age group) below which that individual will be termed as anaemic. These cut-off levels of haemoglobin are given below (for individuals of various age groups).

Age	g/100 ml
6 months to 6 years	11
6 years to 12 years	12
≥12 years Male	13
≥12 years Female	12
Pregnant women	11

Now, you would be interested in knowing deficiency of which nutrient results in anaemia. Anaemia can be due to deficiency of iron which is a part of haemoglobin. In Unit 4, Block 2, you have read that folic acid and vitamin B_{12} also play a role in blood formation. Deficiency of these vitamins can also lead to anaemia.

Clinical Features : The clinical symptoms of anaemia arise when the transport of oxygen by the blood is insufficient to meet the needs of the body. The symptoms are, therefore, related to *physical activity*. The following flow chart explains this fact.

Lack of haemoglobin
↓
Poor supply of oxygen to tissue
↓
Lower capacity to do physical work

As you know, the need for oxygen is increased during any physical activity like walking, running or doing any physical work. Therefore, inability to make sustained physical effort is the common complaint in anaemia. Usual symptoms of anaemia are fatigue, giddiness, breathlessness on exertion, sleeplessness, palpitation and loss of appetite.

Other clinical changes which appear include *pallor or paleness of certain* parts of the body. Paleness (pallor) is one of the clinical signs based on which anaemia is diagnosed. Paleness of the tongue, conjunctiva (white of the eye) and nail beds is seen in an anaemic person. In normal persons when one examines the eyes by pulling the lower lids down, one finds that the conjunctiva is red. Similar is the case with the tongue. In anaemia, due to reduction of haemoglobin these appear very pale and whitish.

The patient may feel that someone is *pricking him/her with pins (pins and needles) on the fingers and toes.* Some patients may complain of chest pain due to reduced oxygen supply to the heart muscle. In severe anaemia, the *nails of the fingers and toes become brittle and spoon shaped* (Figure 18.1). The tongue may appear smooth and glazed *due to atrophy (destruction) of the papillae (numerous projections on the tongue).*

Severe anaemia can even lead to death. The risk of death is higher in anaemic women particularly during pregnancy and delivery. You know that the normal term of pregnancy is about 9 months. Pregnant women with anaemia are likely to deliver babies before completing the normal term i.e. before 9 months of pregnancy. They usually give birth to low birth weight babies (birth weight less than 2.5 kg). Infection of uterus, kidneys and the urinary tract are more common in anaemic people. In general, anaemic people are at a greater risk of catching infections.

Causes : What are the causes of anaemia? As you know anaemia can be due to iron deficiency or folic acid and vitamin B_{12} deficiency. The various *causes of iron*

Fig.18.1 Spoon shaped nails (Photo Courtesy : National Institute of Nutrition,Hyderabad)

deficiency anaemia can be clubbed under two main headings—dietary deficits and iron losses from the body. Let us learn about each of them in detail.

a) *Dietary inadequacy* : Dietary deficit in the body can be due to two reasons—low dietary intake of iron or reduced (low) absorption of iron in the body. As you know, iron requirement is high in the body in certain physiological conditions especially in infants, children and women in reproductive years (as a result of menstruation, pregnancy and lactation). If iron intake during these periods of life is not adequate, obviously anaemia can set in.

You may be surprised to know that many individuals among these do consume enough iron-rich foods, yet they tend to be anaemic. What is the reason for this anomaly? You know that in India because of economic reasons many communities largely consume vegetarian diets. These diets do not contain sufficient absorbable iron (due to the presence of inhibitors). Animal foods from which iron is better absorbed (due to the presence of enhancers) are expensive and generally not consumed in most families in India due to religious and socio-economic reasons.

b) *Losses of Iron :* The second major cause of anaemia is increased loss of iron from the body. In adult women loss of iron occurs every month due to menstrual loss of blood. Apart from menstrual loss, loss of iron occurs during pregnancy, delivery and lactation. As you know in pregnancy the woman loses iron to provide for the iron stores of the foetus. During delivery, due to loss of blood and iron content of the placenta, the loss is substantial. Similarly, when the women are breast feeding their babies they lose iron in milk. This poses additional demands for iron on them. If proper care of women is not taken during these periods, it can lead to anaemia.

Iron losses from the body are also more in case of people suffering from hookworm and other worm infestations. This is because worms residing in the small intestine of an individual feed on his/her blood. Heavy loss of iron from the body in conditions of surgery or accident can also lead to anaemia.

Folic acid and Vitamin B_{12} deficiency : As you have learnt, anaemia can also occur due to the deficiency of folic acid and vitamin B_{12}. Let us now study the causes of deficiency of folic acid and vitamin B_{12} in Indian diets. You have already learnt in Block 2 that these nutrients belong to the B-complex group of vitamins and play an important role in red blood cell formation. As you know, folic acid is widely distributed in foods. Folic acid deficiency is common only among pregnant women who consume diets which do not contain vegetables, fruits, milk or animal foods right through their lives. We generally, do not come across folic acid deficiency in people who eat foods like green leafy vegetables, fruits and milk regularly (which are good sources of folic acid). Women and children are affected by folic acid deficiency more than men.

Anaemia due to the deficiency of vitamin B_{12} is rather rare. The disorder is due to failure to absorb vitamin B_{12} either due to lack of a substance called intrinsic factor (normally present in the stomach) or dietary deficiency. As you know, vitamin B_{12} is present only in foods of animal origin. Dietary deficiency may arise in people who are strict vegetarians or eat no animal products. This is one of the reasons why milk should be added to our diets particularly to those depending on vegetarian diets totally.

Treatment : Haemoglobin in blood can be raised by giving iron in the form of tablets. Ferrous sulphate (iron tablets) is the preparation of choice to treat anaemias. *One tablet (Ferrous sulphate 150-180 mg)* twice or thrice a day before food is recommended. This may cause certain side effects like constipation, discolouration of stools and gastric upset like nausea. The woman should be clearly told about the possibility of these side effects and be prepared so that she does not discontinue the treatment. In fact, a large number of individuals stop taking iron tablets because of these complaints. Treatment should be continued for atleast 3 months after haemoglobin levels return to normal. In the case of infants and children, sweet liquid preparations (syrups) are available. In the case of folic acid and vitamin B_{12} deficiency anaemia, tablets containing folic acid (1-2 mg) and B_{12} (10 μg) are given.

Associated infections should be treated with appropriate antibiotics. In areas where hookworm disease is common, suitable medicines should be given to treat the disease. Simple medicinal iron in the case of individuals with hookworm infestation will not be adequate to treat anaemia.

Prevention : Given below are the few preventive measures which can help to prevent anaemias.

a) *Dietary measures :* The most rational method of prevention of anaemia is to ensure consumption of diets adequate in iron by the population. The women, particularly living in villages and urban slums, should be adequately educated about the importance of prevention of anaemia and should be encouraged to consume iron-rich foods regularly. Inexpensive sources of iron are green leafy vegetables (palak, amaranth etc.), rice flakes, other vegetables like (lotus stem), groundnuts. If these foods are consumed as sources of iron, care should be taken that enough vitamin C-rich and protein-rich foods are consumed along with them (as they enhance absorption of iron). Meat and liver are preferably good dietary sources, if one likes and can afford them.

b) *Fortification of foods:* One of the methods of ensuring adequate consumption of iron through diets is to add iron to a food item, that is consumed by one and all daily. *The method by which the nutritive value of diets is improved by the addition of one or more nutrients to a food item is known as fortification of food.* The food selected for this should be consumed by all, particularly the needy poorer segments of the populations, with very little daily variation in the quantities consumed. Common salt is consumed by the rich and poor daily in our country. It has been identified as the vehicle for fortification with iron. Studies have shown that consumption of common salt to which iron has been added leads to an increase in haemoglobin levels, thus reducing the prevalence of anaemia. Though this programme has not yet been initiated in the country, this will be one of the approaches to control anaemia in future. Baby foods are also fortified with iron to protect infants fed for long periods on artificial milk formulas from anaemia.

c) *Distribution of iron and folic acid tablets :* You know that by giving iron tablets, the haemoglobin levels in the blood can be raised. One of the approaches, that has been in practice in the country for over 20 years is distribution of tablets containing iron (60 mg) and folic acid (500 μg) to the vulnerable sections of the community (those who are more prone to deficiency disorders)—women, pregnant and lactating women, family planning acceptors (women who have been sterilized or those using intrauterine contraceptive devices These women may have more menstrual losses) and children (1-5 years). The Government of India has been implementing a programme called National Nutritional Anaemia Control Programme, since the year 1970. Under the programme, the beneficiaries receive 100 tablets of iron and folic acid. This is expected to control the widespread prevalence of anaemia in the

country. You will learn more about the two programmes in Block 6. Simultaneously the community should be educated to protect themselves against anaemia by consuming foods rich in iron.

Check Your Progress Exercise 1

1) List the population groups at risk of developing anaemia.

.....

.....

.....

2) Fill in the blanks :

a) Nirety five per cent of anaemia in India is due to.....deficiency.

b) Anaemia arises when the transport of.....by the blood is insufficient to meet the needs of the body.

c) In pregnant women, the haemoglobin level below.....in blood is considered as anaemia.

d) Milk is a .....source of iron.

3) Match the following :

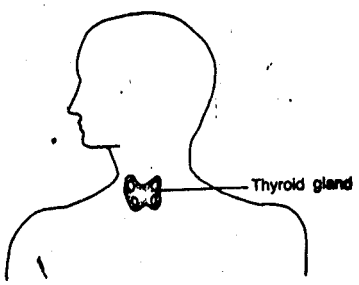
A	B
a) Intrinsic factor	i) Oxygen
b) Absorption of iron	ii) B_{12}
c) Common salt	iii) Animal foods
d) Iron	iv) Fortification
	v) Folic acid
	vi) Haem

18.3 IODINE DEFICIENCY DISORDERS

Iodine deficiency disorders (IDD) present another major health problem in India. About 200 million people are at risk of IDD in our country. It means, they are living in areas where IDD is very common. Isn't it alarming! Till recently, the disease was observed only in Himalayan and Sub Himalayan belts of India (hilly regions) extending from Jammu & Kashmir in the North to Nagaland in the East. In the recent past, however, newer areas south of Vindhyas in Maharashtra, Andhra Pradesh, Karnataka and Delhi in the north are being identified as regions where IDD is becoming more common.

The term IDD includes a spectrum of disabling conditions affecting the health of humans starting from life in the womb through adulthood resulting from an inadequate dietary intake of iodine.

Causes : Iodine is essential for the normal functioning of an endocrine gland known as the thyroid gland. This gland is located in the front portion of the neck as indicated in the following figure.



Location of thyroid gland

The secretion from the gland a hormone called thyroxine, is very important for normal human development and health. Iodine helps in the formation of thyroxine. When iodine is inadequate, the thyroid gland enlarges in an attempt to produce thyroxine for the body needs.

We require very small quantities of iodine (150 µg per day). You have read in Unit 5 of Block 2 that usually we can obtain this iodine through foods and water. In areas where IDD is very common, the environment is deficient in iodine so that soil, water and foods have greatly reduced amounts of iodine. In mountainous and hilly regions, environmental iodine deficiency occurs due to years of washing of the soil by heavy rains and glaciers. In the case of plains, repeated floods deplete the environment of iodine. As a result, water and all animal and vegetable foods dependent on the soil are deficient in iodine. Thus, when foods which are deficient in iodine are consumed, the diet will also be deficient and this produces iodine deficiency.

Apart from this, certain chemical substances called *goitrogens* (goitre-producing substances) interfere with utilization of iodine by the thyroid gland. Foods like cabbage and radish are known to contain goitrogens. Consumption of these foods in large quantities in some cases may produce iodine deficiency. There is, however, no evidence, as yet, to state that these foods by themselves produce IDD, atleast in India.

Clinical Features : Goitre and cretinism are the best known and easily recognizable forms of iodine deficiency. However, you should remember that these are not the only manifestations of iodine deficiency disorders. In fact, the term 'Iodine-Deficiency Disorders' includes a spectrum of crippling conditions affecting the health and well being of mankind starting from early in foetal life through adulthood as we mentioned earlier. Other manifestations of iodine deficiency disorders are indicated in Table 18.1.

Table 18.1 : Spectrum of iodine deficiency disorders in approximate order of increasing severity

Disorders	Level of severity
Goitre	— Various grades of goitre depending upon the size of swelling
Hypothyroidism	— Varying combinations of clinical signs (depending upon age of onset, duration and severity)
Subnormal intelligence Mental deficiency Hearing defects Squint Spasticity Muscular weakness	— Variable severity
Endemic cretinism	
Intrauterine death (Spontaneous abortion, miscarriage)	

Source : Adapted from Iodine Deficiency Disorders in South-east Asia; SEARO Regional Health Papers No. 10 (chapter 1)

Let us study about the clinical manifestations of both goitre and cretinism.

Goitre : The word 'Goitre' means swelling/or enlargement of the thyroid gland.

As you have read, in case of deficiency of iodine in the body, thyroid gland enlarges in order to trap more iodine (whatever is available). The swelling or enlargement can vary in size depending on the severity of the goitre. In fact, you can grade goitre based on the size of the swelling in the neck. At one end is the swelling which is only visible on careful examination with the neck of the patient stretched and at the other

Fig.18.2 Goitre (Photo Courtesy : National Institute of Nutrition, Hyderabad)

end is the big, monstrous goitre which can be seen even from a distance. The prevalence rate (number of cases in 100 individuals) of goitre increases with age reaching a maximum at adolescence. It is more frequent in girls than boys. In fact, if one wants to find out whether goitre is a major problem in an area so as to start a control programme, the goitre rate ove the ages 8-14 years is used as an indicator to know whether an area is endemic (highly affected area) for goitre or not. A prevalence of 10% (i.e. 10 girls out of 100 of this age examined) is taken as an indication that goitre is an important health problem in that particular area.

Cretinism : It is the most severe manifestation of IDD. Cretinism refers to adverse effects of iodine deficiency on the infant and young child. Let us see how cretinism sets in. Iodine deficiency interferes with the brain development of the foetus. This means it can cause irreversible brain damage even before birth. If an infant is born to an iodine deficient mother, he or she is likely to suffer from hypothyroidism. If this condition of iodine deficiency or hypothyroidism continues further after birth the child may suffer from a series of disorders which may include mental retardation, growth failure, speech and hearing defects, neuromuscular disorders, paralysis.

All these defects might lead to a mentally retarded deaf-mute or cretin (a child suffering from cretinism). Fortunately there are very few areas in our country where cretinism is common. However, it has been found that in severely iodine deficient areas more than 80 per cent of children are disabled to some extent due to IDD.

Control : Sin e IDD is primarily due to reduced intake of iodine, the control strategy aims at ensuring sufficient intake of iodine by the population living in areas where IDD is common. A few methods that have commonly been used to increase the iodine intake of people residing in endemic regions include:

1) Addition of iodine to salt.
2) Use of tablets containing potassium or sodium iodide.
3) Use of ic dized oil.

Let us discuss each of these methods separately.

1) Use of Iodized salt : The oldest and the most extensively used method is fortification (enrichment) of common salt with iodine (Potassium iodate). You have earlier learnt that salt may be used for fortification of iron to control anaemia. We consume on an average 10-12 g of common salt every day. For 10 g of common salt about 150 µg of iodine is added. In other words, daily consumption of common salt would ensure daily requirements of iodine. The iodized salt (common salt to which iodine is added) smells, tastes and even looks exactly like the common salt. Now a days, in the market in a number of towns, several brands of iodized salt are available. You would realize that it is difficult to differentiate the same from unfortified common salt. The procedure of iodation is simple and costs little. In India distribution of iodized salt in the endemic areas, is in practice for about 25 years. In these areas entry of non-iodized salt is completely banned by law. However, for various reasons—mainly due to inadequate supplies of iodized salt—salt which is not iodized is being sold in the areas. The Government of India has now decided to make available only iodized salt by the year 1992 so that non-iodized salt is not available in the market. According to the available scientific evidence, consumption of 150µg iodine per 10 g of common salt per day by humans even in areas where goitre is not common may not be a health hazard.

2) Use of tablets of sodium or potassium iodide : Provision of sodium/potassium iodate tablets to school children and addition of iodine to the drinking water suppliers have been tried in some countries. However, this is not a widely accepted method of administering iodine.

3) Use of Iodized oil : During the last decade, injection of oil, to which iodine has been added has been adapted for the control of goitre and cretinism in areas where the IDD is severe. The advantage is that an injection of 1 ml dose of iodized oil can provide protection to an individual for 3-5 years. But this is more expensive and reaching all those at risk by this method is difficult. It is used as a temporary measure particularly in areas which are not easily accessible and iodized salt may not reach due to communication problems.

You know that giving injections to a large number of people is difficult and the people also may not accept them. Hence, efforts are being made to use iodized oil (oil to which iodine has been added) by mouth for controlling goitre. This will also be equally expensive as injections of oil. But of course the acceptability by the community will be better.

Among the various methods available for control of IDD, salt fortification seems to be the method of choice for long term solution of the problem. In fact fortification of common salt with iodine is the major aspect of India's National Programme for control of iodine deficiency disorders. Education of the people about the dangers of IDD and creating political will in the country are important steps in this regard. It is only when the community is sufficiently aware of the various dangers of IDD can we succeed in the implementation of the Iodine Prophylaxis Programme where iodized salt is distributed to the communities in the endemic areas. You will learn more about this programme in Unit 23 of Block 6.

Check Your Progress Exercise 2

1) Which are the areas in India where iodine deficiency has been prevalent for years?

.....

.....

.....

.....

2) List the methods of control of iodine deficiency disorders.

.....

.....

.....

.....

3) Fill in the blanks :

a) Iodine is required for formation of..... .....hormone.

b) We require.....µg of iodine per day.

c) Substances which interfere with utilization of iodine by the thyroid gland are called.....

d) The most suitable method for control of iodine deficiency in India is use of.....

e) .....and.....are the most easily recognized forms of IDD.

18.4 LET US SUM UP

In this unit you have learnt about two major nutritional deficiency disorders i.e. anaemia and iodine deficiency disorders.

Nutritional anaemias are common in women particularly during pregnancy and lactation. In India, most of the anaemia is due to iron deficiency. The anaemic subjects have easy fatiguability, giddiness and breathlessness on physical exertion. Paleness of conjunctiva, tongue and nail beds is present. In severe cases, chest pain and spoon-shaped nails may be present. Dietary inadequacy, menstrual loss and frequent pregnancies in women are important causes. Iron tablets should be given for treating cases of anaemia. Nutrition education to consume foods rich in iron and distribution of tablets of iron and folic acid to vulnerable groups are important measures to prevent anaemia.

Iodine deficiency occurs due to reduction of iodine in the environment i.e. in soil, water and foods. It leads to iodine deficiency in the diets. The commonest manifestation is swelling of thyroid gland (goitre). Cretinism presents the most severe form of iodine deficiency disorder. It is characterized by mental retardation, growth failure and deaf mutism. Goitre and cretinism present extreme ends of the spectrum of iodine deficiency disorders. Within these two forms of IDD are the several others. Iodine deficiency can be prevented by enrichment of common salt with iodine. This programme is in operation in the country since the past 25 years. Injections of iodized oil can protect population from iodine deficiency for 3-5 years. Nutrition education of the community to utilize the services will be important in the control of IDD.

18.5 GLOSSARY

Deaf mutism :	Inability to speak due to deafness occuring since birth or early in life.
Decilitre :	1/10 of a litre or 100 ml.
Deworming :	Treatment for removal of worms like in roundworm disease, hookworm disease etc.
Endemic :	A disease which more or less prevails continuously in a given region.
Endocrine gland :	Organs that secrete specific substances (hormones) which are released directly into the circulatory system. These glands influence metobolism and other body processes.
Family planning acceptor :	Women who underwent sterilization operation or accepted intrauterine devices to prevent pregnancy.

Hypothyroidism :	Condition resulting from lower than normal levels of thyroxine.
Intrauterine device :	A device which is placed in the uterus of women as a measure for family planning.
Palpitation :	Forcible pulsation of the heart perceptible to the patient.
Papillae of tongue :	Numerous projections of the mucous membrane on the tongue.
Still birth :	Delivery of a dead foetus.
Squint :	Abnormality of an eye which does not turn to match the other eye's direction.
Spasticity :	Stiffness of the limbs characterized by muscular weakness, walking difficulties and mental deficiency.
Thyroid gland :	An endocrine gland located at the front of the neck.
Thyroxine :	Active iodine compound made in the thyroid gland and functioning as a hormone.

18.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) Pregnant women, lactating women, children under the age of five years and women in the reproductive age group.

2) a) Iron
   b) Oxygen
   c) 11 g per 100 ml
   d) Poor

3) a) ii)
   b) iii)
   c) iv)
   d) v)

Check Your Progress Exercise 2

1) Sub Himalayan belt extending from Jammu & Kashmir in the north to Nagaland in east.

2) Iodization of salt is the simplest method of prevention of IDD. In remote areas intramuscular injection of iodized oil can protect the community for 3-5 years against IDD or sodium/potassium iodide tablet can also be given.

4) a) Thyroxine
   b) 150
   c) Goitrogens
   d) Iodized salt
   e) Goitre, cretinism

UNIT 19 OTHER NUTRITIONAL PROBLEMS

Structure

19.1 INTRODUCTION

Units 17 and 18 of this block discussed some of the most important deficiency diseases which are not only widely prevalent but, more importantly, lead to complications and death as well. There are also other deficiencies which may occur in a large number of people. Some may cause irreversible changes in the body while others may not cause irreversible complications. Yet, these can interfere with the normal functions of the body. Some vitamin deficiencies are important examples. In this unit, we will discuss vitamin deficiencies like ariboflavinosis, beriberi, scurvy. You will also learn about fluorosis and lathyrism. The latter two diseases are not deficiency diseases. Lathyrism is caused by a toxin present in a foodstuff. On the other hand, fluorosis occurs because of excessive consumption of fluoride in water and foods.

Objectives

After studying this unit, you will be able to :

- describe vitamin deficiencies like ariboflavinosis, beriberi, scurvy, rickets and pellagra
- discuss the major features of fluorosis and lathyrism caused by consumption of excessive amounts of a nutrient (fluoride) or a toxin and
- enumerate the measures taken to treat and prevent these disorders.

19.2 B-COMPLEX DEFICIENCIES

You have learnt that vitamins like thiamine, riboflavin, niacin, folic acid and B_{12} are the vitamins of the B-complex group. In this section, you will learn about what happens when there is a deficiency of these vitamins in the body. Let us begin with ariboflavinosis or riboflavin deficiency.

19.2.1 Ariboflavinosis (Riboflavin deficiency)

This is a nutritional deficiency occuring due to reduced intakes of riboflavin through the diet. Riboflavin deficiency is one of the most common among the

B-complex deficiencies. How can we make out that a person is suffering from this deficiency? As in the case of other deficiency diseases you have studied about, this disease is also associated with certain obvious clinical features.

Clinical Features : The major clinical features of aribоflavinosis include:

a) ***Angular Stomatitis :*** One of the clinical signs of aribоflavinosis is angular stomatitis. The subjects develop cracks on both the sides (angles of upper and lower lips) of the mouth (Fig 19.1). This is a very co mmon sign noticed among children, and as high as 30-35% of the children exhibit angular stomatitis. There is usually not much of discomfort and because of this, children and adults ignore it.

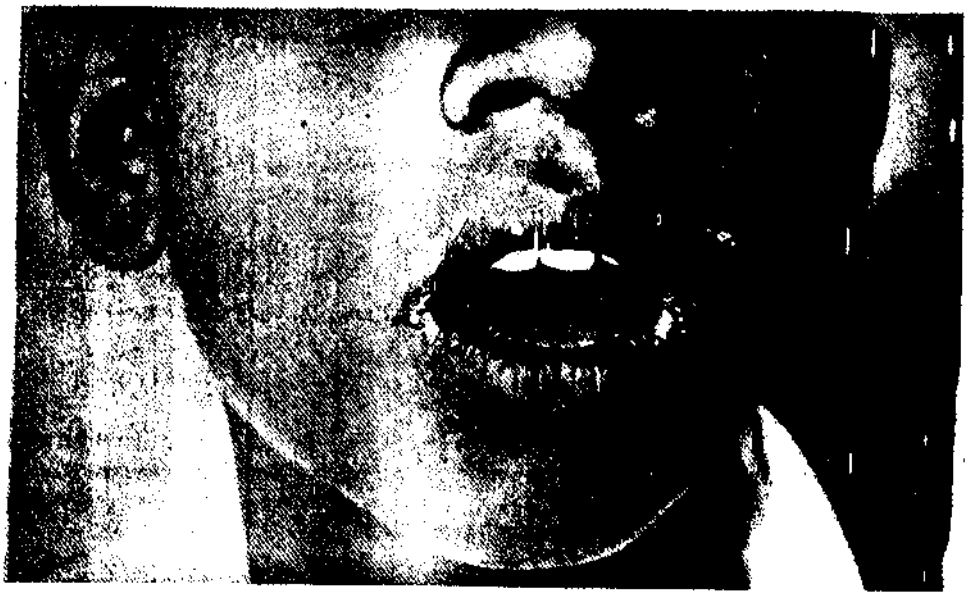


Fig. 19.1 Angular Stomatitis (Photo Courtesy : National Institute of Nutrition, Hyderabad)

b) ***Glossitis :*** This is particularly common among women, especially during pregnancy. The tongue becomes raw and red. There will be a burning sensation whenever foods which are hot and rich in spices are consumed. The tip of the tongue is affected first. In severe deficiency, the tongue may develop cracks as well.

c) ***Cheilosis :*** The lips develop cracks and become red.
The subjects may also lose appetite.

Causes : Aribоflavinosis is due to dietary inadequacy of riboflavin. You already know that green leafy vegetables, milk, organ m eats are good sources of riboflavin. Whole grain cereals, and pulses, nuts provide riboflavin in moderate amounts. As we have already discussed, in the families of poor rural communities, diets contain negligible amounts of pulses and milk. Meat is consumed, but very rarely. As a result, riboflavin deficiency is very common in our country. In fact, the requirements of riboflavin are directly associated with the amount of food energy consumed. Higher the amount of food energy consumed, higher will be the requirements of riboflavin. Turn back to Unit 6 of Block 2 for more information. You have learnt that Indian diets are mainly cereal-based. Cereals are not good sources of riboflavin. Therefore, our diets tend to be deficient in riboflavin.

Treatment : Patients suffering from aribоflavinosis should be given one tablet of B-complex daily for about one week to ten days.

Prevention : Milk is a good source of riboflavin. However, poorer communities cannot afford milk in view of its high cost. We have to make sure that the communities include foods rich in riboflavin like green leafy vegetables, whole cereals and pulses and cheaper nuts in their every day diet to prevent aribоflavinosis.

Check Your Progress Exercise 1

1) List the clinical features of ariboflavinosis.

a) .....

b) .....

c) .....

2) What dietary advice would you give to prevent ariboflavinosis? Answer in three sentences.

.....

.....

3) Fill in the blanks :

a) Milk is a.....source of riboflavin.

b) Higher the consumption of energy in food,.....will be the requirement of riboflavin.

c) The changes noticed in the tongue due to ariboflavinosis are referred to as.....

19.2.2 Pellagra (Niacin deficiency)

This is a nutritional disorder due to the deficiency of niacin, one of the B-complex group of vitamins in the diet. Though it is not as common as ariboflavinosis, pellagra is more frequently seen in the Telengana region of Andhra Pradesh and adjoining parts of Maharashtra and Karnataka.

Clinical features : Pellagra is characterized by typical skin changes (dermatosis), diarrhoea and mental changes.

Dermatosis means changes in the skin. The patients suffering from pellagra exhibit typical skin changes. These changes are symmetrical and are evident only on the parts of the body exposed to the sun like forearms and legs, face and the exposed parts of the neck. The skin becomes dry and scaly (Fig. 19.2).

Fig. 19.2 Pellagra (Photo courtesy : National Institute of Nutrition, Hyderbad)

Diarrhoea i.e. loose motions is also present. In some cases, of course, this may be absent.

Patients of pellagra have slight *mental changes.* These include irritability, forgetfulness and loss of orientation. We are using the word 'orientation' to mean the sense of being able to relate to time, place and events. There may be headache and sleeplessness, tremors of hands and legs and mental depression. Mental changes

may be very noticeable when the patient suffers from severe niacin deficiency. It is estimated that a number of patients with pellagra go to mental hospitals for treatment because of these mental changes. Usually *glossitis* is also seen in individuals with pellagra.

Causes : Pellagra has been known to be common in countries where maize is a staple such as Mexico. The *niacin in maize is in a bound form and is not available to the body.* Hence, people who consume maize as the staple cereal have greater chances of developing pellagra. In India, however, the disease is common in areas where jowar is the staple cereal like in the Telengana region of Andhra Pradesh and the adjoining Maharashtra and Karnataka. This is because of the *presence of excessive amounts of the amino acid leucine in jowar leading to an imbalance between leucine and isoleucine.* You may wonder as to what is imbalance between amino acids. The human body, for normal functioning, has to maintain a balance between various amino acids. When this balance is affected and one amino acid is more than the other it is known as imbalance. You have already learnt that the body needs eight essential amino acids, leucine and isoleucine being two of these. Please refer to Unit 3 of Block 1.

Treatment : Nicotinamide is the drug of choice. It is a compound of which niacin is a part. Niacin as such is not given because when taken in large doses, it produces some unpleasant effects like the face and body becoming hot and red, nausea and vomiting. Nicotinamide brings dramatic relief to patients suffering from pellagra. Generally, a dose of 300 mg per day is given. Along with it, B-complex tablets are also given.

Prevention : You know that pellagra is a preventable disease. The important aspect of prevention is encouraging communities to consume mixed cereal diets so that adequate niacin is available in the diet. The communities should be educated to consume diets based not only on jowar but also rice or wheat. In addition, inclusion of pulses, even in small amounts, is useful in the prevention of pellagra. Nuts, oilseeds and organ meats are also good sources. You learnt in Unit 4, Block 2 that milk contains high amounts of tryptophan which the body converts into niacin.

19.2.3 Beriberi (Thiamine deficiency)

Beriberi is a nutritional deficiency disease caused by the deficiency of the vitamin thiamine in the diet. The disease is rare in our country. Please refer to Unit 4 of Block 2 for more information on thiamine.

Clinical features : Beriberi is a disease of slow origin. Generally, the individual to start with, experiences loss of appetite, weakness and heaviness in the legs. The person also becomes tired easily.

The patient complains of the feeling of pins and needles and numbness in the legs. There may be loss of sensation i.e. loss of the feeling of touch over the legs. The disease occurs in two forms. It manifests itself either as wet beriberi or dry beriberi. *Wet beriberi* is characterized by accumulation of fluid in the body. This can ultimately lead to heart failure. The patient may complain of palpitation (forcible and rapid heart beats felt by the patient) and sometimes of chest pain. There may also be pain in the leg muscles on application of pressure.

In the case of *dry beriberi,* the patient will feel a weakness in the legs progressively making the patient completely bedridden.

Causes : The disease is primarily due to the inadequacy of thiamine in the diet. The disease is very common in communities consuming rice which is highly polished. This is due to the fact that during polishing the thin outer layer of rice (which contains thiamine) is removed. Do you remember Highlight 1 in Block 2? Losses during refining were discussed in detail there. In parts of South India, beriberi was commonly seen when highly polished rice was being consumed. It is rare in our country now-a-days, perhaps, because the diets are not based on highly polished rice. Also rice is rarely the only staple being consumed. Other cereals are also eaten in varying amounts. Even in South India, the communities consume diets consisting of wheat, millets and pulses, though in small amounts. These are good sources of

thiamine. In the communities subsisting on parboiled rice, beriberi is not seen. Can you explain why?

Treatment : In the case of both wet and dry beriberi, thiamine should be given by injection into the muscle atleast for three days. The patient should be advised complete rest. Thereafter, thiamine tablets can be given three times a day.

Prevention : The best way to prevent beriberi is to consume rice which is not highly polished. In fact, hand pounded rice is the best. We can also take steps to reduce polishing of rice while milling. This will help to prevent loss of thiamine. There are a number of modern rice mills where we can produce rice with less polishing. Increase in consumption of pulses and other thiamine-containing foods prevents beriberi. The richest dietary sources of thiamine are yeast and bran (outer layer) of wheat and millets as we mentioned earlier in Unit 4 (Block 2).

Check Your Progress Exercise 2

Match the items in Column A with those in Column B.

Column A	Column B
i) Pellagra cause	a) Nicotinamide
ii) Ariboflavinosis	b) Tryptophan
iii) Heart failure	c) Leucine-isoleucine imbalance
iv) Niacin	d) Wet beriberi
v) Highly polished rice	e) Ariboflavinosis and Pellagra
vi) Milk	f) Leucine-lysine imbalance
vii) Food energy	g) Niacin deficiency
viii) Skin changes on exposed parts of the body	h) B-complex deficiency
ix) Glossitis	i) B-complex and protein deficiency
x) Skin changes	j) Dry beriberi
	k) B-complex requirements
	l) Cheilosis
	m) Low thiamine content

i) List the clinical features of beriberi.

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19.3 VITAMIN D DEFICIENCY

Rickets is a disease of growing children in which the bones become softened and deformed due to the deficiency of vitamin D. *Osteomalacia* is the adult form of vitamin D deficiency. In the subsequent discussion we will explore the major features of these disorders as well as their treatment and prevention. We begin with the causes.

Causes : You have already learnt that vitamin D is one of the fat-soluble vitamins. In Unit 4 of Block 2 you discovered the amazing fact that vitamin D is synthesized (manufactured) in the skin after exposure to sunlight. We have plenty of sunlight in our country and hence the disease is not as common. However, the disease is more frequently seen when there is not enough exposure to sunlight.

In the subsequent discussion on clinical features, treatment and prevention we will have to talk about rickets and osteomalacia separately. Let us begin with rickets.

RICKETS: The young child in certain parts of our country frequently becomes a victim of rickets. Rickets is characterised by a range of specific clinical features as you will see in the following discussion.

Clinical features : In the initial stages of the disease, children become restless. The muscles lose their firmness and become flabby. When the abdominal muscles lose their firmness, the abdomen gets distended. You know that a normal baby's teeth erupt at a particular age. The baby sits and crawls at a particular age. These are known as *developmental milestones.* In the case of rickets, there is a delay in these milestones. For example, teeth erupt late in children with rickets. There is also considerable delay in the age at which the child can sit and crawl. The child is too weak and is unable to walk in some cases.

The most important changes caused by this disorder are seen in the bones. The growing ends (*epiphyses*) of the long bones (like those of the forearm) get extended and widened. For example, there will be a swelling of the forearm bones at the wrist. There may also be swelling at the ends of the ribs which gives an appearance of "beading" of ribs or *rachitic rosary.* In other words, the enlargements on the ribs on the chest of the child give an appearance of a rosary (chain of beads). In normal children the anterior fontanelle—an opening between the skull bones—closes by about 18 months of age. In rickets the ***closure of the anterior fontanelle is delayed.*** In view of the softening of the bones, the children develop what is known as ***craniotabes*** on the skull. As a result, the skull bones instead of being hard give a feeling of yielding when pressure is applied on them.

The child ultimately develops various deformities of the bones. Deformities of the chest with the breast bone becoming prominent are common. This protruding of the breast bone is usually known as *pigeon chest.* The typical deformities seen in children who have recovered from rickets are due to the child's weight bearing down on the legs before complete recovery takes place. At this time the bones are still soft and cannot stand the weight of the child. As a result, the children may have "bow legs" (bent like a bow) or "knock knees" when both the knees will be touching each other, unlike in normal children. Some children may have *bossing* (prominence or jutting out) of frontal (front) and parietal (side) bones of the skull. Deformities of the backbone also may develop if the disease continues beyond the age of 2 years (Fig. 19.3).

Fig. 19.3 Rickets (Photo courtesy : National Institute of Nutrition, Hyderabad)

Treatment : Vitamin D and adequate intake of calcium are the important requirements for treating rickets. Several preparations of vitamin D are available. These also provide vitamin A. Generally, cure results with daily treatment of vitamin D for about 4 weeks. The treatment should be supplemented with calcium.

Prevention : Adequate exposure to sunlight is the most important factor in protecting the child from rickets. Dietary sources are few and the vitamin is found chiefly in fish liver oils and egg yolk. Milk is not a good source of the vitamin. Inclusion of these foodstuffs in daily diets prevents rickets. Supplementation with vitamin D is generally not required in India. However, where required, particularly among families confined to the indoors, cod liver oil is of known value in the prevention of the disease.

OSTEOMALACIA : As you have already learnt, osteomalacia is the adult form of rickets. We come across osteomalacia commonly in women of reproductive age (15-45 years of age). This is more common among women who have had multiple (many) pregnancies. The disease is frequently seen among women belonging to low socio-economic groups depending on poor diets and who are confined to the house. In India, osteomalacia is not that common. Osteomalacia can also be caused by some digestive disorders which may interfere with absorption of vitamin D.

Clinical features : Pain in ribs, hip bone, lower back and legs is the most common complaint. There is muscular weakness and the woman usually finds it difficult to climb stairs. There will be pain on application of pressure on the bones like the hip bone. Sometimes there may be fractures of the bones. Deformities of the back bone are common.

Treatment : Daily vitamin D is the drug of choice. Very rarely, once a week or fortnightly injection of vitamin D into the muscles may be necessary. Supplements of calcium should be given as well. Generally symptoms subside within four to eight weeks.

Prevention : Free access to sunlight is the best way to prevent osteomalacia. Once the deformities occur we cannot correct them. Vitamin D supplements in pregnant women can be undertaken in susceptible cases like in the case of people who are generally confined indoors and in women who had multiple pregnancies.

Check Your Progress Exercise 3

1) Fill in the blanks :

   a) Rickets and osteomalacia are due to the deficiency of.....in children and.....respectively.

   b) The changes noticed on the ribs due to rickets appear like a.....

   c) Exposure to.....is the best way of meeting vitamin D needs.

   d) In rickets.....ends of the bones get extended and widened.

   e) For the prevention of rickets.....oil is of known value.

2) What is required for the synthesis of vitamin D by the body and where is it synthesized?

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19.4 VITAMIN C DEFICIENCY—SCURVY

Scurvy is a nutritional disorder due to inadequate intake of vitamin C. It is observed when people subsist for prolonged periods on diets devoid of fresh fruits and vegetables. It is not a commonly observed nutritional deficiency in India.

Clinical features : The most important clinical sign of scurvy is *spongy, bleeding gums.* The gums are swollen, particularly in the region between the teeth. They bleed even on slight touch. Infection of gums is also usually present. Tiny spots may be seen on the skin above the knees and on the lower parts of the thighs due to bleeding. There may also be anaemia due to associated iron or folic acid deficiency. Untreated, the deficiency can lead to death due to *internal bleeding.*

Causes : Scurvy is due to consumption of diets which do not contain fresh fruits and vegetables for very long periods. This leads to deficiency of vitamin C or ascorbic acid. You know that vitamin C is destroyed by heat i.e. by cooking. Hence even if the diet may appear to contain adequate amounts of vitamin C, it may still cause scurvy due to destruction of vitamin C during cooking.

Treatment : Vitamin C tablets should be given to the patients. Vitamin C by mouth is most often adequate. In acute cases vitamin C injections into the veins will be necessary. It should be followed by administration of vitamin C by mouth continuously.

Prevention : Amla, guava, citrus fruits (lime, orange), are rich sources of vitamin C. Amla is, in fact, the richest source of vitamin C. Similarly sprouted (germinated) pulses like whole bengal gram are good sources of vitamin C. Communities should be educated to include one of these foods in the diet regularly.

19.5 FLUOROSIS

Fluorosis is a disease caused by consumption of excessive amounts of the mineral fluorine for long periods. Fluorine is essential for the development and maintenance of normal bones and teeth. However, if it is consumed in excessive amounts it leads to fluorosis. Research has also indicated that low fluoride intake can lead to dental caries (cavities) in teeth. Fluorosis is an importan health problem in some districts in the States of Andhra Pradesh, Punjab, Karnataka, Tamil Nadu and Rajasthan.

Causes : The main source of fluoride for us in India is drinking water. Drinking water should contain less than 1 mg per litre of fluoride. In areas where fluorosis is common, the fluoride content of water is as high as 3-12 mg/litre. In these areas the population depends on wells for their drinking water. Normally fluoride content in flowing rivers is not high. In our country, due to the hot climate we generally consume more water and thus take in higher amounts of fluoride. The foods do not, however, contribute much of fluoride. The daily diets, however, may provide about 0.25 mg of fluorine. Only foods such as sea fish, tea and cheese are rich in fluorine.

Clinical features : Fluorosis is manifested as changes in the teeth (dental fluorosis) and in bones (skeletal fluorosis). In other words, the clinical manifestations will be seen in teeth and bones.

Dental Fluorosis : In children living in areas where fluorosis is common the disease affects only the teeth. The teeth lose their shine and chalky, white patches appear on them. This is known as *mottling* of teeth. Mottling is considered as an early sign of fluorosis. Later, these white patches become yellowish. In severe cases of fluorosis the hard, glistening substance covering the crown of the teeth (enamel) gets eroded ultimately leading to depressions on the teeth (Fig. 19.4). This is known as *pitting.* Mottled enamel is best seen on the upper cutting teeth known as incisors. You do not see mottling in the teeth of children below the age of 5 years.

Skeletal Fluorosis : In older individuals, fluorosis leads to changes in the bones because of consumption of excess of fluoride for prolonged periods. Initially, the individual will have pain in the neck and stiffness of the back. This progressively leads to difficulty in the movement of the neck and back. We can see the changes in bones only when X-rays are taken in early cases of skeletal fluorosis. In severe skeletal fluorosis the patient will be so incapacitated as to be completely bed-ridden. Recently, in some areas of Andhra Pradesh and Tamil Nadu, a new form of fluorosis has been recognised. In such a case we see changes in legs which look like a severe

Fig. 19.4 Dental fluorosis (Photo courtesy : National Institute of Nutrition, Hyderabad)

form of knock knees. This new form of fluorosis seen in Andhra Pradesh and Tamil Nadu is called *genu valgum*. What causes genu valgum? We are still not sure but trace element imbalances appear to be the reason along with high intakes of fluoride.

Prevention : Fluorosis can be prevented but cannot be cured. The best method to prevent fluorosis is to consume water which has less than 1 mg per litre of fluoride. In other words, steps should be taken to supply drinking water with safe levels of fluoride to the communities to prevent fluorosis. Where this is not possible ***defluoridation*** (removal of excess fluorine) of water is the only alternative. This can be done at the household level. A simple method is to first add lime powder to the pot of drinking water. Then alum is added. It is stirred for about 10 minutes. The water is then decanted off and stored in clean vessels. Such water will have fluoride in safer levels. Large scale defluoridation using costly modern instruments is not possible. Intensive education of the community is necessary to encourage domestic defluoridation.

Check Your Progress Exercise 4

1) Fill in the blanks :

   a) Fluorosis is due to.....consumption of.....

   b) Normal drinking water should contain less than.....of fluoride.

   c) Fluoride in inadequate amounts in the diet can cause.....of teeth.

   d) Changes in bones due to excessive consumption of fluoride is known as.....fluorosis.

2) The following is a list of symptoms of nutritional deficiency disorders. Tick the ones specific to scurvy.

   i) Mental changes
   ii) Glossitis
   iii) Cracks on lips
   iv) Spongy, bleeding gums
   v) Rashes on skin
   vi) Pale conjunctiva
   vii) Spoon shaped nails
   viii) Tiny spots below skin
   ix) Bleeding on touch

3) How can you remove excess fluoride from water at the domestic level?

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19.6 LATHYRISM

Lathyrism is a disease of the nervous system caused by consumption of a pulse, kesari dal, for prolonged periods. It is a serious public health problem in some districts in the States of Madhya Pradesh, Bihar and Uttar Pradesh where kesari dal is widely grown.

Causes : Kesari dal *(Lathyrus sativus)* contains a toxin which affects the nervous system (neurotoxin). The toxin causes damage to the nervous system. The disease is common among landless agricultural labourers in Madhya Pradesh, Bihar and Uttar Pradesh. Particularly during drought seasons, the agricultural labourers depend solely on kesari dal. In fact, kesari dal is a hardy crop which can survive even in severe droughts when much of the wheat crop is damaged. The agricultural labourers in these areas receive the dal from the landlords as wages. They prepare rotis using the dal and consume the same.

Clinical features : This is a disease of the nervous system as we have already mentioned. In the initial stages, when the individual is subjected to physical stress (exercise) he exhibits a gait (walking style) which looks awkward. At this stage, if the dal is withdrawn further progress of the disease can be controlled.

The progress of the established disease is typical and one can observe four clear stages. In the first stage, the patient will walk with jerky movements without the aid of a stick. This is called the *no stick stage*.

As the disease progresses, the patient can walk only with the support of a stick. This is called the *one stick stage.* During this stage, the patient walks on his toes with the support of a stick with the knees slightly bent. While walking, there is the crossing of legs one over the other.

When the symptoms are more severe, the patient can walk only with the support of two sticks *(two stick stage).* The gait is slow and clumsy. There is crossing gait i.e. the legs cross one over the other while walking and the knees are markedly bent. The patient gets tired easily on walking even short distances.

Ultimately the knees are bent completely and the patient can only crawl. This is called the *crawling stage.* Young agricultural labourers are affected by the disease. Ultimately these youths end up as beggars due to this disabling paralysis.

Prevention : There is no specific treatment for the disease. Appropriate steps should be taken to prevent the disease.

Banning of the crop is the surest way of preventing the disease. In fact, under the Prevention of Food Adulteration Act of Governn ent of India, kesari dal is banned in all forms i.e. whole dal and flour. Unfortunately, it is not being effectively operated in States like Madhya Pradesh and Bihar where the problem of lathyrism is common.

There are other methods of prevention. If only we can remove the toxin in the dal, we can still use the dal (Highlight 3).

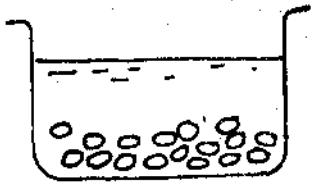
Fig. 19.5 Stages of lathyrism (Photo Courtesy : National Institute of Nutrition, Hyderabad)

HIGHLIGHT 3

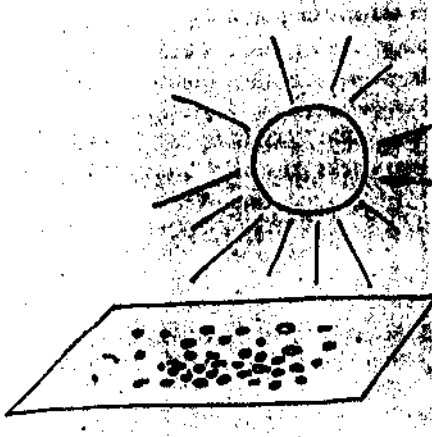
Removing The Toxin From Kesari Dal

Parboiling of kesari dal is one of the simple methods to remove the toxin. This method can be organized on a large commercial scale.

At the domestic level the toxin in kesari dal can be removed by steeping. In this method, water is first boiled and the container of water is removed from the fire. The dal is then soaked in this boiling water for about one hour. The water is drained off and the dal is then sun dried. About 90-95% of the toxin in the dal is leached off or dissolved in the water. This practice can be encouraged through education of community members.



Dal soaked in water which has just been boiled for one hour.



Dal then sun dried

Agricultural scientists are now trying to identify types of kesari dal with low levels of the toxin or no toxin at all. Such varieties would help to solve this problem because of the fact that kesari dal is a sturdy crop with a good yield. Without the toxin, it is a valuable food.

In the long run, the food habits of the communities require to be changed so that they do not solely depend on kesari dal. Large scale nutrition education efforts are required for the purpose.

Check Your Progress Exercise 5

1) Fill in the blanks :

   a) Lathyrism is caused by a.....present in.....

   b) The toxin present in kesari dal affects the.....system.

   c) The surest way of prevention of lathyrism in the country is.....of the crop.

   d) At the domestic level the toxin in kesari dal can be removed by.....method.

2) The following alternatives (a).....(e) describe symptoms typical of a particular nutritional problem. Identify the problem in each case.

   a) Cracks on angles of lips, raw and red tongue, cracks on lips, sensitivity of eyes to light.

   Problem : .....

   b) Gum problem, internal bleeding on touch, associated anaemia.

   Problem : .....

   c) Symmetrical skin rashes on exposed body parts, loose motions, loss of orientation.

   Problem : .....

   d) Tiredness, palpitation, loss of sensation, pain in leg muscles, accumulation of fluid.

   Problem : .....

   e) Delayed developmental milestones in young children, beading of ribs, delayed closure of anterior fontanelle, bow legs.

   Problem : .....

19.7 LET US SUM UP

In this unit you have learnt about some more vitamin deficiencies and problems arising due to excess intake of fluorine and kesari dal. You have read that *ariboflavinosis* is due to the dietary deficiency of riboflavin, one of the B-complex vitamins. The main clinical features are angular stomatitis and glossitis. It can be prevented by addition to the daily diets of pulses/nuts/milk/green leafy vegetables.

Pellagra is due to the deficiency of niacin, one of the B-complex group of vitamins. It is characterized by skin changes, mental changes, diarrhoea. It is common in populations solely subsisting on maize and jowar. The disease can be prevented by consuming mixed cereal diets.

Beriberi is due to the deficiency of thiamine, one of the B-complex vitamins. It was common in populations consuming highly polished rice. The disease is rare nowadays. Wet beriberi manifests with swelling of legs and face. Dry beriberi presents as weakness in limbs. There may be palpitation (rapid heart beats); chest pain, feeling of pins and needles and numbness. The disease can be prevented by consuming hand pounded rice or rice which is not highly polished.

Rickets is due to vitamin D deficiency in children and osteomalacia is its adult counterpart. Vitamin D is synthesized in the skin on exposure to the ultraviolet rays of the sun. It is common in India in individuals who are not exposed to the sun and remain confined indoors. The growing ends of long bones become widened and the muscles become weak in rickets. Developmental milestones like the age at sitting and crawling are delayed in the disease. When the disease heals, bow legs, knock

knees, pigeon chest, frontal bossing etc. may develop. Spinal deformities are also common. Vitamin D is given for treatment and prevention is by exposure to the sun and inclusion of good food sources if possible.

Deficiency of vitamin C in the diet causes *scurvy*. In India it is relatively uncommon. It is characterized by spongy bleeding gums where gums start bleeding even on slight touch. Tiny bleeding spots also may be seen around the knees and lower thighs. It can be prevented by the consumption of diets which contain foods rich in vitamin C such as citrus fruits (orange, lime), guava, amla and sprouted pulses like chana or bengal gram.

Fluorosis is a disease caused by excessive consumption of fluoride. It is an important health problem in some districts of Andhra Pradesh, Karnataka, Punjab, Rajasthan and Tamil Nadu. In children, it manifests as dental fluorosis which is characterized by mottling and pitting of teeth. In the case of older individuals, skeletal fluorosis develops. It is characterized by changes in the bones which can be seen only in X-rays. The patient develops pain and stiffness of the neck and back. Defluoridation of water can be done at the domestic level to remove excess fluorine. This would help to prevent fluorosis.

Lathyrism is a disease of the nervous system seen in landless labourers in the States of Madhya Pradesh, Bihar and Uttar Pradesh due to consumption of kesari dal for prolonged periods. It leads to paralysis of the lower extremities affecting mainly youth who end up as beggars. The toxin in the dal can be removed by parboiling of the dal on a large scale or steeping it in hot water. Education of the communities in the areas to avoid dependence on the dal or banning of the crop can help in the control of the disease.

19.8 GLOSSARY

Alum :	A chemical compound containing a double sulphate of aluminium. It helps in settling of physical impurities of water.
Anterior fontanelle:	A diamond shaped opening on the scalp between frontal and parietal skull bones.
Bow legs :	A deformity when legs are bent like a bow.
Dental fluorosis :	Changes in the teeth due to fluorosis
Enamel :	The hard, glistening substance covering the crown of a tooth i.e. its top part.
Frontal bone :	The single skull bone forming the forehead.
Gait :	Walking style
Incisors :	Cutting teeth, four in number in each jaw
Microgram (μg) :	1/1000th of milligram
Mottling of teeth :	A sign of dental fluorosis in which chalky white or yellowish patches appear on the teeth.
Muscle tone :	Firmness of muscle
Parietal bones :	The bones, two in number, forming part of the upper and each side of skull.
Pins and needles :	A feling of pricking by sharp pins or needles.
Prevention of Food Adulteration Act :	An act formulated by the Government of India to prevent adulteration of foods with harmful substances.

19.9 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) Angular stomatitis, glossitis, cheilosis.

2) To include in the diets one or more of the following:

   Green leafy vegetables, pulses, nuts, milk.

3) a) good
   b) greater or higher
   c) glossitis

Check Your Progress Exercise 2

1) (i)—(c), (ii)—(l), (iii)—(d), (iv)—(a), (v)—(m), (vi)—(b), (vii)—(k), (viii)—(g), (ix)—(e), (x)—(i).

2) List symptoms of wet and dry beriberi separately.

Check Your Progress Exercise 3

1) a) Vitamin D; adult women
   b) rosary
   c) sunlight
   d) growing
   e) cod/liver

2) Sunlight is required for synthesis of vitamin D by the body. Vitamin D is synthesized under the skin.

Check Your Progress Exercise 4

1) a) Excessive, fluoride/fluorine
   b) 1 mg per litre
   c) Caries
   d) Skeletal

2) (iv), (viii), (ix)

Check Your Progress Exercise 5

1) a) Neurotoxin, kesari dal
   b) Nervous
   c) Banning
   d) Steeping

2) (a) Ariboflavinosis (b) Scurvy (c) Pellagra (d) Wet beriberi (e) Rickets.

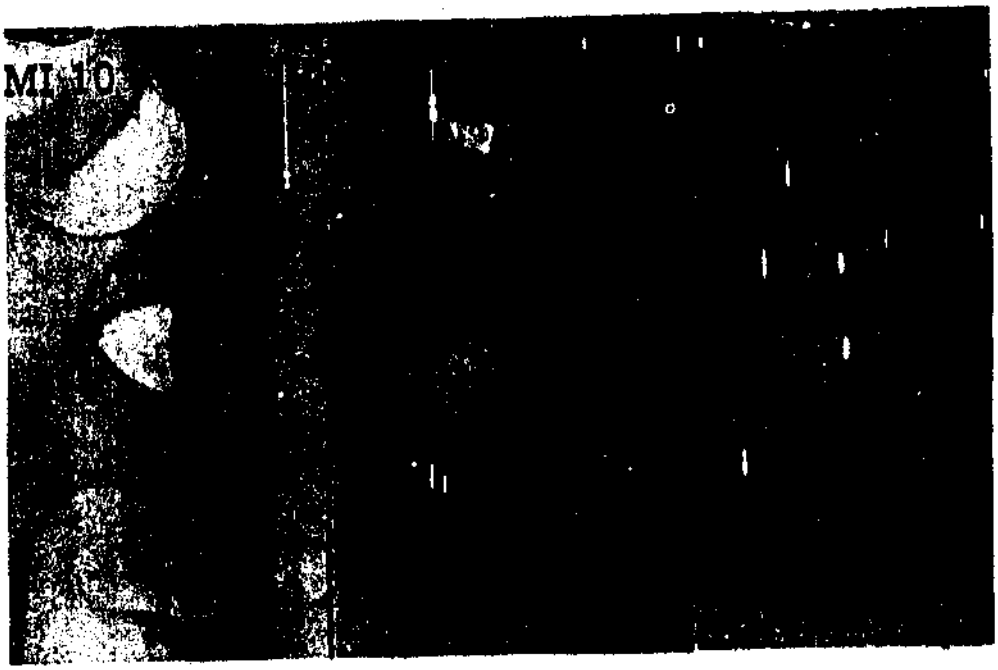
CAN YOU IDENTIFY THESE DISORDERS ?

A

B

Slides Courtesy : Voluntary Health Association of India in collaboration with Dr. David Morley, Institute of Child Health, London

CAN YOU IDENTIFY THESE DISORDERS ?



C

D

Slides Courtesy : Voluntary Health Association of India in collaboration with Dr. David Morley, Institute of Child Health, London

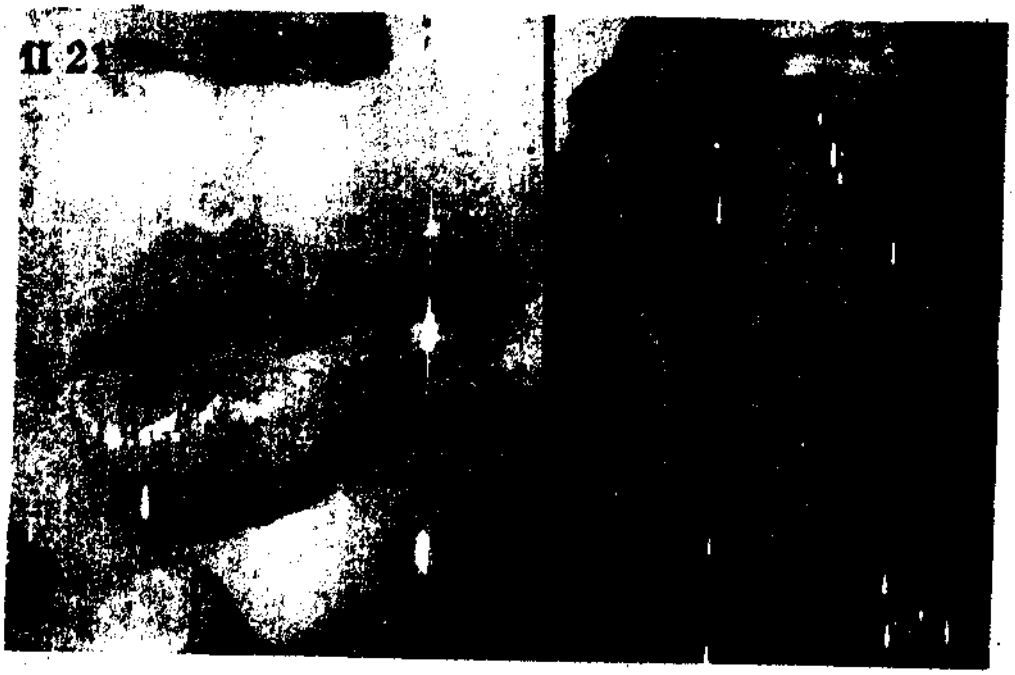
CAN YOU IDENTIFY THESE DISORDERS?

E

F

Slides Courtesy : Voluntary Health Association of India in collaboration with Dr. David Morley, Institute of Child Health, London

CAN YOU IDENTIFY THESE DISORDERS ?



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Slides Courtesy : Voluntary Health Association of India in collaboration with Dr. David Morley, Institute of Child Health, London

UNIT 20 NUTRITION AND INFECTION

Structure

20.1 INTRODUCTION

You are aware that children suffering from malnutrition like PEM almost always have infections such as diarrhoea and respiratory infections. As you may know, the infections are caused by microorganisms which can be seen only through a microscope. Just as infections are common in cases of severe malnutrition, infections like measles, diarrhoea and whooping cough can also lead to malnutrition. Therefore, a understanding of the relationship between malnutrition and infection is essential. Based on such an understanding, you will be able to plan programmes to control malnutrition. This unit presents a detailed discussion on the interaction between infection and malnutrition and the effect of infections on nutritional status. It focuses on the dietary management of two of the common infections—diarrhoea and measles.

Objectives

After studying this unit, you will be able to :

- discuss the interaction between infection and malnutrition
- describe the effects of infections on nutritional status of children
- discuss how malnutrition can lead to infection and
- state the dietary considerations for management of infections like measles and diarrhoea

20.2 INTERACTION BETWEEN INFECTION AND MALNUTRITION

You have just learnt that children with PEM usually have either diarrhoea or respiratory infection. In fact, children suffering from either PEM or a severe form of vitamin A deficiency most often die due to infections. This is due to the fact that infections and malnutrition increase the severity of each other.

When two diseases exist in the same person concurrently, the interaction between the two diseases may alter the behaviour of the diseases. Suppose, there is a child with PEM who is also suffering from diarrhoea. In such a case, the usual result is an exaggerated clinical condition or disease. It means that because of the existence of these two conditions i.e. PEM and diarrhoea, the overall clinical status of the child worsens often resulting in increased complications or increased duration of the diseases and finally death. In other words, the coexistence of infections and malnutrition in the same child is producing an effect that is beyond the summed effect expected from the two diseases acting alone. *This is described as synergism.* For example, if a child with moderate PEM also has infections like measles or diarrhoea, the moderate nutritional disorder such as loss of weight often is precipitated to manifest as kwashiorkor. Similarly, the severity of the infection process can get increased. Both these put together can lead to death and complications in the disease.

The relationship between malnutrition and infection can be described as a vicious cycle (Figure 20.1).

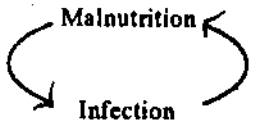

Fig.20.1 Vicious Cycle of Infection and Malnutrition

Malnutrition can increase the risk of infections and infections can, in turn, lead to malnutrition. This interrelationship and the synergistic effect of malnutrition and infections often lead to a high rate of child deaths in poorer communities in India. The cumulative effect of malnutrition and infection produces retardation of physical growth leading to stunting or short stature in children. The effects of stunting are long lasting. As a result, the capacity to do physical work of adults may also be reduced. We can, for example, see as to what generally happens to a poor rural child starting from birth to adulthood in India. The child at birth weighs much lower than a normal child. Subsequently he/she is solely breast fed for longer periods. The delayed supplementary feeding i.e. delayed introduction of additional food usually triggers slowing in growth. In other words, malnutrition sets in. In view of the poor environment and lack of hygiene, the children are constantly exposed to infections like diarrhoea and respiratory infections. There is reduction in food intake by the child due to loss of appetite due to these infections. As a result, there is further slowing down of growth. The cycles of dietary deficit and infections ultimately may lead to kwashiorkor in a child. (Figure 20.2)

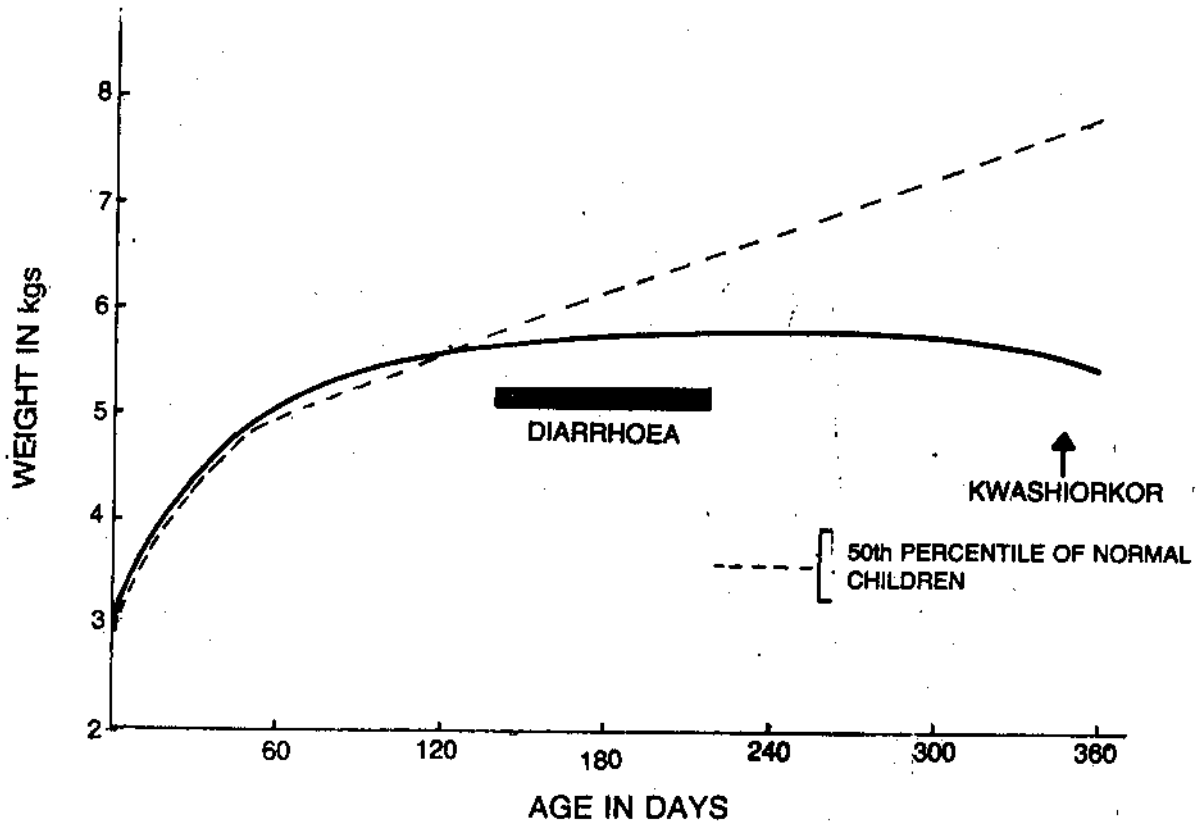

Fig. 20.2 Weight curve of an infant who developed undernutrition. (Source : Gopalan and Vijayaraghavan, K. Nutrition Atlas of India, 1971, National Institute of Nutrition, Hyderabad)

The story is same in all such children. The ill effects of malnutrition and infection on the health of the child get accumulated year by year and the effects are devastating. Ultimately the child with poor nutrition and health during his childhood enters adulthood as a malnourished adult. They are not only much shorter than their normal counterparts but also have weights lower than healthy individuals. Consequently their capacity to do physical work is significantly reduced. This, as you know, can hamper the development of the country.

So far we have studied about interaction of infection and malnutrition. Let us now look at the effect of malnutrition on infection.

10.2.1 Effect of Malnutrition on Infection

The following discussion documents, how malnutrition favours infection.

a) **Reduction in antibody production :** A normal child who is adequately fed and well nourished is at a lower risk of infection. More importantly, the child can fight the infections better. Why? This is due to the ability of the healthy and well nourished child to produce disease-fighting substances called *antibodies*. You may recall reading about antibodies (as proteins in the human body which help fight infections) in Block 1, Unit 3. In view of this, normal children recover from infections faster, as a result, the ill effects of the infections are negligible in the child. However, in the case of severe PEM, or vitamin A deficiency there is a reduction in antibody production. In other words, in malnutrition the disease fighting capability of an individual is considerably lowered, thereby, making the child more prone to infections.

b) **Effect on the integrity of skin and mucous membrane:** In normal and well fed individuals, the skin, mucous membranes and other tissues prevent the entry of infectious agents. These tissues act as barriers to infection and prevent the infectious agents from entering the human body. In PEM, such a protective mechanism will be absent. The secretion of mucous may be reduced, mucous membrane becomes readily permeable and a favourable environment for the growth of the infectious agents will be created. Consequently, a malnourished child can catch infections easily.

You may know that human intestines harbour microorganisms even when an individual is healthy and normal. In healthy normal individuals these organisms do not produce any disease. But, in PEM, the microorganisms may produce diarrhoea.

c) **PEM and worm infestation :** You would have learnt that during digestion food that is ingested, is pushed down the digestive tract with the help of certain type of movements. Always remember that proper mobility (movement) of the digestive tract is important for normal digestion. In individuals with malnutrition this mobility of the digestive tract may slow down, because of which, there is more time available for the worms to multiply. As a result, worm infections like round worm disease may become severe. In addition, the duration and severity of gastrointestinal infections may be more in malnourished individuals.

You have so far learnt how malnutrition can lead to or aggravate infections. We have also discussed that the relationship between malnutrition and infection is in the form of a vicious cycle. Now in the next section we will learn how infections can influence the nutritional status.

Check Your Progress Exercise 1

1) What is synergism?

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2) List the factors which contribute to malnutrition in infection.

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20.2.2 Effect of Infection on Nutritional Status

Nutritional status, you know, is the condition of health of an individual as influenced by the utilization of nutrients. How does infection influence the utilization of nutrients? What effect does it have on the nutrient intake? These are the aspects discussed in this subsection. We begin with the effect of infection on food intake.

a) **Reduced food intake :** When a child is suffering from infections like diarrhoea or respiratory infection, one of the first changes noted by the mother is loss of appetite. Quite often, the child may not like or tolerate food. As a result of this, the child consumes less food or there is reduced dietary intake. Furthermore, the antibiotics used in the treatment of infection may also reduce the appetite in the child leading to reduced food intakes.

One of the common practices in our country when a child is suffering from infection or a disease is restriction or withholding of food. For example, in the case of diarrhoea solid foods and milk are restricted and in their place starchy gruels are given. Such a practice is deleterious to the child particularly, when the child is already on border line of malnutrition due to dietary deficiency over a period of time. It would mean that there is further reduction in the intake of nutrients, thereby, leading to poor nutritional status.

b) **Effect on absorption of nutrients :** We studied about the process of digestion in Unit 2, Block 1. We learnt that during digestion various nutrients are absorbed and they enter the blood stream. Any decrease in the absorption of nutrients can lead to the deficiency of the particular nutrient. It is observed that in the case of infections like diarrhoea, measles and respiratory disease there is reduction in the absorption of nutrients. Only 60-70 per cent of the nutrients consumed are available to the body. Even worm diseases like round worm disease usually reduce the absorption of nutrients, thus, leading to ill-health.

c) **Loss of protein :** In some of the infections and fevers, few nutrients, particularly proteins are excreted i.e. lost from the body. This naturally increases the requirement of protein during infections and fevers.

The overall effect of the infections on the dietary intake of the child is substantial. In a poor rural child, who is already on a deficient diet, the effect of the infections can, therefore, be devastating. It is not, therefore, surprising that in our country, kwashiorkor or marasmus are commonly precipitated by diarrhoeal disease, measles and whooping cough in children whose nutritional status is already poor.

Let us now study the effect of few specific infections namely diarrhoea and measles on the nutritional status.

a) Measles and Nutritional Status

Measles is a viral disease which generally attacks children around one year of age. Measles leaves the child completely weak and emaciated. The child suffers not only from the effects of measles but is exposed to a number of complications which invariably follow an attack of measles. The common complications of measles are (a) diarrhoea and (b) severe respiratory disease. These complications by themselves lead to loss of weight in children. In the case of poorly nourished children the body weight does not return to the original weight the child had before the disease, for a very long time. Measles by itself decreases the disease-fighting ability of a child thus making the child easily susceptible to infections. Furthermore, one of the common practices observed among rural mothers in India is that they withhold diet to the child during measles. To add to this is the fact that absorption of nutrients is also considerably reduced in measles. Measles also can cause blindness by increasing vitamin A deficiency in a child living on inadequate diet. In other words, the risk of

nutritional blindness in children with measles is much more than those without measles. So these factors together lead to poor nutritional status.

b) **Diarrhoea and Nutritional Status**

Diarrhoea is a symptom characterized by the sudden onset of frequent stools of watery consistency, abdominal pain, cramping, weakness and sometimes fever and vomiting. You know that diarrhoea is very common among children. As in the case of any other illness, diarrhoea can reduce the appetite of the child considerably. As a result, the child does not eat properly.

In addition, the mother may think that the diet of the child with diarrhoea should be restricted with the belief that the number of loose motions may increase if the child is fed. So what are the consequences? Obviously, there is reduced food intake; which ultimately leads to poor health of the child.

Further you are aware that in diarrhoea fluids are lost from the body. Along with the fluids important minerals such as sodium and potassium (usually known as electrolytes) are also lost. You would recall reading about these losses during diarrhoea in Unit 5 of Block 2. *This loss of fluids and electrolytes during diarrhoea leads to dehydration.* It is this dehydration which is responsible for high death rate in the children with diarrhoea. In the villages and slum areas in the cities, the children generally suffer from frequent and repeated attacks of diarrhoea. Repeated attacks of diarrhoea lead to significant weight loss in children. If we examine the nutritional status of severe cases of diarrhoea we notice that the body weight of these children is much lower than the normal children. Similarly, in the case of kwashiorkor and marasmus the incidence of diarrhoea is higher.

20.3 DIETARY CONSIDERATIONS FOR MANAGEMENT OF INFECTIONS

From our earlier discussion you would have got a clear idea of how malnutrition and infections like diarrhoea and measles affect growth and development of children. Looking at the synergism between malnutrition and infections, it is important to remember that the preventive measures must necessarily take both conditions into account. How to prevent malnutrition has already been discussed earlier in this block. The dietary considerations for the management of two of the most common childhood infections—diarrhoea and measles—are however discussed in the next subsection. We begin with dietary management of measles.

20.3.1 Dietary Management of Measles

You have just learnt about the serious and deleterious effects of measles on the nutritional status of the children. You should, in such cases, take steps to ensure that the child gets proper nutrition. Generally, it is believed by the village mothers that nothing should be given to a child with measles. This is a wrong belief and you should educate and convince the mothers that without proper diet the child may develop severe malnutrition. Few dietary considerations to be advocated are:

a) If the child is breast fed, advice the mother to continue breastfeeding the baby.

b) Give to the child liquids like milk or semi-solid preparations like Kanjee, soft khichri; nutritious porridges which have been thinned by the addition of ARF. ARF (you may recall reading in Unit 9, Block 3) is nothing but a few grams of germinated wheat powder which has the ability to instantly break down the thickness of gruels and to make them much easier for a sick child to swallow.)

c) If the child also has diarrhoea, the mother should be advised to give the child oral rehydration solution to prevent dehydration. What is oral rehydration solution? Refer to sub-section 20.3.2 for the preparation of oral rehydration solut

d) All children with measles should get a large dose of vitamin A (200,000 IU) orally by mouth.

e) Ensure proper feeding of the child suffering from measles. If the child is properly fed you would notice that the reduction in body weight will be much less.

20.3.2 Dietary Management of Diarrhoea

You are aware that, like in measles, mothers often withhold food during diarrhoea due to the fear that the disease may become more severe. This belief is wrong. You should educate the mothers, in such cases, to properly feed the children. The dietary considerations include :

1) Advice the mothers to continue breastfeeding specially if the child is breast fed or alternatively give milk feeds mixed with equal amount of boiled, clean water.

2) Serve soft, well-mashed, non-spicy foods to the child which are easy to digest. For example, soft well-cooked rice with dal preparation or khichri, soups, eggs, fish etc. can be given to the child. As stated earlier nutritious cereal-pulse—oil porridges suitably 'thinned' with ARF, can also be given.

3) Give the child foods rich in potassium such as fruit juices, mashed bananas, potatoes, carrots, well-cooked whole grain cereals.

4) Give the child food as much as he wants and atleast 5-7 times a day.

5) As soon as diarrhoea starts, give the child more fluids than usual for example, rice water(kanjee),fruit juice, coconut water, butter milk (lassi), dal soup, diluted milk, tea, nimbu pani (fresh lime in water),barley water or any other fluid available at home and acceptable to the child.

6) Give oral rehydration solution (ORS) to the child. What is ORS? ORS is a solution made from sugar and salt dissolved in water. This solution helps replace the fluids and electrolytes lost in the stools during diarrhoea. You may be aware that in the market several electrolyte mixtures are available. This mixture should be added to one litre of clean water (preferably boiled and cooled) and the child should be fed this solution as frequently as possible and after every loose stool. We can prepare this solution at home as well in the following manner:

   Take one litre of clean water, add three finger pinch of common salt and four finger scoop of sugar and mix well (Fig. 20.3).This mixture is as good as the electrolyte mixtures available in the market. It is now known that salt (as stated above) added to one litre of thin rice kanjee or barley water will also serve as well. Low income mothers prefer this as they very often may not have sugar or jaggery at home, but all homes will have some cereal or the other to make a kanjee solution. The child should be given this solution as frequently as possible.

The education of the mothers is the sheet anchor in the management of diarrhoea. Tell the mother she can prevent diarrhoea, if:

- she gives her child fresh, clean and well-cooked food and clean drinking water and
- she practices good hygiene.

Check Your Progress Exercise 2

1) Explain in four or five lines the relationship between infections and nutritional status.

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2) How will you prepare oral rehydration mixture at home? Discuss

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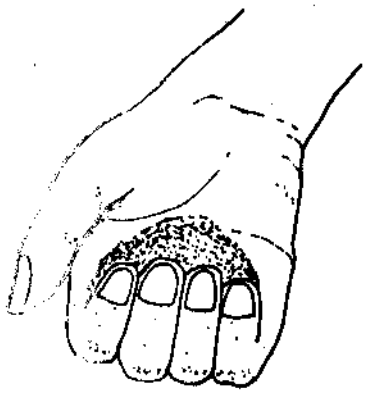
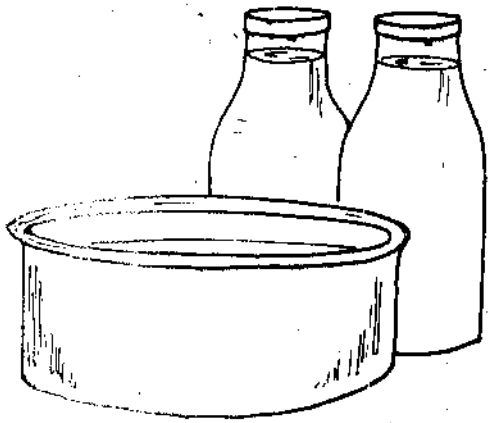
Three finger pinch of common salt



Four finger scoop of sugar



Salt and sugar should be added in one litre of water

Fig. 20.3 Preparation of Oral Rehydration Mixture

3) What dietary advice will you give to a mother for the management of measles?

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4) Fill in the blanks :

a) The relationship between malnutrition and infection can be described as a.....cycle.

b) In malnutrition the disease fighting capability of an individual is.....

c) In poorly nourished children after measles the body weight does..... return to the pre-disease weight.

d) In dehydration there is loss of fluids and.....

20.4 LET US SUM UP

Malnutrition and infections often coexist in Indian children. The combined effect of both these conditions on the health of the children is devastating. Malnutrition can lead to infections by reducing the disease-fighting capacity of the child. Infections on the other hand can lead to malnutrition because of reduced nutrient intake due to loss of appetite, dietary restriction, reduced absorption etc. Thus malnutrition and infection form a vicious cycle. Measles and diarrhoea contribute significantly to the high rate of malnutrition. Measles immunization, oral rehydration and proper dietary advice can help reduce the effect of infections on the child's nutritional status.

20.5 GLOSSARY

Antibiotics	:	Medicines used to treat infections.
Antibiotics	:	Chemical substances which help in fighting infections in the body.
Dehydration	:	Loss of fluids and electrolytes in the body often leading to death.
Diarrhoea	:	Frequent passing of loose stools.
Measles	:	An acute viral infeciton characterized by fever and skin rash.

20.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) The interaction between two diseases or condition producing a summed effect of the diseases resulting in increased complication or increased duration of the disease is called synergism.

2) Loss of appetite, restriction of diet by mother, reduced absorption of nutrients, intolerance to food.

Check Your Progress Exercise 2

1) Infections have a significant effect on nutritional status. During infection there is reduced food intake. The absorption of nutrients is also considerably reduced. Further there is loss of nutrients from the body. All these factors together lead to poor nutritional status.

2) Take one litre of clean water. Add three finger pinch of common salt and four finger scoop of sugar and stir well. ORS is ready. This should be given to the child as frequently as possible.

3) a) Continue breastfeeding the child if breastfed.
   b) Serve liquids like milk or semi-solid preparations like kanjee, soft khichri, nutritious porridges to the child.
   c) Give oral rehydration solution to the child suffering from diarrhoea.

4) a) vicious
   b) reduced
   c) not
   d) minerals (electrolytes)

UNIT 21 DIETARY MANAGEMENT OF OBESITY, HEART DISEASE AND DIABETES MELLITUS

Structure

21.1 INTRODUCTION

You know that malnutrition can manifest itself in the form of either undernutrition or overnutrition. In the earlier units of this block, you have already acquainted yourself with many nutritional disorders related to undernutrition. In this unit, you would be introduced to some of the nutritional disorders due to overnutrition. Can you recall the definition of overnutrition given in earlier blocks? Overnutrition refers to the intake of nutrients in amounts more than that required by the body.

Nutritional disorders like obesity, heart disease and diabetes mellitus (high blood sugar levels) are the result of overnutrition. The prevalence of these nutrition-related disorders is quite high in rich and affluent countries like America, China, Russia, Japan. Recent investigations have shown that the prevalence of these disorders has increased in developing countries like India also.

In this unit, you will find an interesting discussion on clinical symptoms, risk factors and dietary management of some of the overnutrition related diseases like obesity, diabetes mellitus and heart disease. Various technical terms often used in context of these diseases are also explained here.

Objectives

After going through this unit, you will be able to

- identify the nature and clinical features of obesity, diabetes mellitus and heart disease
- describe the risk factors of above mentioned disorders and
- discuss the dietary management of these disorders

21.2 OBESITY

Obesity refers to being fat or having excess fat tissue (i.e. more than that required for optimal functioning). Most of us do not consider it as a serious disorder. Some of us consider it bad from the point of view of body appearance only, while others may think only in terms of reduced work capacity or inability for active participation in sports or other such activities. However, this is not all. Data gathered by Life Insurance Corporation shows that an obese individual has shorter life expectancy than the individual having normal weight. Obese individuals are more at risk of developing heart diseases or diabetes mellitus. These diseases are the principal cause of death in obese individuals.

The hazards of surgery, pregnancy and child birth are more in obese individuals. Obesity can lead to various respiratory problems (breathing problems) also due to more stress on the respiratory system.

After learning about such consequences aren't you interested in knowing about the causes and treatment of this nutritional disorder? Surely, you would be. Before doing so, let us find how to diagnose obesity or in other words when would we call a person obese/not obese. According to the definition of obesity mentioned earlier, it is due to accumulation of excess fat in the body. Threrefore in order to diagnose obesity, you need to determine total body fat content. However, this is not an easy task. In simple terms, obesity can also be equated to body weight. You can call a person obese, if he or she weighs 20 per cent above the ideal body weight (if a person's ideal body weight is 45 kg and he weighs 55 kg i.e. higher than 20 per cent of his ideal body weight, he is obese). Very often people use another term "overweight" as a synonym for obesity. However, there is a clear cut distinction between the two terms and these should not be used interchangeably. The term overweight is applied only to persons who weigh 10 per cent to 20 per cent more than the ideal body weight.

You would have noticed the use of the term "ideal body weight" in the definitions for both obese and overweight individuals. Let us try to understand what we mean by the term "ideal body weight" here. Ideal body weight refers to average or desirable weight according to height and body frame of a healthy individual. For adults over the age of 25 years, height-weight tables compiled by Life Insurance Corporation of India provide a rough guide for estimating ideal body weight according to height and body frame (Tables 21.1 and 21.2).

The tables are based on the principle that the ideal weight for one's height and body frame at the age of 25 should be maintained throughout adult life.

Table 21.1 : Weight for Height for Females

Height (cm)	Weight (kg)	Overweight limit (+ 20%) (kg)
148	46.5	56.0
152	48.5	58.0
156	50.5	60.5
160	52.5	63.0
164	55.0	66.0
168	58.0	69.5
172	60.5	72.5
176	64.0	77.0
180	67.0	80.5
184	70.5	84.5
188	74.0	89.0

Source : Life Insurance Corporation, Agent's Manual.

Table 21.2 : Weight for Height for Males

Height (cm)	Weight (kg)	Overweight limit (+ 20%) (kg)
148	47.5	57.0
152	49.0	59.0
156	51.5	62.0
160	53.5	64.0
164	56.0	67.0
168	59.0	71.0
172	62.0	74.5
176	65.5	78.5
180	68.5	82.0
184	72.0	86.5
188	75.5	90.5
190	77.5	93.0

Source : Life Insurance Corporation, Agent's Manual.

Tables 21.1 and 21.2 provide information regarding the ideal body weight for a particular height for females and males respectively. They also tell you about the overweight limit (i.e 20% of the ideal body weight). If a person's weight lies between the ideal body weight and the overweight limit, he or she is overweight. On the other hand, if weight of a person is above the overweight limit, he or she is definitely obese. For example if a female (148 cm) weighs 54 kg, she is overweight. However, if she weighs 60 kg, she is obese.

Risk factors : Obesity is invariably a product of energy imbalance in the body. Energy imbalance here refers to imbalance between energy intake and energy output. If you consume more food (i.e. take in more energy) and do lesser work (i.e. spend lesser energy) it would result in energy imbalance in the body (Figure 21.1). There are several factors which favour the development of such an imbalance in the body. These factors are termed as risk factors. Let us talk about some of the risk factors.

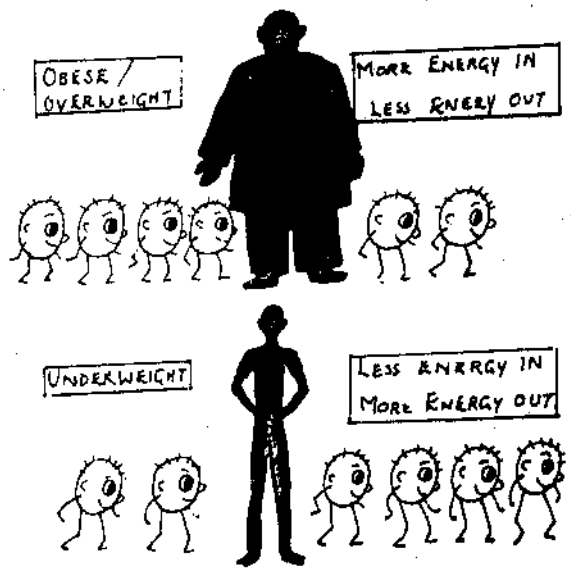

Fig. 21.1 Energy imbalance

Over-eating : Eating too much is a habit with many people. If one is in the habit of eating more food in general or consuming energy-rich foods like butter, cakes, pastries, jam, jellies, wafers and other rich snacks and desserts, one is likely to gain weight. Some people prefer to eat less during the meal time, but keep on munching snacks in between meals. Remember that total intake of calories goes up in this way and it increases the possibility of weight gain.

Sedentary life-style : Besides food intake another factor which influences the energy balance of the body is activity pattern. In urban areas, especially the affluent or rich class people tend to have a sedentary life-style. Most of the time they are involved in some kind of mental work and do very little of running or walking around. Housewives are equipped with electric gadgets like vacuum cleaner, mixer, washing machine, etc. to make work simpler for them. Such people tend to spend or use very little of calories they have consumed as part of food. The result is energy imbalance and consequent weight gain.

Psychological factors : Some people tend to eat more if they are tense or bored or lonely. Such conditions make food as the focus of their attention and a means or outlet for release of tension and boredom. Such people also have a tendency to gain weight and become obese.

Genetic influence : Obese parents do tend to have obese children. This fact has been brought into focus by many research investigations. In one of the research studies it was found that if both parents are of normal weight, the probability is that 7 per cent of the children will be obese. On the other hand, if one of the parents is obese, the possibility is that 40 per cent of children will be obese. If both the parents are obese, the chances that children will be obese goes up to 80 per cent.

Dietary Management of Obesity : Dietary management of a disease means the dietary measures or steps to be taken for the treatment of a disorder/disease. Dietary management of any disorder/disease has three steps:

1) Defining the principles of dietary management

2) Working out nutritional needs (modifications in RDIs) according to the effect of disease on the body and major principles of treatment

3) Dietary management i.e. modifying day's diet based on changes in RDIs.

We shall discuss the dietary management of obesity and other disorders in this unit, according to the above mentioned steps :

Let us now discuss dietary management of obesity.

1) **PRINCIPLES OF TREATMENT OF OBESITY :** The main principles are—

- slow and gradual reduction of body weight till it is closer to ideal body weight
- maintenance of weight loss achieved
- prevention of complications like heart disease or diabetes mellitus.

2) **THE MODIFIED NUTRITIONAL NEEDS :** Let us study what modifications are needed in the amount of energy, protein, carbohydrate, fat, vitamins and minerals for obese individuals.

Energy : As you have read earlier in this unit, obesity is the result of energy imbalance in the body. So modifications in energy (calorie) needs are important. Do remember that this modification in energy is not the same in every individual. One has to cut down 500 to 1000 Kcal from a day's diet depending on the individual requirements. In general, a restriction of 500 Kcal per day results in a loss of about 450 g (1 pound) a week and 1000 Kcal leads to a loss of about 900 g (or 2 pounds) a week. In many studies, it has been found that a daily intake of 1400-1600 Kcal results in satisfactory weight reduction. However, it is not the same for every individual. The extent of energy reduction can go up to 1000 to 1200 Kcal depending upon individual requirements. Do remember that one should not try calorie (energy) adjustment on one's own. One should consult a dietitian or a physician for this purpose.

Protein : Care should be taken to include enough protein-rich foods in the diet. Around 1 g protein/kg body weight can be given.

Fat : Total fat intake in the form of visible fats needs to be restricted. Saturated fats and cholesterol-rich foods should be avoided (as obese individuals are more at risk of developing heart disease).

Vitamins and minerals : Diet should provide vitamin and minerals in adequate amounts according to recommended dietary intakes.

3) **DIETARY MODIFICATIONS :** Following points are to be taken into consideration for dietary management of obesity:

i) **Restrict total food intake :** For the purpose of restriction of total food intake, make a note of foods one (obese individual) eats daily as parts of meals. Don't forget to count the foods one eats in between meals like biscuits, namkin, a piece of sweet, toffees or chocolates. Calculate the total energy intake (use food composition tables given in Annexure 2, Practical Manual – I for this purpose). Compare total intake with RDIs. Find out the extent of energy restriction required for weight reduction (Take the help of an experienced dietitian/physician for this purpose). You will find the following guidelines useful for the purpose of restriction of total food intake.

- Do remember that energy restriction is not an easy task and one cannot achieve miracles by reducing one's intake by 1000 to 1200 Kcal in a day. It has to be slow and gradual. Start reducing 200-300 Kcal per day and slowly more restriction can be achieved.

- Do not start energy restriction with main meals. First cut down on the extra tit bits one tends to eat in between. Give smaller meals at regular intervals. Don't let the person miss a meal. Otherwise one will tend to eat a lot more in the next meal. Do not eat while watching television or reading.

ii) **Cut down intake of fat and fat-rich foods :** Restrict the intake of visible fat. Give visible fats in the form of cooking oils. Avoid giving ghee, butter or hydrogenated fats—they have more of saturated fats and cholesterol and tend to increase the possibility of heart diseases or diabetes in obese individuals. Avoid giving fat-rich foods like meats, cakes, pastries, fried snacks, nuts and oilseeds.

iii) **Give more of protein rich foods :** Milk (toned milk or whole milk from which cream has been removed), pulses, lean meats, chicken, fish.

iv) **Give more of leafy vegetables and yellow and orange fruits :** They provide the basic protective and regulatory nutrients.

v) **Give more fibre-rich foods :** Whole cereals, whole pulses, fibrous fruits and vegetables. Fibrous foods have more satiety value and hence tend to satisfy hunger and at the same time provide less energy (calories).

Besides dietary modifications, physical exercise and psychological support are also important components of treatment of obesity.

Check Your Progress Exercise 1

1) Match the following :

Column A	Column B
i) Death risk statistics	a) 10-20% more than the ideal body weight
ii) Overweight	b) Life Insurance Corporation
iii) Obesity	c) Modification in RDIs
iv) Dietary management of disease	d) 20% above the ideal body weight
	e) Ideal body weight

2) Answer the following in brief :

a) What do you understand by 'energy imbalance'?

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b) List the factors which favour development of energy imbalance in the body.

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c) What measures would you adopt to prevent such an imbalance?

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21.3 DIABETES MELLITUS

You must be familiar with the word 'sugar' used in context of a disease in which blood sugar levels are high and traces of sugar are observed in urine. It is interesting to note here that the word 'sugar' is colloquially used for the disease called 'diabetes mellitus'. Let us in this section study about clinical symptoms, risk factors and dietary management of this disease.

Diabetes mellitus is defined as a metabolic disorder characterized by an elevation of blood sugar (glucose) level.

The main factor behind this condition is lack of a hormone called insulin. The disease can develop under the following circumstances :

- if insulin is present in the body but it is not functional
- if insulin is present but in lesser amounts than that is required by the body
- if there is total lack of insulin in the body.

For better understanding, let us give more attention to insulin and its role in body metabolism.

Insulin is secreted by the beta cells (Islets of Langerhans) of the pancreas (Figure 21.2).Insulin plays a major role in oxidation of glucose in the body (carbohydrate metabolism). In the case of deficiency of insulin in the body, glucose cannot be oxidized properly in the body cells. This results in increase in levels of glucose in the blood *(hyperglycemia).* If accumulation of glucose in the blood is beyond the levels the kidney can retain, it can lead to passage of glucose in the urine also *(glucosuria).* Deficiency of insulin also affects fat and protein metabolism. In such a condition, fat formation in the body decreases and breakdown increases. This leads to accumulation of byproducts of fat metabolism (called ketone bodies) in the blood. This condition is known as *Ketosis.* As energy is not available from carbohydrates, tissue protein are also broken down to supply energy to the body. As a consequence, weight loss occurs.

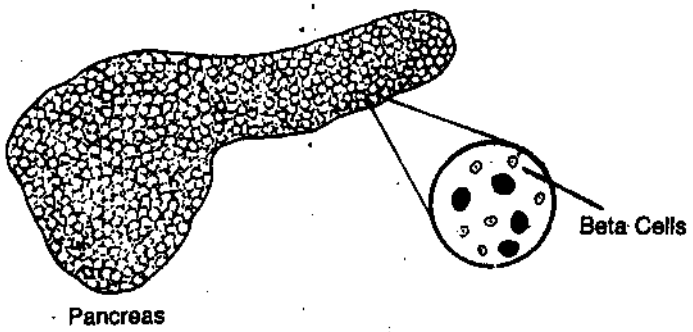


Fig. 21.2 The beta cells of the pancreas

As you have read, in diabetes there can either be insufficiency or total lack of insulin in the body. The disease can be divided into two types depending on the insulin status of the body.

- **Insulin dependent diabetes mellitus (IDDM)**—In this type of diabetes mellitus (in order to function normally) body is dependent on insulin doses from an exogenous source (outside source). It occurs more frequently in young children and adolescents.

- **Non-Insulin dependent diabetes mellitus (NIDDM)**—In this type of diabetes mellitus there is lack or insufficiency of insulin in the body which can be brought under control by either diet alone or a combination of diet and certain drugs. The body is not dependent on insulin from an outside source. This is frequently observed in adults (especially those who are overweight).

How will you diagnose diabetes in an individual? If you find that an individual has *increased thirst, increased urination, increased hunger or weight loss all of a sudden,* it can be due to diabetes. Other symptoms which indicate presence of *diabetes are blurred vision, weakness or loss of strength, pain in legs.*

However, in order to confirm the presence of diabetes in an individual, one has to depend on blood and urine tests. Here a sample of blood or urine is tested in the laboratory.

Urine test : In this test urine is tested for presence of glucose, 2 to 3 hours after a full meal. You should note that no glucose is present in the urine of a normal individual.

Blood test : Do you know what the normal fasting blood glucose level is? It is 80-120 mg per 100 ml. Fasting level here refers to the level of glucose taken after a fast of 12 hours. It is generally taken early morning (without breakfast or bed tea). Obviously, in a diabetic individual these levels will be higher than 120 mg per 100 ml. Minor variations in these levels can be noticed due to reasons other than diabetes. So fasting blood sugar level of 140 mg/100 ml or above is considered an indication of diabetes.

A test called glucose tolerance test (GTT) is usually also used to confirm the presence of diabetes in an individual.

In this test a dose of around 75 g of glucose is given to an individual (adult) after a fast of around 10-12 hours. In the case of children, dose is worked out on the basis of body weight. Blood glucose levels are recorded at an interval of ½ an hour from 0 to 2 hours (½ hour—1 hour —1½ hours—2 hours). In some cases, fasting blood glucose levels are taken at 0 hour and 2 hours only.

RISK FACTORS : Some of the risk factors of diabetes are given below.

Age : Although diabetes can begin at any age, middle aged people are prone to it.

Malnutrition : Undernutrition and overnutrition both play a role in development of the diseases. Thus, both underweight and obese (overweight) individuals are more at risk.

Heredity : People whose parents, grand parents or siblings are suffering from the disease are at higher risk.

Gestation: Some women develop diabetes during pregnancy (gestation). In most of the cases it gets cured after delivery. Such women who had diabetes during pregnancy are at risk of developing the disease later.

Stress : Some of the studies have indicated that some factors like emotional stress, anxiety etc. can lead to development of the disease in the body.

DIETARY MANAGEMENT : Besides dietary management, oral drugs and insulin doses are also used for treatment of diabetes. The three measures commonly adopted for control of the disease are:

a) dietary management alone
b) dietary management and oral drugs
c) dietary management and insulin doses.

As you can note here, dietary management is central to the success of treatment of diabetes in any of the above mentioned measures. Any of these measures is prescribed by a physician depending on the type of diabetes and insulin status of the body. Dietary management alone or dietary management with drugs is prescribed in

case of non-insulin dependent diabetes mellitus. However, for treatment of insulin dependent diabetes mellitus, one has to use dietary management and insulin doses.

Dietary management of insulin dependent diabetes is a bit complicated. In this case the meals have to be adjusted according to the type of insulin dose being taken. So, you need the help of an experienced dietitian or physician.

In this unit, we shall discuss dietary management of non-insulin dependent diabetes. Before starting the discussion on dietary management of diabetes mellitus, you should note here that diabetes mellitus is a progressive disease, which is there for life. You cannot cure it. But, you can keep it under control. If diabetes is properly controlled, the individual lives a near normal life without complications. If he does not keep a control over it, he is likely to develop certain complications like blindness, kidney failure and even death. Remember that in most of the non-insulin dependent diabetics, the disease can be kept under control, by controlling the diet alone.

Let us now focus our attention on some aspects of dietary management of diabetes.

1) **MAIN PRINCIPLES OF TREATMENT** : The principles for treatment of diabetes mellitus are to—

   a) maintain ideal body weight and general well—being

   b) keep the person relatively free of symptoms

   c) prevent further complications.

2) **MODIFICATIONS IN NUTRITIONAL NEEDS** : The following modifications are needed in RDIs for various nutrients.

Energy : Control of energy intake in order to maintain ideal body weight is essential. If the individual is underweight, an increase in total energy intake is recommended. However, if an individual is overweight energy restriction is essential. Remember that, whatever be the circumstances, the main aim of treatment is to maintain ideal body weight.

You can use the following chart for deciding the total energy intake for a diabetic individual (adult).

Body condition	Kcal per kg body weight (Desirable weight)
For weight loss	20
For a bed patient	25
For light work	30
For medium work	35
For heavy work	40

Source : Normal and Therapeutic Nutrition by Robinson H.C., Lawler R.M.; Page 605 (1982)

Let us understand how to make use of this chart. You can refer to Tables 21.1 and 21.2 for finding the desirable or ideal body weight of an adult individual. For example, if a sedentary man (one who does light work) is 156 cm tall (according to table 21.2) his ideal body weight is 51.5 kgs. He requires 30 kcal/kg body weight (see chart). His total energy requirement would be 30 x 51.5-1545 kcal. Similarly, you can make use of this chart for calculating energy requirements of other diabetic individuals also.

Protein : The recommended dietary allowance of protein of 1 g/kg body weight is considered desirable for diabetic individuals also.

Carbohydrate : It is often a common mistake to give a carbohydrate-restricted diet to diabetic patients. You should note here that around 80-100 g carbohydrate should essentially be there in the diet to prevent too much breakdown of fat and accumulation of its byproducts (ketosis). In fact, 50-55 per cent of a day's calories should come from carbohydrates. However, most of the carbohydrate taken should

be in the form of complex carbohydrate (having more of fibre). Refined or simple carbohydrates need to be avoided. Many research studies have shown beneficial effects of fibre on the control of diabetes. Fibre reduces fasting blood sugar level and insulin requirements. On the other hand simple carbohydrates tend to increase fasting blood glucose levels. They are readily absorbed and immediately raise blood sugar. Thus, it is advisable to consume fibre-rich foods like whole pulses, whole cereals, leafy vegetables.

Fat : The diabetic individual should not be allowed to take more than 15 to 20 g fat per day. This is because he/she is more at risk of developing heart disease. Foods high in saturated fat and cholesterol should be limited. Effort should be made to give fats having unsaturated fatty acids. Can you recall some of the rich sources of saturated fatty acids, cholesterol and unsaturated fatty acids.(Refer to Unit 3, Block 1) For your benefit we have listed them again in Table 21.3.

Table 21.3 : Rich sources of Fat (saturated fatty acids, cholesterol and unsaturated fatty acids)

Cholesterol	Saturated fatty acids	Unsaturated fatty acids
Egg yolk	Egg yolk	Cooking oils
Organ meats like liver, kidney, brain etc.	Mutton, beef hydrogenated fats	like groundnut oil
Butter	Butter	Safflower oil
Hydrogenated fats	Ghee	Soya oil
Ghee	Cream	Corn oil
Cream	Whole milk	Cottonseed oil
Whole milk		

Vitamins and minerals : The diet should provide vitamins and minerals in adequate amounts according to recommended dietary intakes.

3) DIETARY MODIFICATIONS : Before suggesting any modification in the diet, you should talk to the individual about his meal pattern, work schedule and likes and dislikes. You should not give a very tight diet-schedule to an individual which the person may find it difficult to adhere to. In fact, you should suggest only few dietary modifications in his/her earlier meal pattern (as few as possible to keep diabetes under control).

1) Regulation of the meals consumed is essential. Diabetic individuals should be encouraged to have meals at regular intervals. It is advisable for him/her not to skip meals or keep a fast.

2) All the main meals consumed should provide fairly even amount of calories.

3) Care should be taken to include foods from all three basic food groups. However, suitable modifications are needed within each group to ensure control. Let us see what these modifications are:

Energy-Giving Group

Cereals—Use of whole grain cereals like whole wheat flour is recommended. Use of refined cereal products like maida, suji etc. should be restricted or avoided.

Roots and tubers—Use of roots and tubers like yam, colocasia, potato, sweet potato should be in moderation as they contain more of refined or simple carbohydrates.

Sugar—Sweeteners like table sugar, jaggery, honey, glucose and others like jams, jellies, marmalade, and concentrated sweets (like toffees, chocolates, burfi, gulab jamuns and other such sweets) should be avoided.

Fat—As has already been mentioned, not more than 15 to 20 g of visible fat should be allowed. Unsaturated fats like groundnut oil, soya oil, safflower oil, corn oil etc. should

be used in moderation. Saturated fats and cholesterol-rich foods should be avoided (refer to Table 20.3).

Body-Building Group

Milk—Milk should be taken liberally. Use of milk products like paneer, curd, khoya etc. should be encouraged.

However, use of full fat milk or buffalo's milk should be restricted (as it has more of fats). One can give milk to diabetic individuals after removing the fat layer or cream (which covers the surface after boiling).

Pulses—Use of pulses (especially the whole pulses) should be encouraged. This is because whole pulses are not only rich in protein but also fibre.

In order to ensure adequate intake of protein and fibre in the diet, one could mix the flour of bengal gram (whole) in atta (whole wheat flour) used for making chapatis for a diabetic individual in the proportion of 1:2 (1 part of bengal gram (whole) flour and 2 parts of atta (whole wheat flour).

Egg—Eggs (especially egg yolk) should be consumed in moderation. If one is fond of taking eggs, one can take egg white and discard the yolk portion (as it is a rich source of cholesterol).

Flesh foods—Organ meats like liver, kidney etc. are rich sources of cholesterol, hence they should be avoided. You should select lean cuts of meat for diabetic individual or preferably use chicken or fish. Care should be taken to select the right method of cooking (i.e. roasting or baking instead of frying).

Protective/regulatory Group

Vegetables : Increase the intake of vegetables especially fibrous vegetables (like leafy vegetables, lotus stem, brinjal, beans etc.).

Fruits : Fruits, as they are sweet, need to be taken with caution. One should take very sweet fruits like mango, grapes, sapota, watermelon, sugarcane juice, all canned foods, banana and apple etc. with caution. If one wants one can just have a piece of it occasionally. Others like guava, apples, oranges, mausmbi etc. can be taken in moderation (just one or two a day).

Check Your Progress Exercise 2

1) Fill in the blanks :

   a) The normal fasting blood glucose leve is.....

   b) .....glucose is present in the urine of a normal individual.

   c) Diabetes mellitus can develop, even if insulin is present in the body but is not.....

   d) Insulin is secreted from.....cells of the pancreas.

   e) The body is not dependent on insulin from.....source in..... diabetes mellitus.

2) Comment on the use of the following foodstuffs in the diet of a diabetic individual.

   a) Refined cereals .....
   .....
   .....

   b) Groundnut oil.....
   .....
   .....

   c) Full fat milk .....
   .....
   .....

d) Mango .....

e) Cream .....

f) Bengal gram (whole) .....

21.4 HEART DISEASE

You may be familiar with the term 'heart disease'. You probably might be using it in context of heart attack or high/low blood pressure. You can add a lot to your knowledge in context of heart diseases by reading through this section. Major heart diseases can be divided into two categories—Coronary heart disease and hypertension (high blood pressure). Both these terms may sound quite unfamiliar to you. Read on to find the meaning of these terms.

21.4.1 Coronary heart disease

Coronary heart disease or CHD is the result of an inadequate supply of blood to the myocardium (or heart muscle) due to obstruction in the flow of blood through coronary arteries. This definition is a little difficult to understand, as it has many unfamiliar terms. Explained in the following paragraphs is the meaning of terms like 'Coronary artery' and 'myocardium' and the process by which the disease sets in. You will find this discussion interesting as you will be introduced to many other technical terms used in connection with coronary heart disease. You have to read these paragraphs carefully to get a clear picture.

There are two kinds of blood vessels—*arteries* which carry oxygenated blood from heart to body tissues and *veins* which carry deoxygenated blood from body tissues to heart. The following (Figure 21.3 (a) shows an artery).

The blood flows through the lumen of the artery. What do you think would happen if the lumen of the artery is narrowed due to deposition of fatty layer on the arterial wall (Figure 21.3 b). Obviously, it will obstruct the flow of blood through the arteries. The process of deposition of fatty layers and the narrowing of lumen may result in the formation of a blood clot (the fatty layer mainly consists of compounds of cholesterol and other forms of fat). Eventually, the blood clot blocks the passage of blood (Figure 21.3 c) through the artery involved. ***This characteristic thickening of the arterial wall due to deposition of fatty layer and obstruction in blood flow is known as atherosclerosis.*** What will be the result of such blockage? The tissue or cells which were getting their supply of oxygen and nutrient through the blocked artery, will not receive their share. They will die in the process. This problem is not so serious if a small artery is involved. However, if major arteries or coronary arteries are involved, the situation becomes serious. *Coronary arteries are the arteries which supply oxygen and nutrients to the heart muscle or myocardium.* The group of heart diseases resulting from obstruction/blockage of blood flow through coronary arteries is termed as coronary heart disease (CHD).

The following flow chart explains the process by which coronary heart disease sets in.

Deposition of fatty layers on the arterial wall (coronary artery) and narrowing of lumen.
↓
Further narrowing of lumen and obstruction in flow of blood
↓
Formation of blood clot
↓
Blockage of the artery
↓
Death of the part of the tissue of myocardium or heart muscle.

Fig. 21.3 Changes in the artery in CHD

The disease may manifest itself clinically in three forms:

Angina pectoris : This is due to narrowing of 60-70 per cent of lumen of coronary artery. It results in significant reduction in flow of blood. The patient experiences tight pressing, severe pain across the chest after exertion or hard work.

Myocardial infarction (or heart attack) : occurs when a clot is formed in the coronary artery resulting in complete blockage of blood to that part of myocardium which is being supplied by that particular artery. It reduces the functional capacity of heart.

Congestive heart failure : Finally, the heart muscle becomes too weak due to repeated heart attacks or myocardial infarctions and is unable to maintain its function of normal blood circulation. It results in fluid imbalance or accumulation of fluid in lungs or other parts of body. This condition results in added problems in breathing and more stress on the heart. It can even lead to death.

RISK FACTORS : Coronary heart disease is a multifactoral disease. Various factors responsible for the disease can be clubbed in three categories:

- personal characteristics
- learned behaviour
- background conditions

Let us discuss risk factors placed in each one of these categories.

Personal characteristics—These include factors like sex, age, family history (which one acquires at birth). These are not in control of a person. Let us see how these factors have an influence on CHD or coronary heart disease.

Age — The incidence of CHD rises with ageing particularly after middle age.

Sex — Men are more prone to CHD than women.

Family history—Those persons who have the family history of CHD (i.e. their parents or grand parents are suffering from it) are more prone to CHD.

Learned Behaviour—This category includes behaviour patterns, eating habits and style of living which one tends to acquire after birth over the course of time. These factors have a definite influence on CHD or coronary heart disease.

Sedentary life style—Sedentary individuals (who are engaged in light physical activity and remain sitting most of the time in a day) are more prone to CHD.

Stress—Anxiety and emotional stress increase the chances of CHD.

Smoking—Many research investigations have proved the definite influence of smoking on CHD. Heavy smokers are more prone to CHD than non-smokers.

Diet—A number of dietary factors have been found to be associated with coronary heart disease. It has been established in several research studies, that consumption of diets rich in saturated fat and cholesterol increases the chances of CHD.

Obesity—Obese individuals are more prone to CHD, than those having normal weight.

Background Conditions—These include other disease conditions like diabetes mellitus, hypertension, hypercholesterolaemia (higher levels of cholesterol in the blood) etc. by which one might have been suffering from. The persons suffering from these diseases are at increased risk of developing CHD.

DIETARY MANAGEMENT OF CORONARY HEART DISEASE : Dietary management of coronary heart disease has several phases. During *the acute phase of illness* (myocardial infarction or congestive heart failure) *the patient is generally* hospitalised. *The diet is given to the patient under the supervision of trained dietitians.* The discussion of hospital diets given to the patient is outside the purview of this unit.

Here, in this discussion, we will study about the dietary management of coronary heart disease from the point of the following individuals:

a) *those individuals who are at risk of developing CHD (prevention of development of disease)*

b) *those who already have some manifestations like atherosclerosis or angina pectoris*

c) *those who have recovered from the acute phase of illness (i.e. myocardial infarction or congestive heart failure)*

1) **MAIN PRINCIPLES OF TREATMENT** : The main principles for prevention of CHD are:

- to keep fat and cholesterol levels in the blood in normal limits
- to prevent clinical manifestations like angina pectoris, myocardial infarction or congestive heart failure.

2) **MODIFICATIONS IN NUTRIENT NEEDS** : The following modifications in requirement of various nutrients need to be made—

Energy—Energy restriction is needed in case of obese individuals. Energy intake should be just enough to maintain ideal body weight. If the person is of normal weight, energy intake should be according to recommended dietary intakes for energy. If the person is obese or overweight suitable modifications are to be made under the supervision of a dietitian or physician (See dietary management of obesity under Section 20.2).

Protein—The recommended dietary intake of 1 g protein/kg body weight is suitable for these patients.

Fat—As fat and fat-rich foods have a direct connection with heart disease, one has to carefully monitor the intake of fat by the patient. Normally not more than 10 to 15 g (2 to 3 tsp) of visible fat in the form of cooking oils should be allowed. In addition, restriction of other *fat-rich* foods (especially foods containing saturated fatty acids and cholesterol is essential).

Vitamins and Minerals—Vitamins and minerals should be present in adequate amounts according to recommended dietary intakes. Particular care has to be taken with regard to fat-soluble vitamins (because of fat-restricted diets).

3) **DIETARY MODIFICATIONS** : The main crux of dietary management is to provide a fat controlled and energy restricted diet to the patient. The following points summarize the major changes to be made in the diet.

Energy restriction : You need to make the following modifications:

- Cut down the intake of total food.
- Avoid consumption of fat-rich foods.
- Give cereals in moderation. Cut down intake of refined cereals, encourage use of whole grain cereals.
- Give more of pulses especially the whole pulses. Other body-building foods like milk and milk products and flesh foods have to be given by taking their fat content into consideration.
- Increase the intake of fruits and vegetables (especially fibrous ones).
- Cut down the intake of sugar and other sweeteners.

Fat restriction : As you can see, fat control is the major aspect in the changes suggested above. Let us now find out how to achieve reduction in fat intake. You have already studied about some of these points under dietary management of diabetes mellitus (Section 20.3).

i) Reduce the intake of fats and oils.

ii) Replace saturated fats like ghee, hydrogenated fats, butter with unsaturated fats like groundnut oil, soya oil, safflower oil.

iii) Oils like mustard oil and coconut oil have more saturated fatty acids than unsaturated fatty acids. Their use should be limited.

iv) Use low fat milk or toned milk instead of whole milk. Whole milk can be given after removing the fat or cream (which comes on top after boiling).

v) Give eggs in moderation. If possible not more than one egg should be given to the patient (or otherwise, it should be given after removing the yolk portion of it).

vi) Avoid giving fat-rich portions of flesh foods. Select lean cuts of meat. Trim visible fat from it before cooking.

vii) Use roasting, baking, boiling and steaming as methods of cooking instead of frying (both shallow and deep frying).

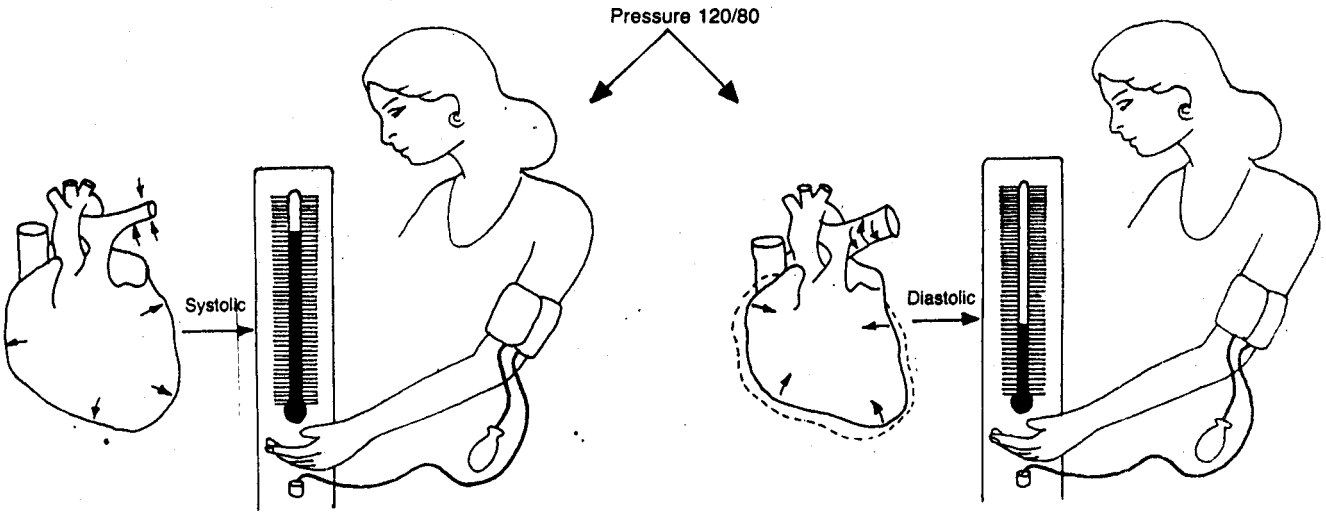
viii) Don't give nuts like groundnuts, cashewnuts, walnuts etc. They are rich in fat.

ix) Avoid giving other fat-rich desserts and fried snacks like cakes, pastries, samosas etc.

Sodium restriction—As you have read that hypertension or high blood pressure is one of the risk factors for CHD. Sodium intake influences blood pressure. Thus, high intake of sodium indirectly becomes a risk factor for CHD also. Those individuals who have hypertension or their family members are suffering from hypertension, should keep a check on intake of sodium (common salt). How one can restrict intake of salt in the diet, is discussed in the next subsection.

21.4.2 Hypertension

'Hypertension' is the technical term used for a condition of the body in which blood pressure is higher than normal. How do we define 'blood pressure'? Blood pressure refers to the pressure exerted by the blood flowing through the arteries on the arterial wall. It is measured by using an instrument called sphygmomanometer. The normal blood pressure is 120 mm Hg/80 mm Hg. (Here "mm Hg" stands for "millimetres of mercury, a unit of pressure"). The upper figure is called systolic pressure (recorded during contraction of heart muscle) and the lower figure is called diastolic pressure (recorded during relaxation of heart muscle). In hypertension there can be increase in either systolic/diastolic pressure alone or diastolic and systolic pressure both. Increase in diastolic pressure is considered more dangerous. Hypertension is classified in three categories—mild, moderate and severe—depending on the diastolic pressure.



Mild Hypertension—If diastolic pressure is 90 to 104 mm Hg, it is termed as mild hypertension.

Moderate Hypertension—If diastolic pressure is 105 to 119 mm Hg, the condition is known as moderate hypertension.

Severe hypertension—If diastolic pressure is 120 to 130 mm Hg and above, the condition is known as severe hypertension.

It has been found that incidence of hypertension is on the increase in the past few decades in our country. Most of the time the cause of hypertension is unknown. However, some of the factors like sedentary life style, obesity, diet (rich in saturated fat, chloesterol or salt), smoking, emotional stress etc. can be considered as risk factors for it. No symptom may be observed in the case of mild hypertension. It does, however, have serious implications if not treated and controlled. Sometimes, the patient may complain of headache or giddiness. If one experiences repeated headaches, or feels tired and giddy very often, one should get the blood pressure checked by a doctor. It is advisable to get the blood pressure checked once a year, even if one experiences no symptoms.

Dietary Management—In treatment of all cases of hypertension—mild, moderate or sever—diet plays a central role. In fact mild hypertension is controlled by dietary modifications only. However, in moderate and severe hypertension suitable medication is also given in addition to a modified diet. In this discussion we will talk about aspects of dietary management related to mild hypertension.

For treatment of patients of moderate or severe hypertension you need the help of a trained dietitian and a physician.

The diet for hypertension patients like any other heart disease involves a check on intake of fat and total energy. The fat controlled and energy restricted diet as prescribed for CHD patients is applicable here also. It means you need to make similar modifications in the diet to reduce intake of fat and hence the total energy intake as given in sub-section 21.4.1. In addition, you need to carefully monitor intake of sodium by these patients. *It has been proved in many research studies that intake of sodium directly influences blood pressure.* It has also been found that restriction of sodium intake accompanied by fat restriction can effectively control mild or moderate hypertension.

What are the major sources of sodium in our diet?

The main source of sodium in our diet is common table salt or sodium chloride. Can you recall some of the other sources of sodium (refer to Unit 5, Block 2)?

The other sources include :

- baking powder and baking soda
- some preservatives and other substances added to food (like monosodium glutamate)
- Rich food sources like milk, egg white, meat, poultry, fish, green leafy vegetables, beet root, radish, carrot, cauliflower, lotus stem (dry), pulses, spices like cumin seeds, omum etc.

In mild hypertension, just restriction of intake of common salt can be helpful. However, for moderate and severe hypertension patients, no salt is recommended to be used for cooking. In addition for some patients restriction of intake of foodstuffs rich in sodium is also imposed.

Let us now study how to reduce intake of common salt for patients of mild hypertension. Common daily intake of salt in our country is around 3-4 g to a maximum of 10-12 g. This needs to be cut to 2 to 2.5 g day. Some tips for cutting down total salt intake are given below—

- Use salt lightly in cooking.
- Do not add salt to the cooked food.
- Do not give salt-preserved foods like ketchups, sauces, pickles, chutneys, canned foods, processed meats, salted or smoked fish.
- Do not give highly salted foods like salted butter, fast foods, wafers, namkeens, salted nuts, cheese, cheese spreads.
- Check for labels of medicines and foodstuffs. Do not give medicine whose label mentions sodium as one of the ingredients. Similarly, avoid giving foodstuffs whose label indicate the word 'salt' or 'sodium

Check Your Progress Exercise 3

1) Match the following :

Column A	Column B
a) Myocardium	i) Fat deposition in the lumen of an artery
b) Atherosclerosis	ii) Myocardial infarction
c) Hypertension	iii) Significant narrowing of lumen of coronary artery
d) Angina pectoris	iv) Heart muscle
	v) Diastolic/systolic
	vi) Coronary artery

2) Mr. X is suffering from hypertension. He has been advised by his doctor to restrict intake of salt. What dietary measures would you suggest to him for doing so.

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3) Mr. Y is suffering from CHD and is advised to restrict egg intake. However, he is very fond of eggs. What advise would you give to Mr. Y?

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.....

4) Comment on the use of following groups of foodstuffs in the diet of CHD patients?

a) Cooking oil — Hydrogenated fats

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b) Mutton curry — Roasted chicken

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21.5 LET US SUM UP

In this unit you have read about three overnutrition related disorders—obesity, diabetes mellitus and heart disease (coronary heart disease and hypertension).

Given below is the brief description of what has been discussed in the unit about each of these diseases.

- Obesity is the result of energy imbalance in the body. An excessive intake of food and relatively less energy output leads to accumulation of fat in the body. Factors like over-eating, sedentary life style, psychological factors result in energy imbalance and hence obesity. The essential components of dietary management are restriction of total intake of food, fat, fat-rich foods and other energy giving foods.

- Diabetes mellitus is a metabolic disorder in which blood sugar level rises above the normal limit. The normal fasting blood glucose level is 80-120 mg/100 ml. If accumulation of glucose in the blood is beyond the limits the kidney can retain, there is passage of glucose in the urine also. The disease is due to lack or insufficiency of a hormone called insulin (secreted from beta cells of pancreas).

The disease is classified into two types—insulin dependent diabetes and non-insulin dependent diabetes. The main dietary principles are energy intake just for maintenance of ideal body weight, adequate intake of carbohydrates (however, restriction of sugar and other simple carbohydrates), restriction of fat and fat-rich foods and adequate intake of body-building and protective/regulatory foods.

- Coronary heart disease or CHD is the heart disease due to inadequate supply of blood to the heart muscle. It is a multifactorial disease having a number of risk factors (which ultimately lead to onset of the disease). It may manifest itself in three forms—angina pectoris, myocardial infarction and congestive heart failure. Fat controlled, energy restricted diets are mainly used to prevent the development of such a disorder.

  Hypertension, is another heart disease in which blood pressure of the body is higher than normal. Normal blood pressure is 120/80 mmHg. Upper figure is called systolic pressure and lower figure is called diastolic pressure. Hypertension is classified into mild, moderate and severe hypertension depending upon the range of increase in diastolic pressure. Fat controlled, energy restricted and salt restricted diets are prescribed for patients.

21.6 GLOSSARY

Atherosclerosis : A form of heart disease in which blood vessels are blocked by fatty deposits on the inner walls of the vessel.

Coronary : Arteries that supply nutrients and oxygen to the heart muscle.

Deoxygenated blood : Refering to blood in which haemoglobin is in combination with carbon dioxide.

Diastolic : Refering to the period of relaxation of heart muscle.

Dietitian : A specialist (nutritionist) who translates physician's diet prescription into food and food items.

Fasting blood glucose levels : Refering to blood glucose levels taken after the fast of 10-12 hours. Normally it is taken early morning after an overnight fast.

Hypercholesterolaemia : Refering to higher levels of cholesterol in blood.

Ideal body weight : Average or desirable weight according to height and body frame of an healthy individual.

Insulin : A hormone secreted from beta cells of pancreas.

Ketosis : A condition of the body in which byproducts of fat metabolism or ketone bodies accumulate in the blood.

Myocardial infarction: Death of part of heart tissue caused by blockage of coronary arteries supplying blood to it.

Oxygenated blood : Refering to blood in which haemoglobin is in combination with oxygen.

Physician : A physician diagnoses the disease and prescribes suitable medicines and diet.

21.7 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) i) b; ii) a; iii) d; iv) c

2) A) Energy imbalance refers to imbalance between energy intake and energy output. In other words, when more foods are consumed (energy intake) and

less energy is spent for moving around doing work, the result is energy imbalance.

B) Factors like over-eating, sedentary life style, psychological factors like tension, anxiety and genetic factors are some of the risk factors which favour energy imbalance in the body.

C) In order to prevent energy imbalance a) one should consume enough food (not less or more) to provide sufficient energy according to recommended dietary intakes. b) Regular exercise especially for sedentary individuals is also important.

Check Your Progress Exercise 2

1) a) 80-120 mg/100 ml. b) No c) functional d) beta e) outside; non-insulin dependent.

2) a) Refined cereals are not good as they contain more of simple carbohydrates (sugar). They get immediately absorbed in the blood and raise blood sugar levels.

b) Groundnut oil is a good cooking medium for diabetic patients as it has no cholesterol and saturated fatty acids. However, it should be used in moderation as it contains the same calories as ghee, butter or hydrogenated fats.

c) Full fat milk is rich in fat, so it should be given to diabetic patients only after removing the excess fat (or cream layer which covers the top after boiling).

d) Mango is too sweet. It is also rich in energy. It's use should be avoided.

e) Cream is rich in cholesterol and saturated fatty acids. It's use should be avoided.

f) Bengal gram (whole) is a good choice for diabetic patients. It is rich in fiber as well as protein. It can also be mixed in the wheat flour for making chapaties.

Check Your Progress Exercise 3

1) a) iv; b) i; c) v; d) iii.
2) You can ask Mr. X to

- add less salt while cooking food
- not to add salt on cooked food
- avoid taking highly salted foods like wafers, namkeens, cheese, cheese spread, salted butter, fast foods etc.
- avoid taking salt preserved foods like ketchups, sauces, chutneys, pickles, canned foods, processed meats etc.
- check the labels of packed foods and medicines for inclusion of sodium or salt.

3) Mr. Y should be asked to take eggs in moderation just one or two a day. He should take only egg white and discard egg yolk.

4) a) Cooking oil is a better medium of cooking for CHD patients. Hydrogenated fats are rich in saturated fatty acids and cholesterol.

b) Roasted chicken is the better choice as chicken as lesser amount of saturated fat. Usually roasting involves use of less fat for cooking. On the other hand, mutton is rich in fat. Usually curry preparation requires lot of fat as medium for cooking.

UNIT 22 MATERNAL MALNUTRITION

Structure

22.1 INTRODUCTION

In the previous units of this block we have looked at several nutrition-related disorders. They ranged from PEM and IDD which affect the younger child to lathyrism and fluorosis which manifest themselves in the years of adolescence and adulthood. We also covered the spectrum of undernutrition (e.g. PEM) and overnutrition (fluorosis and the diseases of affluence).

This unit now focusses on malnutrition in women. Why do we need to emphasise this aspect? You would probably know the answer. The health of the woman influences the nutritional status of her children and the family as a whole. A significant proportion of women in our country are poorly nourished. This increases the likelihood of infection and death. Pregnancy and lactation are periods of particular stress as you already know. Too many closely spaced pregnancies usually have very adverse effects on the health of women.

We will discuss in some detail the important features of maternal malnutrition and its impact on the health of the newborn and young child. As you read on, you will find that there are ways in which we can identify women who need special care particularly during pregnancy and take action to help them remain healthy as well as maintain the health of their children.

Objectives

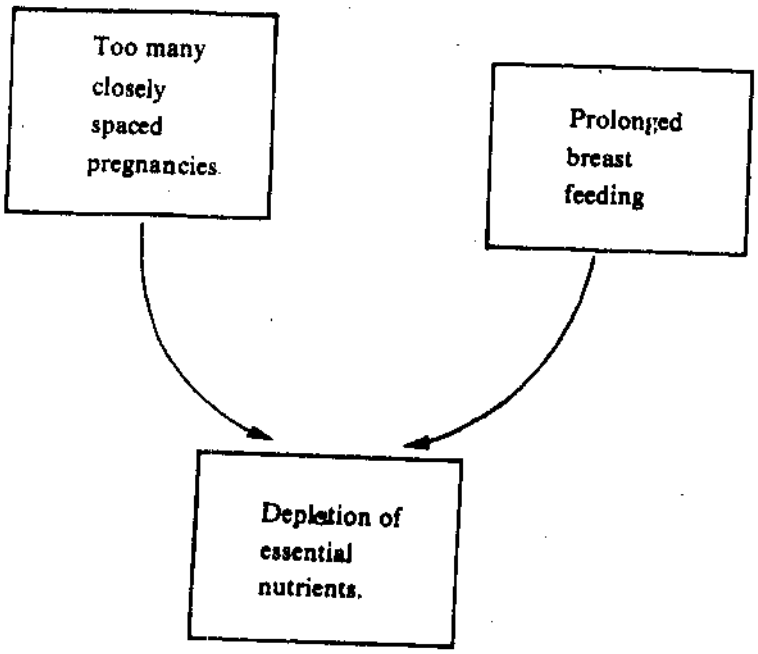
After studying this unit, you should be able to

- describe the influence of maternal nutritional status on the nutritional status of children
- identify high risk factors in pregnancy and discuss their influence on the outcome of pregnancy.

22.2 MATERNAL MALNUTRITION

The word maternal refers to the mother. "Maternal malnutrition" therefore means malnutrition of mothers. It can be extended to include women in the reproductive age. The physiological stress of added nutrient demands makes pregnancy and lactation high-risk periods in the life of a woman. The woman's tissues become depleted of essential nutrients as she enters the vicious cycle of too many closely spaced pregnancies and prolonged breast feeding (see fig.). This is the main reason why so many of our women die. They are vulnerable to disease and infections which ultimately take their toll. We must also remember that most maternal deaths in our country are due to poor antenatal care i.e. care of the mother during pregnancy. An

even when women survive they continue to suffer from the consequences of inadequate health care and malnutrition.



What causes maternal malnutrition? The answer, obviously, is less food and not enough food of the right kind. This accounts for the lower heights and weights of women particularly in rural areas and urban slums. It also explains why so many Indian women suffer from anaemia and vitamin B-complex deficiences. The diets of these women are inadequate largely because they are poor and do not have the money to purchase enough food. Ignorance adds to their problems. They do not have the knowledge to make wise food choices for themselves or their families.

In fact we do not often realize that maternal malnutrition begins with poor nutrition during the years of adolescence. Our health and nutrition programmes should also be targeted at adolescent girls so that they can be better equipped for safe motherhood. We discussed this aspect in detail in Unit 10 of Block 3.

Now what are the consequences of maternal malnutrition? We mentioned the effects of maternal malnutrition for the woman herself. It results in ill health and often, even death. However, maternal malnutrition also affects the health and well-being of the foetus, the infant and the young child. It often results in death of the child. Even if the child survives, it can condemn the child to a lifetime of poor health. We will return to this aspect in Section 22.4.

22.3 NUTRITIONAL STATUS OF INDIAN WOMEN

You are aware that we make use of body weight and height to measure the nutritional status of an individual. An Indian woman belonging to a low income group living in villages or urban slums, on the average, weighs about 40-45 kg according to surveys conducted in different parts of the country. A well nourished woman's weight is about 55 to 60 kg. Thus, a poor Indian woman is about 10 to 15 kg lighter than a well fed and healthy woman. Similarly, the height of the low income group Indian woman is 150 cm as against the average height of about 160 cm in the case of a healthy, well nourished woman. These figures directly show the effect of poverty on nutritional status. As a result of short stature the woman can have a difficult delivery and may even die during such difficult labour. It is also a fact that women with low body weights deliver babies who are underweight. *Children born with weight less than 2.5 kg are considered underweight and are known as low birth weight babies.* Among the children born to poorly nourished women of low income groups, the rate of low birth weight is high as you will find on reading the next section. The dangers of low birth weight are two fold. First the child is at a

high risk of death. Secondly, even if the child survives, the child ends up as a short statured, malnourished adult whose productive capacity in turn is very low.

A good indicator of the nutritional status of the mother as well as the growth of the foetus is the weight gain during pregnancy. In fact, the amount of weight a woman puts on during her pregnancy is dependent on her nutritional status. Do you recall what contributes to the weight gain during pregnancy? Generally, the weight of the foetus, enlargement of reproductive organs i.e. uterus and placental weight, increase in volume of blood, extracellular fluids and fat contribute to the weight gain during pregnancy. A well fed woman gains 10-12 kg during the period of pregnancy i.e. she adds 10-12 kg to her pre-pregnant weight. In India, however, a very large proportion of pregnant women gain only about 6.5 kg due to undernutrition. Low weight gain is injurious to the health of the mother. In addition, it causes low birth weight in the offspring. Table 22.1 highlights the alarming impact of poor maternal nutritional status on the health of the child. Poor diets, increased physical activity and absence of proper health care during pregnancy are the main reasons for this situation.

Table 22.1 Maternal Nutritional Status and Outcome of Pregnancy

Group (according to nutritional status in childhood)	Foetal loss %	Average Birth weight (kg)	Birth weight below 2.5 kg (%)	Death during infancy %
Severely undernourished (37)	11.8	2.41	52.9	11.8
Moderately undernourished (49)	8.9	2.57	42.2	8.9
Mildly undernourished (66)	8.2	2.55	37.1	3.3
Normal (30)	3.3	2.62	38.3	6

Source : Women and Nutrition in India, Edited by C. Gopalan and Suminder Kaur, Nutrition Foundation of India, New Delhi, 1989.

Highlight 2 discusses adequacy of the diets of pregnant and lactating women as revealed by dietary surveys.

HIGHLIGHT 4

Diets During Pregnancy and Lactation

You know that a woman needs extra nutrients, particularly energy and protein during pregnancy or lactation. The diet of an Indian woman is usually not adequate whatever be her physiological status, i.e. she consumes the same amount of food whether she is pregnant, lactating or non-pregnant and non-lactating. The diets of women provide as low as 1500-1600 kilocalories during pregnancy. Most Indian women particularly women living in villages are also physically active even during pregnancy. They carry out agricultural and other jobs, in addition to household jobs. Thus, if these physical tasks are taken into account, the energy in the diets of pregnant women can be as high as 800-1000 Kcal per day. Why are the intakes so low? The low intakes are due to poverty or low purchasing power. In addition, due to ignorance, taboos and false beliefs pregnant women do not consume certain foods and sometimes even reduce their intake of food. They believe that if they eat more food during pregnancy they will deliver bigger and heavier babies. They fear that this may lead to difficult delivery. Hence they do not consume adequate diets. There is, therefore, a need to educate women along with providing dietary supplements during pregnancy and lactation. Dietary supplements based on locally available foods can, to a large extent, bridge the dietary gap. Such supplements for the pregnant woman should be made much more culturally acceptable. For instance, pregnant women in Gujarat and Maharashtra traditionally consume high energy food called 'Methipak' during the last stages of pregnancy and throughout lactation. Similarly, other regions of the country have specific traditional snacks offered to pregnant and lactating women. The use of such foods should be encouraged. This will not only improve the nutritional status of women but reduce the incidence of low birth weight among the babies. The Government has also started supplementary feeding programmes for pregnant women during the last three months of pregnancy and first six months of lactation to fill up the dietary deficits.

Let us now summarize the specific points we have learnt from this discussion:

i) Maternal diet is related to the birth weight of the infant.

ii) Women of low stature or low weight for height tend to have infants with low birth weights.

iii) Infants born with low birth weight are more prone to infections and death. Even if they do survive, their mental and physical growth is affected.

22.4 THE HEAVY PRICE OF MATERNAL MALNUTRITION

We have already learnt that the nutritional status of the woman decides her reproductive performance, particularly the outcome of pregnancy. A woman who is well fed and healthy can complete pregnancy successfully giving birth to a healthy, normal child. If, on the other hand, the woman is poorly nourished we pay a heavy price—the ill health and death of mother and child.

We have already mentioned that poor maternal nutrition and low birth weight are related. The frequency of births with weights below 2.5 kg among poor income groups is more because of extensive malnutrition among the women. In a normally fed population, for every 100 births 8 to 10 children may have low birth weights (less than 2.5 kg). In the case of poorly nourished women, however, 30-40% of their children will have low birth weights. Children with low birth weights are at a higher risk of death as compared to those with normal weights. This is one of the reasons for high death rate among infants (referred to as infant mortality rate). The lower the birth weight, the higher will be the risk of death in the case of the child. Besides high mortality rates, low birth weight babies also tend to have:

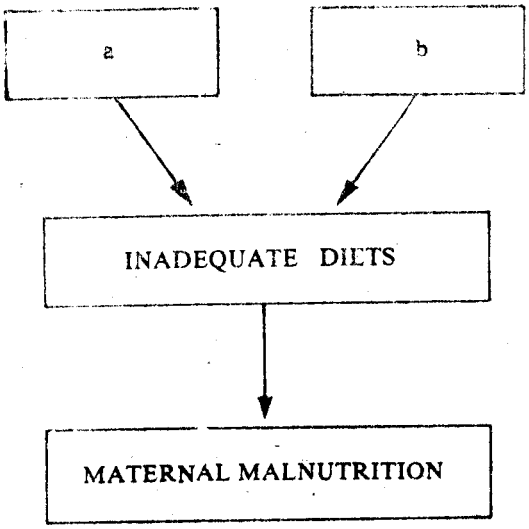
- greater incidence of infections
- fewer brain cells
- lower growth rates and
- greater incidence of mental retardation

As you have just seen, lack of food is a major culprit in causing maternal malnutrition and therefore low birth weights. Lack of specific nutrients such as iron and folic acid in the diet of the mother can also cause low birth weight as you learnt in Unit 18.

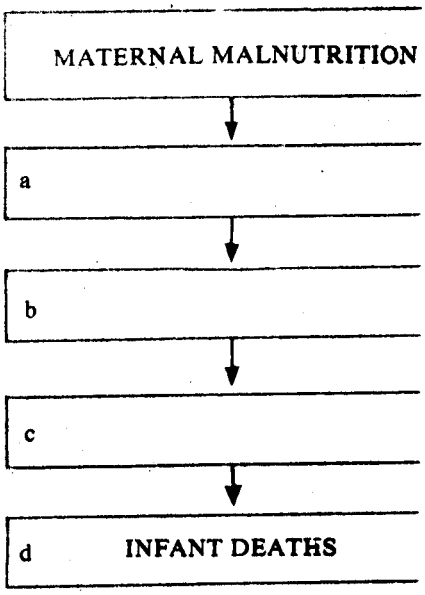
You know that the prevalence of anaemia is very high in pregnant women (Unit 18, Block 5). Severe anaemia leads to premature births (birth before 37 weeks of pregnancy) and low birth weights. There are risks for the mother as well. In anaemic pregnant women, the deaths during delivery are also more. Anaemic women will not be able to do normal physical work. In fact, the physical capacity of women with anaemia has been shown to be much less. The high rate of anaemia is mainly due to consumption of inadequate dietary iron and folic acid by pregnant women. The Government of India has a programme for distribution of tablets containing iron and folic acid to pregnant women to control anaemia and its consequences. Research studies have proved that such supplementation also helps to ensure that the birth weight of the infant would be normal. You will learn more about this programme in the next block.

Check Your Progress Exercise 1

1) Look at the following flow charts (A) and (B). They depict the causes and effects of maternal malnutrition. Can you complete them? Write your answers in the boxes provided.



Flow Chart (A)



Flow Chart (B)

22.5 RISK FACTORS IN PREGNANCY

In the earlier section we have discussed the causes and impact of maternal malnutrition. The crucial question we must now talk about is—how do we tackle this problem? How do we predict which woman will become malnourished? Much research has been done on this aspect in India and abroad. The results indicate that a woman would be likely to be malnourished if any one or more of the following conditions exist:

- repeated pregnancies
- closely spaced births
- high infection rate
- heavy workload
- smoking and alcohol consumption

Repeated pregnancies

An average woman in India (particularly in rural areas) goes through the cycles of pregnancy and lactation a number of times. Such *multiple and repeated pregnancies adversely affect the health of the woman and child.* The prevalence of anaemia is higher in these women. The children born to women who had multiple pregnancies are also likely to be low in birth weight.

Closely spaced births

Many women in our country have the next child when the older child is just about one year of age. The spacing or the gap between the two children, therefore, is very small. Such *close spacing of births is harmful not only for the health of the mother but also for the child.* Pregnancy and lactation are conditions which impose additional nutritional stress on the part of the mother. Closely spaced deliveries do not provide enough time for the woman to recover from the physiological stress caused by the previous pregnancy. You may know that the gap between two children should be atleast 3 years. Only then will the mother have an opportunity to recover and maintain a good nutritional status. Similarly, the children born with very little gap between them are likely to be of low birth weight. They are at a higher risk of developing severe forms of malnutrition like kwashiorkor or marasmus. If the gap between the children is adequate the mother can breast feed the child for sufficient time and provide proper child care as well.

Higher rate of infections

The rate of infections in pregnancy tends to be high. In fact, pregnant women are

more susceptible to urinary infection. They also suffer from diarrhoea, malaria and hepatitis. In addition, anaemia, which is very common among them, increases the risk of infections. *Infections can slow down foetal growth and may lead to still birth or low birth weight.* They also seriously weaken the mother.

Heavy work load

Indian women even during pregnancy continue to participate in agricultural labour in addition to household activities. In view of poverty more women from lower income groups have to work as labourers. You may also know that in remote rural areas women have to walk long distances to collect water or gather firewood. *The energy needs of such women are, therefore, higher. Since these women subsist on inadequate diets the weight gain during pregnancy is low and they have smaller children.*

Smoking and alcohol consumption

Smoking and alcohol consumption have deleterious effects, particularly on the weight of offspring. The prevalence of low birth weights in women who are regular smokers is about twice that of non-smokers. If the smokers are also regular consumers of alcohol the prevalence of low birth weight is estimated to be 4 times that of non-smokers and non-alcohol consumers. In India, smoking and alcohol abuse is increasing in the case of women and this is a cause for concern.

We have so far looked at some of the major conditions associated with health of the mother and child. On the basis of this information we can identify the major *risk factors* in pregnancy. What are risk factors? A risk factor is a condition which can cause problems for both the mother and the child. The greater the number of risk factors associated with a particular woman, the more the chances of ill health and even death of mother and child. Let us now list the risk factors. These are:

i) Age below 18 years or above 35 years.

ii) Height less than 145 cm.

iii) Weight less than 42 kg.

iv) Woman with previous child weighing less than 2 kg at birth.

v) History of twin births.

vi) Woman having severe anaemia (haemoglobin below 8 g per cent)

vii) Closely spaced pregnancy.

viii) Repeated pregnancies (four or more).

ix) Woman who had lost her previous child.

x) Woman belonging to very poor family.

xi) Woman who had difficult labour during the earlier pregnancy.

xii) Women suffering from diseases such as diabetes, heart disease, high blood pressure.

xiii) Woman who is heavy smoker or drinker or is addicted to drugs.

22.6 THE IMPORTANCE OF HEALTH CARE

The previous discussion has highlighted the fact that the health of the pregnant woman to a large extent determines the health of the children and the community. Proper care is vital in keeping both mother and child well nourished and healthy. We must take care of them properly. *Pregnant women should be observed periodically throughout their pregnancy so that prompt remedial measures can be taken, if necessary.* They should contact a medical officer regularly and undergo medical check up frequently. These contacts or visits are called *antenatal (before birth) check ups.* Antenatal check ups are recommended

- monthly in the first trimester
- fortnightly during the second trimester and
- weekly in the third trimester.

It has, however, been found that even three minimum antenatal check ups by trained health personnel are adequate to recognize possible problems. The following chart lists the guidelines for these check ups given by the World Health Organization (WHO) for health personnel:

CHECK UP	TASK FOR HEALTH PERSONNEL
First Check Up (Early three months of pregnancy)	* Find out history of previous pregnancies * Exclude anaemia * Determine size of uterus * Rule out the possibility of the foetus growing in any region outside the uterus.
Second Check Up (20 week of pregnancy)	* Detect any rise in blood pressure * Detect any swelling of the legs * Determine haemoglobin level * Assess foetal growth so as to identify any cases of growth retardation
Third Check Up (37th week of pregnancy)	* Make sure that the foetus's head is correctly positioned and is not too big to cause problems in delivery.

The chart shows how health workers examine pregnant women. The growth of the foetus is carefully assessed. In addition, the physical state of the mother and her age, height, weight gain during pregnancy is recorded. Blood pressure and haemoglobin levels are also noted. In the case of women pregnant for the first time, the breasts and nipples are also examined. During antenatal check ups suitable dietary advice and treatment for any ailments is also provided, if necessary. Preventive steps can be taken if any complication is suspected to occur during delivery. Anaemia and complications like pre-eclampsia can be promptly diagnosed and appropriate treatment can be provided. Iron and folic acid supplements and education regarding breast feeding after delivery can be provided during the antenatal check ups. In the case of poor women, dietary supplements are also provided during the last 3 months of pregnancy.

During antenatal check ups, high risk pregnancies can be identified. All pregnant women who are at a greater risk can be monitored so that suitable steps can be taken to protect the health of the mother and the child. In the previous section we have already discussed the risk factors in pregnancy. Do you recall them?

Health workers should be trained to identify high risk pregnant women i.e. women having risk factors and constantly keep track of their health during their routine home visits. In our country about 80 per cent of the deliveries are conducted by untrained dais under unhygienic and improper conditions. This is responsible for high maternal deaths. The health workers should arrange for supervised delivery of these high risk pregnant women by trained health workers or doctors. *The improvement of the health of women should be considered as the stepping stone to promoting the health of the child, the family and the community.*

Check Your Progress Exercise 2

1) List the factors in the case of pregnant women that may influence the birth weight of infants.

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.....

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.....

2) Fill in the blanks :

a) Weight gain in Indian pregnant women of low income groups may be only.....

b) Maternal malnutrition means malnutrition of.....

c) Normal women gain..... .....kg during their pregnancy.

d) The children born with very little g o between them are at a..... risk of malnutrition.

e) Body weight less than..... ....kg is a risk factor during pregnancy.

3) List four major risk factors in pregnancy. Give one reason why it is important to identify high risk women.

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22.7 LET US SUM UP

Maternal nutritional status has a substantial effect on the birth weight of the infant and the infant's subsequent growth. Many pregnant women in India are shorter and lighter and the weight gain during pregnancy is much less than it should be. Research has revealed that their diets are not very different from those of non-pregnant women though the requirements are considerably increased during pregnancy and lactation. Ignorance, taboos and poverty contribute to these low intakes. As a result there is a high prevalence of anaemia and other nutritional deficiency diseases in pregnant women and maternal deaths are many. For improvement of the nutritional status of pregnant women, apart from dietary supplements, proper antenatal care particularly of those who are at high risk is necessary.

22.8 GLOSSARY

Dai : Traditional birth attendant (i.e. person from the community who assists in delivering babies).

Eclampsia : Convulsions occuring during the later part of pregnancy.

High risk factor : Factors, if present in a pregnant woman are likely to lead to complications during pregnancy or delivery.

Infant Mortality : Number of infant deaths for every 1000 born alive i.e. 1000 live births.

Pre-eclampsis : A condition preceding ecalmpsia.

22.9 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) A) a. Poverty b. ignorance
   B) a. Maternal ill health and deaths b. foetal malnutrition
   c. Low birth weight infants d. Infant deaths.

Check Your Progress Exercise 2

1) Low weight gain, multiple pregnancies, anaemias, high rate of infections, smoking and alcohol abuse, ignorance and poverty.

2) a) 6.5 kg
   b) Mother
   c) 10-12 kg
   d) High
   e) 42 kg

3) Any four of the following :

   1) Age less than 18 years or above 35 years.
   2) Woman with height less than 145 cm.
   3) Woman weighing less than 42 kg.
   4) Woman with previous child weighing less than 2 kg at birth.
   5) Woman having severe anaemia (haemoglobin below 8 g per cent)
   6) Woman with history of twin births.
   7) Closely spaced pregnancy.
   8) Repeated pregnancies (four or more).
   9) Woman who had lost her previous child.
   10) Woman belonging to very poor family (below the poverty line).
   11) Woman who had difficult labour during the earlier pregnancy.
   12) Woman suffering from diseases such as diabetes, heart disease, high blood pressure.
   13) Woman who is a heavy smoker or drinker or is addicted to drugs.

It is important to identify high risk women so that they can be given adequate care and more frequent medical check ups to ensure normal delivery and a healthy baby.

APPENDIX I

TABLE 1 : SUMMARY OF PEM AND XEROPHTHALMIA

NUTRIENTS INVOLVED	DEFICIENCY DISEASE	SYMPTOMS/ CLINICAL FEATURES	TREATMENT	PREVENTION
Energy, protein	PEM Kwashiorkor	• Oedema • Failure of growth • Irritability • Skin changes • Hair changes	• High calorie Liquid foods introduced directly into the stomach in severe cases • Energy and Protein rich diets • Vitamin capsules	• Adequate intake of energy and protein rich foods
	Marasmus	• Muscle wasting • Growth failure • Loss of fat layers beneath skin leading to wrinkling of skin		• Proper child feeding practices • Prompt treatment of infectious diseases • Immunization
Vitamin A	Xerophthalmia	• Night Blindness • Conjunctival xerosis • Bitot's spots • Corneal xerosis • Keratomalacia	**In severe cases** • Vitamin A injections into the muscle (100,000 IU) followed by 200,000 IU • **In mild cases** 200,000 IU of vitamin A	• Good intake of vitamin A sources including green leafy vegetables, papaya, mango and other orange-yellow fruits and vegetables • Prompt treatment of infectious diseases particularly measles • Immunization

TABLE 2 : SUMMARY OF NUTRITIONAL ANAEMIAS

NUTRIENT INVOLVED	SYMPTOMS/ CLINICAL FEATURES	TREATMENT	PREVENTION
Iron Folic acid Vitamin B_{12}	Fatigue, giddiness, loss of appetite, paleness or pallor of eyes, tongue, nail beds, spoon shaped brittle nails, atrophy of tongue	**For iron deficiency anaemia :** One ferrous sulphate tablet (one tablet 150-180 mg) twice or thrice a day sweet liquid preparation for infants and children **For folic acid deficiency anaemia :** Tablet containing folic acid (1-2 mg) and B_{12} (10 µg)	• Diet including foods from all three food groups particularly rich sources of iron and folic acid • Fortification of some foodstuffs like salt, baby foods etc. with iron • distribution of iron and folic acid tablets to pregnant and lactating women

TABLE 3 : SUMMARY OF DEFICIENCY DISEASES OF VITAMIN C AND B-COMPLEX VITAMINS

NUTRIENTS INVOLVED	DEFICIENCY DISEASE	SYMPTOMS/ CLINICAL FEATURES	TREATMENT	PREVENTION
Vitamin C	Scurvy	• Spongy, bleeding gums • Tiny blood spots on skin above knees	Acute cases : Vitamin C administration intravenously In mild nd moderate cases : Vitamin C tablets	• Consumption of vitamin C rich foods—amla, guava, citrus fruits, sprouted pulses
Riboflavin	Ariboflavinosis	• Angular stomatitis • Glossitis • Cheilosis	One tablet of B complex daily for one week to ten days	• Consumtion of good sources of riboflavin — green leafy vegetables, whole cereals and pulses, cheaper nuts
Niacin	Pellagra	• Dermatosis (symmetrical) • Diarrhoea • Mental changes • Glossitis	300 mg nicotinamide per day	• Consumption of good sources—nuts, oil seeds and organ meats, milk (source of tryptophan)
Thiamine	Beriberi	• Loss of appetite • Weakness, heaviness of legs	Acute cases Thiamine injected into muscles for 3 days	• Consumption of good sources—whole cereals, pulses
		• Feeling of pins and needles, numbness in legs • Accumulation of fluid (wet beriberi) • Palpitation (wet beriberi) • Heart failure (wet beriberi)	In mild or moderate cases : Thiamine tablets thrice a day	
Vitamin D	Rickets (in children)	• Loss of muscle firmness • Distended abdomen • Delayed developmental milestones • Pigeon chest, knock knees, rachitic rosary, delayed closure of anterior fontanelle, frontal and parietal bossing	• Vitamin D preparations given daily for about 4 weeks • Calcium supplementation	• Exposure to sunlight • Vitamin D in cod liver oil • Consumption of food sources
	Osteomalacia (in adults)	• Pain in ribs, hip bone, lower back and legs, muscular weakness. • difficulty in climbing stairs • Pain on application of pressure on bones • Bone fractures and deformities	• Daily vitamin D and calcium In severe cases injection of Vitamin D	• Exposure to sunlight • Vitamin D supplements for individuals at risk

TABLE 4 : SUMMARY OF IODINE DEFICIENCY DISORDERS

NUTRIENT INVOLVED	SYMPTOMS/ CLINICAL FEATURES	PREVENTION
Iodine	Any of these depending on age of onset and severity. (Goitre and cretinism present the extreme ends of the spectrum) • Goitre (swelling of thyroid gland) • Hypothyroidism (varying combination of clinical signs) • Subnormal intelligence • Mental deficiency • Squint • Spasticity • Muscular weakness • Endemic cretinism • Intrauterine death	• Addition of iodine to salt • Use of tablets of sodium or potassium iodide • Use of iodized oil

TABLE 5 : SUMMARY OF OTHER NUTRITION—RELATED DISORDERS

DISORDER (CAUSE)	SYMPTOMS/ CLINICAL FEATURES	TREATMENT	PREVENTION
Fluorosis (excess intake of fluoride)	• Dental fluorosis (mottling of teeth, erosion of enamel, pitting of teeth) • Skeletal fluorosis (difficulty in movement), leading to complete immobility, skeletal deformities)	No treatment except stopping disease from progressing further by decreasing intake of fluoride	• Defluoridation of water
Lathyrism (intake of toxin in kesari dal)	• Crippling paralysis of lower limbs	No treatment except stopping disease from progressing further by stopping intake of kesari dal	• Stopping consumption by banning of kesari dal and payment of wages as the dal • Use of low-toxin varieties of kesari dal

NOTES

Utter Pradesh
Rajarshi Tandon Open University

Nutrition for the Community

Block

6

NUTRITION PROGRAMMES

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ISBN-81-7263-290-8 Sept 1994 (Reprint)

BLOCK INTRODUCTION

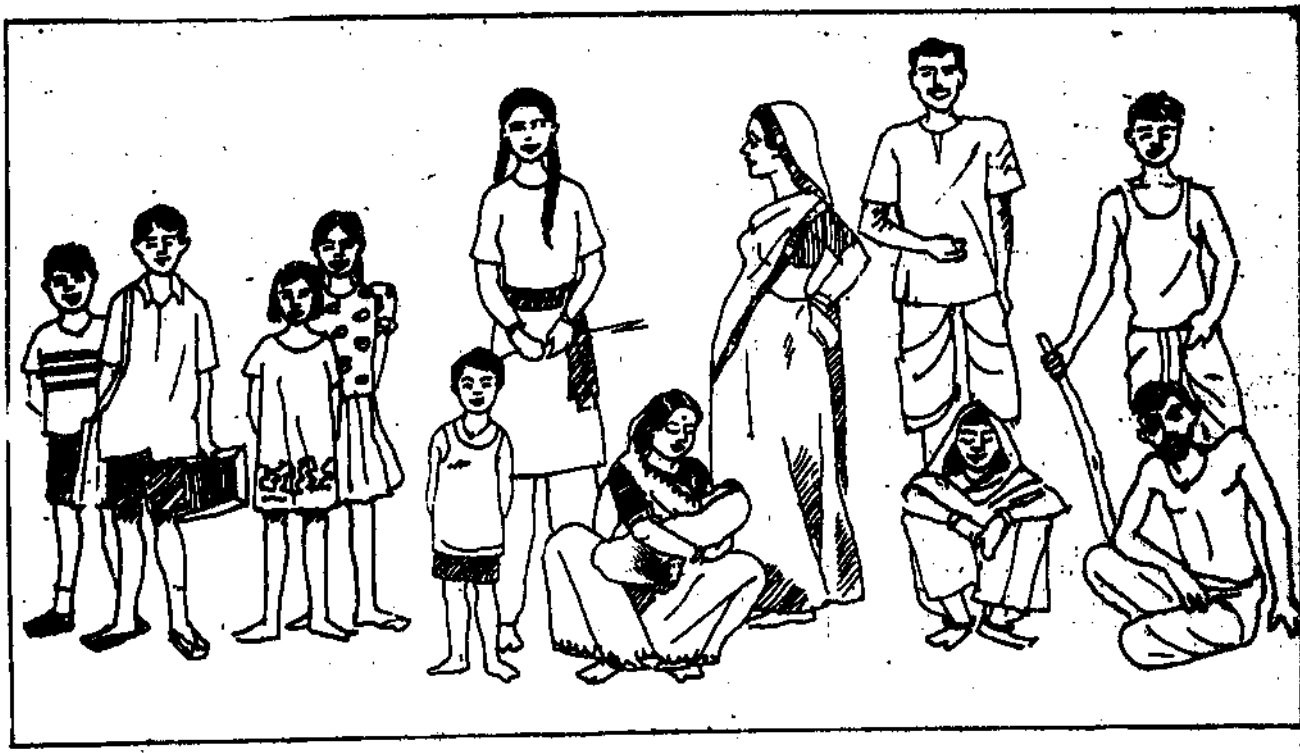
In the previous block you have learnt about the various deficiency disorders—their nature, causes and treatment. Can you recollect the names of the four major deficiency disorders which are important from the public health point of view? These are — Protein Energy Malnutrition, Xerophthalmia (vitamin A deficiency), Anaemia (iron deficiency) and Iodine Deficiency Disorders.

Realizing the widespread nature and harmful effects of these deficiency diseases, the Government of India initiated a few nutrition programmes. The term 'nutrition programmes' here refers to organized programmes through which nutritional benefits are provided to vulnerable sections (who are more susceptible to nutrient deficiency disorders i.e. young children, and women of childbearing age) of the population.

In this block you will learn about the major nutrition programmes. The two specific kinds of programmes discussed in the block are nutrient deficiency control programmes and supplementary feeding programmes. Unit 23 discusses nutrient deficiency control programmes or prophylaxis (preventive) programmes — the National Prophylaxis Programme for Prevention of Nutritional Blindness, the National Nutritional Anaemia Control Programme and the Iodine Prophylaxis Programme. Under these programmes commercially prepared products of vitamin A, iron and iodine are given to vulnerable sections of the community.

Unit 24 focuses on supplementary feeding programmes. These programmes aim to tackle the problem of protein energy malnutrition. Under these programmes nutritional supplements (food supplements given to fill the energy and protein gap between the home diet and RDIs) are provided to vulnerable sections of the community. The two programmes discussed in the unit are 'The Integrated Child Development Services Programme' (ICDS) and the 'Mid-Day Meal Programme' (MDM).

How does the health workers (who is distributing the benefits of nutrition programme) decides about the people who should get benefits of the programme. They screen people according to their nutritional status. The various ways for assessment of nutritional status are discussed in Unit 25.



STUDY GUIDE

As you know the two aspects covered in the block are — the nutrition programmes and assessment of nutritional status. The following guidelines will help you to read through the block and have the better understanding of the two aspects.

1) Units 23 and 24 give details on various nutrition programmes. You should know the objectives/components, target beneficiaries and the dose/other benefits given; for each programme.

2) As already mentioned Unit 25 deals with another aspect — assessment of nutritional status of an individual. You should be familiar with various ways of assessment (i.e. anthropometric, biochemical, clinical and dietary). Concentrate on anthropometric measures and growth monitoring.

3) Like the previous blocks highlights are inserted at appropriate places. Do not skip them. They provide useful information.

4) Appendix 1 to 4 are given at the end of the block. Appendix 1 lists the various ways of communicating nutrition messages to people. It also gives simple suggestions to make simple nutritional aids/material. Appendix 2 gives few charts on standards of reference (for weight, height and mid upper arm circumference respectively) used for assessment of nutritional status. Appendix 3 gives the proforma for twenty four hour recall method of diet survey. Appendix 4 presents an indigenous calendar for accurate age assessment. You can refer Appendix 2 to 4 whenever needed. There is no need to memorize the information given in Appendix 2 to 4.

UNIT 23 MAJOR NUTRITION PROGRAMMES – I : NUTRIENT DEFICIENCY CONTROL PROGRAMMES

Structure

23.1 INTRODUCTION

You know that one suffers from the symptoms of a particular vitamin or mineral deficiency disorder, if one does not consume diet adequate in that nutrient for quite sometime. One obvious way to prevent such disorder is to consume diet rich in vitamins and minerals. However, poor people cannot afford these foods as they are too expensive. It is not possible for the Government to make these foods available to poor and needy on regular basis.

As an alternative method, Government of India runs organized prophylaxis (preventive) programmes. Under this scheme, the commercially prepared vitamins and minerals are supplied to vulnerable sections of our population through organized programmes. These programmes are known as nutrient deficiency control programmes or prophylaxis programmes and are of nature of stop-gap arrangement. These are expected to be phased out as and when the purchasing power of people improves and they start consuming balanced diets.

In this particular unit, you will study about the three nutrient deficiency control programmes — the National Prophylaxis Programme for Prevention of Nutritional Blindness, the National Nutritional Anaemia Control Programme and the Iodine Prophylaxis Programme. You will find information regarding the objectives, target beneficiaries of the programmes and the distribution strategy.

Objectives

After going through this unit, you will be able to

- explain the basis of nutrient deficiency control programmes
- describe the objectives, target group and method of distribution of benefits of three nutrient deficiency control programmes i.e.
  - National Prophylaxis Programme for Prevention of Nutritional Blindness
  - National Nutritional Anaemia Control Programme
  - Iodine Prophylaxis Programme

23.2 NATIONAL PROPHYLAXIS PROGRAMME FOR PREVENTION OF NUTRITIONAL BLINDNESS

Can you recall some of the symptoms which appear due to deficiency of vitamin A (Unit 17, Block 5)? Vitamin A deficiency leads to complaints of night blindness and other eye signs like conjunctival dryness (xerosis) and bitot spots. These signs are not dangerous because they can be cured by giving vitamin A. But the severe forms of vitamin A deficiency specially among children of preschool age (1 to 5 years) result in keratomalacia — a condition where the cornea (black portion of the eye) gets completely destroyed. This condition is irreversible (incurable) and when occurs,

makes the child blind. The socio-economic implications of blindness or blind children are tragic for the family as well as for the society. Therefore, a preventive programme of distribution of massive doses of vitamin A is being undertaken in the country. The basis of this programme is the fact that the human liver can store vitamin A consumed in excess of daily requirement. The stored vitamin A is released as and when the body needs it. In other words the liver acts as a 'saving bank', in which the body saves (stores) its surplus vitamin A and withdraws it when the intake falls short of the requirement. Making use of this knowledge, the National Institute of Nutrition gave 2000 preschool children large doses of vitamin A, two times a year. The dose called as the massive or mega (big) dose, was calculated to give the child adequate vitamin A every day for six months. An examination of these children at the end of a year showed most encouraging results. These were :

— None of the children were nightblind

— None developed conjuctival xerosis or bitot spots

— None developed nutritional blindness.

Thus the National Prophylaxis Programme for prevention of Nutritional Blindness was born.

Let us now study about the details of the programme. We shall discuss this programmes as well as other nutrition programmes in the block under three main headings — objectives, target groups and distribution strategy. You should get familiar with these terms.

Objectives : Refer to the specific aims to be achieved through the programme.

Target group : Nutrition programmes cater to only vulnerable sections of the community. Each programme targets at some particular vulnerable sections of the community i.e. target group.

Distribution Strategy : Refer to the method of distribution of benefits of the programme.

Let us learn about the objectives, target group and the method of distribution benefits of National prophylaxis programme for prevention of nutritional blindness.

Objectives : The programme aims at preventing blindness due to vitamin A deficiency in childern (between 6 months to 5 years) by supplying mega (high) dose of vitamin A.

Target group : All children of 6 months to 5 years are eligible (particularly those living in rural, tribal and urban slum areas).

Dose and distribution strategy : *A liquid preparation of vitamin A in oil providing 200,000 IU (in 2 ml) is given to every child between the ages of 1 and 5 years.* Vitamin A solution is kept away from direct sunlight and a bottle once opened is utilized within 6-8 weeks. A child must receive a total of 9 oral doses of vitamin A by fifth birthday. *An infant between the age of 6-11 months is given a dose of 100,000 IU.* The contact with an infant during administration of measles vaccine between the age of 9-12 months is considered practical time for administering the vitamin A supplement of 100,000 IU to infants.

The mother child immunization card is used to record and monitor the administration of vitamin A dose to children under two years. Similarly growth monitoring cards or registers used for monitoring growth of children under the ICDS Programme are used for recording and monitoring administration of vitamin A solution till the age of five years.

Distribution of vitamin A is carried cut by the Auxiliary Nurse Midwife (ANM) — a functionary belonging to Health Department in Ministry of Health and Family Welfare. There is an ANM for a population of 3000–5000 people in a state. Her main task is family welfare. She also educates people about healthy living and helps in distributing the benefits of nutrition programmes. Actual feeding (administration) of the dose is conducted at the 'door-step' of the beneficiary, once in six months. It is recommended that the health worker, as soon as she receives the stock of vitamin A, should cover all the eligible children of her area within as short a period as possible (on cash basis) by home (domiciliary) visits (administration at the clinics or at one place is not recommended). Wherever Integrated Child Development Services (ICDS) is functioning, anganwadi workers should be involved in the distribution and administration of vitamin. You will learn more about anganwadi workers and Integrated Child Development Services in Unit 24.

Check Your Progress Exercise 1

1) Fill in the blanks

   a) Massive dose of vitamin A provided under national prophylaxis programme for prevention of nutritional blindness is ..... IU per child

   b) Children in the age ..... to ..... years are prone to vitamin A deficiency.

   c) The vitamin A dose is given to ..... children living in rural and tribal areas or urban slums.

   d) The dose of vitamin A is given to children ..... in six months.

2) What is the basis of National Prophylaxis Programme for Prevention of Nutritional Blindness?

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23.3 THE NATIONAL ANAEMIA CONTROL PROGRAMME

Anaemia is another major nutritional problem affecting the health of the people in the country. It is particularly serious among the women of child bearing age (especially during pregnancy and lactation) and young children.

Surveys done by various research organizations including the World Health Organization (WHO) have shown that in our country as many as 50% of preschool children of poor communities are anaemic. In case of women, particularly during pregnancy, as many as 70% or even more of them are likely to be anaemic (haemoglobin level less than 10 g per 100 ml). The anaemia among women tends to increase with increasing number of pregnancies. You know that anaemia has certain harmful consequences. It reduces the capacity for doing work and hence this effects the work output. Anaemic mothers often give birth to low birth weight babies (babies born with birth weight less than 2500 g or (2.5 kg). It can even lead to death of the mother.

In view of these serious consequences of nutritional anaemias, the Government initiated the National Nutritional Anaemia Control Programme.

Objectives : The programme aims at significantly decreasing the prevalence and incidence of anaemia in women in reproductive age group especially pregnant and lactating women and preschool children. The programme focuses on the following :

- Promotion of regular consumption of foods rich in iron.
- Provision of iron and folate supplements in the form of tablets to the "high risk" groups.
- Identification and treatment of severely anaemic cases.

Target group : The beneficiaries of the programme are :

a) Pregnant women
b) Lactating mothers
c) Family planning acceptors (women who accept family planning measures like intrauterine devices (IUD) and tubectomy)
d) Children of both sexes between ages 1 to 5 years.

Distribution Strategy : Supply of iron-folic acid tablets to the target population constitutes the main input. Two types of tablets being distributed are : (1) *big tablets, each containing 60 mg of iron (ferrous sulphate) and 500 µg of folic acid* (for women). One big tablet per day for 100 days should be given to pregnant woman after first trimester. The contact during the administration of tetanus toxoid should be utilized for distribution of tablets to pregnant woman after the first trimester of pregnancy. Similarly lactating woman and IUD acceptors should receive one tablet per day for

100 days. Mothers often accompany their infants on immunization sessions. They can be handed over tablets during this time (2) small tablets, each containing 20 mg of iron and 100 μg of folic acid (for children) daily for 100 days every year. Register used for growth monitoring of children can be used to record the intake of tablets also.

For young children who cannot swallow tablets, iron and folic acid (in the same dose, as in a small tablet) are given in 2 ml of syrupy liquid.

The health functionaries like Auxiliary Nurse Midwife (ANM) is responsible for distribution of tablets/liquid. Of late, the services of Anganwadi Worker (AWW) of Integrated Development Services (ICDS) are also being used to distribute the Iron-folate tablets.

Check Your Progress Exercise 2

1) State whether the following statements are true or false. Correct the false statements.

   a) Women of child bearing age and children are the target beneficiaries of the National Anaemia Control Programmes.

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   b) Nutritional anaemia can be only due to iron and folic acid deficiency.

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   c) Anaemia can even lead to death of women during child birth.

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   d) Sixty milligram of iron is given to women during pregnancy as a prophylactic measure.

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   e) Dosage of iron and folic acid in National Nutritional Anaemia Control Programme is same for women and children.

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23.4 NATIONAL IDD CONTROL PROGRAMME

Goitre, as you know, is a condition in which the thyroid gland (located in front portion of the neck) is enlarged. This condition is caused due to the deficiency of iodine. In fact, iodine deficiency leads not only to goitre but also to a number of other disabilities like physical and mental retardation, hearing and speech defects (deaf-mutism) among children and spontaneous abortions and still birth among women (refer to Unit 18, Block 5).

As you have read in Unit 18, Block 5, the problem of iodine deficiency is endemic in certain areas of the country. The surveys conducted indicated that the problem of goitre is present in a broad sub-Himalayan belt of mountain slopes of our country. It stretches from Kashmir in the north-west to the Naga Hills in the East and includes parts of the states of Himachal Pradesh, Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Mizoram, Meghalaya, Tripura, Manipur, Nagaland and Arunachal Pradesh. In addition, pockets of endemic goitre have been recently detected in the states of Gujarat, Maharashtra, Andhra Pradesh and including Kerala and Delhi.

It is estimated that a population of nearly 140 million, live in endemic areas and out of this, nearly 40 million are said to suffer from obvious manifestations of IDD (Iodine Deficiency Disorders).

Realizing the serious health and social implications of the problem of iodine deficiency disorders, Government of India launched a *National Goitre Control Programme (NGCP) in 1962*. The Government has given directions to change the nomenclature of the National Goitre Control Programme (NGCP) to "National IDD Control Programme" from August 1992. The basis of the programme was a study conducted in the mid-fifties in the Kangra Valley, by the Scientists of All India Institute of Medical Sciences. The study showed that the prevalence of goitre comes down considerably when the common salt supply to the population is replaced by iodized salt. In keeping with the results of this study the control programme was initiated.

Objectives : The main objectives of the control programme are to

- identify goitre endemic regions .
- supply iodized salt in place of ordinary common salt in goitre endemic areas
- assess the impact of the programme over a period of time.

The questions which may arise in your mind at this stage are why is salt fortified with iodine? Why can't some other foodstuff be fortified with iodine? The answers to these questions are provided in Highlight 1.

Highlight : 1

Common salt as a vehicle for supplying iodine

The common salt is fortified with Potassium iodate (a compound of iodine). The suggested minimum level of fortification of common salt with potassium iodate is 25 parts per million. This will provide 150 micrograms of iodine in 10 g of iodized salt. Given below are the reasons for fortifying the salt with iodine in our country :

1) The salt constitutes an essential article of the diet and is consumed regularly by all the sections of society irrespective of socio-economic status.

2) Its daily consumption varies within a narrow range of 10-15 g per person as against the other foodstuffs which show wide changes in consumption.

3) The salt is produced in a few selected locations hence can be easily monitored for quality control.

4) Addition of iodine to salt does not change its appearance or taste.

5) The technology of adding iodine (iodation) to salt is more simple and less expensive than adding to other foodstuffs.

Distribution Strategy : The iodized salt is produced at some selected locations in the country. From production plants (which are located in Gujarat, Rajasthan and Tamil Nadu) the iodized salt is transported to endemic areas by Railways and/or roads on priority basis. In endemic areas the traders are prevented from selling non-iodized salt. The local administration while ensuring regular flow of iodized salt in the endemic area, is expected to see that non-iodized salt does not enter from the neighbouring non-endemic areas.

Difficult terrain, inadequate production of iodized salt, transport bottlenecks and difficulties in pursuading the local traders to cooperate with the administration (in the absence of adequate profit incentives) are some of the problems in the way of efficient implementation of this Programme.

The programme is in operation since past several decades yet there has been no remarkable improvement in the condition of goitre and other iodine deficiency disorders. This is attributed to the dual supply of salt i.e. iodized and non-iodized salt are available to public in endemic areas. To overcome this problem, the government, is now considering to iodize the total salt produced in the country so that iodized salt reaches all places.

Check Your Progress Exercise 3

1) Fill in the blanks

a) Goitre is a condition in which.....gland is enlarged and is due to.....deficiency

b) Besides goitre other manifestations of iodine deficiency disorders include ..... and .....

c) National goit ontrol programme was launched t the year ..... nd is now know ....

d) Ten grams of lized salt provide.....micro ns of iodine

e) Common salt s fortified with. ... a compou

2) List the ma obj iv be

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3) a) Why is salt chosen as the vehicle for supplying nutrients in our country

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So far, you have read about the prophylactic dose of vitamin A, iron, and iodine being supplied to vulnerable sections of the community as part of nutrient deficiency control programmes. One important component which is essential for the success of these programme is nutrition education.

Highlight 2 focuses on importance of nutrition education as one of the essential component of these prophylaxis programmes.

Highlight 2

Importance of Nutrition Education/awareness for success of Nutrition Programmes

What do you think is necessary for the success of prophylaxis programmes? You would think if correct dosage reach at right time to the health worker and she is motivated enough to make it available at the doorstep of the beneficiary, it should be successful. However, you may be quite amazed to know, even then the programme can be a failure. The dose of the particular vitamin or mineral may not reach the mouth of the beneficiary. The missing link between the hand of the health worker and mouth of the beneficiary is health awareness and nutrition education. The following example illustrates the importance of these two aspects. In a study conducted in Yonharam and Doma Primary Health Centres of Ranga Reddy District in Andhra Pradesh, it was found that level of awareness regarding anaemia was very low among the beneficiaries. Some of them reported few signs and symptoms of anaemia such as tiredness, giddiness, sweating, poor appetite, numbness in feet etc. However, they didn't consider them serious enough symptoms to be motivated to take tablets. Few who took tablets reported discomfort after consuming them—pain in abdomen, vomiting, black stools or diarrhoea. Now here you can realize the importance of component of education in these prophylaxis programme.

People should know answer to the questions/facts like—What is anaemia? What are harmful consequences of anaemia? Which tablets are being supplied to them?

Are they similar to contraceptive pills being supplied at their health centre or different from that? What benefits will they get from these tablets? What are the side effects of these tablets? Should they discontinue the use of tablets if they experience these side effects. What is right time to give vitamin A dose to children? From where can they obtain iodized salt? What harm will they get if they continue using uniodized salt?

It is very important to educate people regarding these facts. How do you think such an information can be communicated to people living in rural and tribal areas? Who will help in the process?

Health workers working under various departments of ministry of health and social welfare, voluntary organizations and social workers can form a means for communicating health and nutrition messages to people. They can make effective use of audio-visual material like charts, models, flash cards, posters, puppets, radio and TV programmes, printed matter etc. You may not be familiar with some of the audio-visual material mentioned here, and their use in communicating messages. Appendix 1 provides a detailed discussion on 'Nutrition Education' and use of audio-visual material for communicating nutrition messages to people. It also tells about the skills and methods of making simple nutritional aids for the purpose.

In the particular study mentioned above few methods adapted for increasing awareness among the beneficiaries were — a magazine in different languages— Nutrition (English), Poshan (Hindi), Poshana (Telugu) (this magazine became popular among people. Arrangements were made to release programmes through the television network. All India Radio, Hyderabad, gave broadcast on nutrition and health topics. As a result, it was found that most of the beneficiaries expressed their willingness to accept tablets.

23.5 LET US SUM UP

Majority of people living in rural and urban slum areas are economically poor and socially deprived. Their poor purchasing capacity does not enable them to include enough of nutritious foods (i.e. foods rich in vitamins, minerals and good quality protein) in their diets. As a result, they suffer from a variety of nutritional deficiency disorders.

Hence, to control and prevent the harmful effects of deficiency disorders, the Government has started a few nutrient deficiency control programmes or prophylaxis programmes. In this unit you have read about three prophylactic programmes.

- National Prophylaxis Programme for Prevention of Nutritional Blindness supplies every preschool child (1-5 years) a large dose (200, 000 IU) of vitamin A once in 6 months. The programme recommends that the distribution be done at the 'door step' of the beneficiary and proper records be maintained. This is important because the large dose is not expected to be repeated before 6 months.

- Under National Nutritional Anaemia Control Programme women who are either pregnant or lactating or adopting family planning methods are given iron-folic acid tablets. Each tablet contains 60 mg iron and 500 μg folic acid. Children between 1 to 5 years are also covered by this programme. They (young children) receive smaller tablets containing 20 mg iron and 100 μg folic acid. Very young children who cannot swallow the tablets are given liquid (syrup) preparation.

- National IDD Control Programme aims at controlling the problem of goitre through supply of iodized salt, in place of common table salt, to the people living in endemic areas. The suggested minimum level of fortification of common salt with potassium iodate is 25 parts per million. It is so calculated that a person consuming about 10 g of salt every day should be able to receive 150 microgram iodine. Production plants are mainly located in the States of Gujarat, Rajasthan and Tamil Nadu. The fortified salt is distributed through retail shops.

23.6 GLOSSARY

Abortion : Termination of pregnancy before birth

Ante-natal : (Ante-before; natal-birth) before birth means during pregnancy

Endemic : This term is used when a disease is fairly common, always present and affects large number of persons in a given area

Maternal : Pertaining to mother or pregnant women

Mega dose : A big dose

Prophylaxis Programme : Programme of prevention.

Post-natal : (Post-after; natal-birth) after birth

Tubectomy : Operation in which the tubes which carry the egg to the uterus are cut to prevent pregnancy

23.7 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) a) 200,000 b) 1:5 c) all d) once.

2) The basis of the programme is the fact that human liver can store large amounts of vitamin A. If large doses of vitamin A are given to preschool children, they can be stored and used whenever needed.

Check Your Progress Exercise 2

1) a) True b) False; It can also be due to vitamin B_{12} deficiency; c) True; d) True; e) No, Children are given smaller doses.

Check Your Progress Exercise 3

1) a) thyroid; iodine;
   b) You can fill in any two of these—hypothyrodism, speech and hearing defects, muscular weakness, spasticity, still birth; c) 1962, Iodine prophylaxis programme, d) 150; e) potassium iodate

2) The main objectives of Iodine Prophylaxis Programme are
   — to identify goitre endemic regions
   — to supply iodized salt in endemic areas
   — to assess the impact of the programme over a period of time

3) The main reasons are given below :
   i) Salt is consumed by all communities of the country
   ii) There is only minor variation in the amount of salt consumed per person as compared to other foodstuffs (which show wide change in consumption).
   iii) It is produced at few selected locations and hence its quality can be easily monitored
   iv) Addition of iodine to salt does not change its appearance or taste
   v) The technology of adding iodine to salt is not complicated or expensive.

UNIT 24 MAJOR NUTRITION PROGRAMMES – II : SUPPLEMENTARY FEEDING PROGRAMMES

Structure

24.1 INTRODUCTION

The diets of poor people in our rural areas and urban slums lack several nutrients. In the last unit we talked about how the Government is trying to tackle the problem of specific deficiencies of iron, iodine, and vitamin A through prophylactic programmes. However, these programmes do not help to solve the problem of inadequate energy and protein in the diet. In this unit we discuss the approaches the Government is using to provide as much of the energy and protein which is missing in the home diets.

You are already aware that the worst forms of malnutrition afflict the vulnerable groups in the population. Pregnant and lactating women and young children are particularly at risk. To control this the Government of India has started supplementary feeding programmes (SFP) for children and women. A supplement usually takes the form of a ready-to-eat snack or dish and provides a substantial amount of energy and protein.

The programmes under which supplementary food is presently provided are the

i) Integrated Child Development Services (ICDS) and

ii) Mid Day Meal (MDM) programmes.

Objectives

After studying this unit, you will be able to :

- discuss the concept of supplementation and its relevance
- describe the major features of the ICDS and MDM programmes
- identify the advantages of adopting an integrated approach in improving health and nutritional status of people.

24.2 THE CONCEPT OF SUPPLEMENTATION

We have earlier mentioned the vulnerable groups in our population. These include infants and preschoolers, pregnant and lactating women. It is a fact that there is quite a wide gap between the RDIs and the amount of energy and protein actually supplied by the diet.

How do we fill this gap? The answer, obviously is to give a nutritious food supplement rich in energy and protein. Our effort is to add extra food to the home diet of a person so as to meet the RDIs for energy and protein. The following figure illustrates this.

Recommended Dietary Intakes of Nutrients	
Nutrients Supplied by Diet	Nutrients Supplied by Food Supplement

This is the basic concept of food supplementation. The approach is short-term because we are providing extra food to population groups without necessarily giving them the means to earn more. In the longer term we should aim to increase the purchasing power of people and educate them. This fosters a sense of independence and makes people less dependent on others for their food needs.

It is interesting to note that the supplementary feeding programmes initially catered only to children. Later, pregnant and lactating mothers were also included. Such programmes not only helped the mother through a safe birth but also improved the birth weight of the babies. Babies with a birth weight of 2.5 kg or more, have a definite health and nutritional advantage over those who are lighter at birth as you learned in Unit 22 of Block 5.

With experience, there has also been the growing realization that giving a food supplement alone is not enough. Poor people often live in unhygienic surroundings and are victims of many infectious diseases. You already know that malnutrition and infection go hand in hand. Therefore food supplements would be effective only when measures are taken to control and prevent infections and improve living conditions. Further all efforts will fail if people themselves are not convinced of the need for such services. This is where the role of education comes in.

Many of our feeding programmes continue to rely on only a food supplement. However, there is one—the Integrated Child Development Services (ICDS) programme—that seeks to offer a package of services where a food supplement is combined with health and educational services.

In this unit we will look at the major features of the ICDS programme and the Mid Day Meal programme (MDM). You will notice differences in approach and focus. The ICDS is targeted at infants, preschoolers and pregnant and lactating women. On the other hand, MDM is basically targeted at children.

Let us now begin with the ICDS programme.

24.3 INTEGRATED CHILD DEVELOPMENT SERVICES (ICDS) PROGRAMME

The ICDS programme is primarily a child welfare programme. It was started by the Government of India in 1975-1976. Before ICDS a number of child health and nutrition programmes were being operated by different departments but without proper coordination. In ICDS, for the first time an attempt has been made to combine (integrate) all the relevant services of health, nutrition and education and deliver them as a package to children and their mothers. Integration of services and consideration of the mother and child as one 'biological unit' are the unique features of this programme.

You may have heard of a programme called the Special Nutrition Programme (SNP) in our country. This programme provided a food supplement to vulnerable groups and was operational for several years. With the start of the Integrated Child Development Services (ICDS) programme in the mid-seventies, this programme was

gradually linked up with the other components of ICDS. Today, supplementary nutrition forms one of the most important components of the ICDS package. As a result, SNP is in the process of being phased out as an independent programme.

24.3.1 Concept, Relevance and Objectives of ICDS

The nutrition programmes discussed in Unit 23, as you know, are specific nutrient supplementation programmes. They aim at the control and prevention of specific nutrient deficiency diseases like xerophthalmia, anaemia and iodine deficiency disorders. In other words, these programmes are single purpose programmes with emphasis on immediate benefit to the target population. But, we know that in economically poor communities malnutrition is not only due to the poor purchasing power of people. Even faulty feeding habits due to ignorance or superstitions and repeated infections and worm infestations due to bad environment (causing diarrhoea, dysentery, cough and fever) are equally responsible. Many of the deficiency diseases mentioned in this block often coexist in the community. In other words people suffer from more than one type of malnutrition at the same time, for eg. a child suffering from PEM may have vitamin A deficiency and anaemia as well. A woman with goitre can suffer from anaemia or vitamin deficiencies. Therefore, the real solution to the problem of malnutrition is tackling all these multiple factors namely, poverty, illiteracy and ill-health simultaneously in a coordinated manner. Realization of this fact by the Government led to the conceptualization of an integrated approach to overall development of children which resulted in the ICDS programme.

The programme's main aim is to provide nutrition, health and educational services to children before and after birth and through the early childhood period so that their proper physical, mental and social development is ensured.

The specific objectives of ICDS are to :

i) improve the nutritional and health status of children in the age group of 0 to 6 years and adolescents;

ii) lay the foundation for proper psychological, physical and social development of the child;

iii) reduce the incidence of mortality, morbidity, malnutrition and school drop-out;

iv) achieve effective coordination of policy and implementation amongst the various departments to promote child development; and

v) enhance the capability of the mother to look after the health and nutritional needs of the child through proper nutrition and health education.

24.3.2 Components of ICDS

What are the components of ICDS?

The term 'components' refers to the kinds of services offered by the programme such as supplementary nutrition or immunization. As you read the following discussion you will realize that the ICDS programme is a package of several services.

In the last unit you would have come across the term 'beneficiary'. A beneficiary is the person who receives a particular service. All services in the ICDS programme are not extended to the entire population as you will find. Let us now begin our discussion on the components of the ICDS programme.

The components are :

A) Supplementary nutrition
B) Immunization
C) Periodic health check-ups, treatment of minor ailments and referral services
D) Growth monitoring
E) Non-formal preschool education
F) Health/nutrition education to women
G) Safe drinking water

The focal point of the convergence (bringing together) of these services is the 'Anganwadi' (AW). The AW or preschool child centre is located within a village slum or tribal area. Each centre is managed by an anganwadi worker (AWW) and a helper, and usually covers a population of 1000 in rural and urban areas and about 700 in tribal areas. The details of services and beneficiaries is summed up in Figure 24.1

SERVICES AND BENEFICIARIES

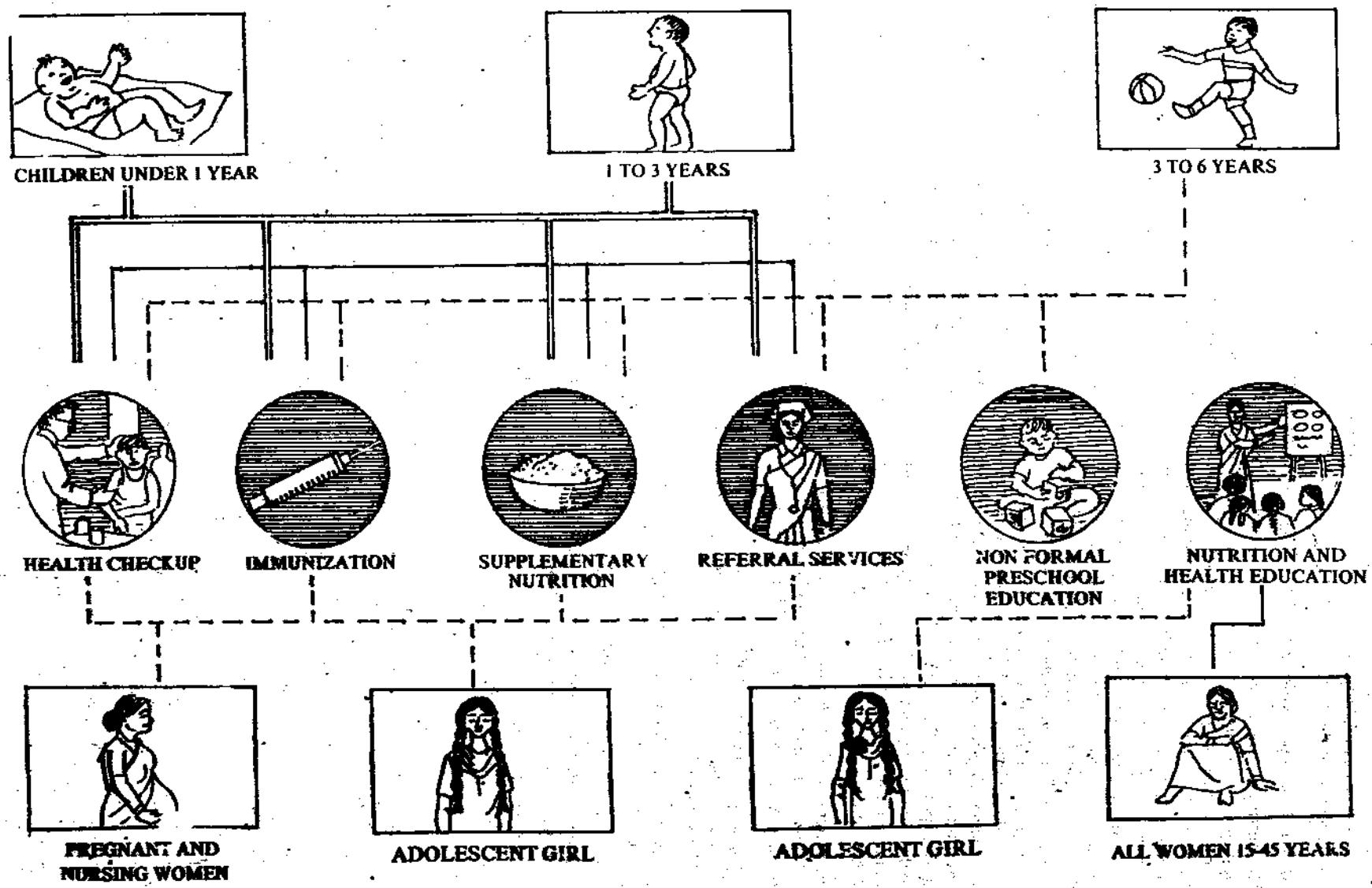

Fig. 24.1 The ICDS Programme : Services and Beneficiaries. (Courtesy : UNICEF, India)

A) Supplementary Nutrition : This is one of the major components of ICDS. You know the meaning of the words 'supplementary nutrition'. Let us now understand how supplementary nutrition is provided to the beneficiaries. Further, how are vulnerable sections of a particular community identified? For this purpose all families in the community are surveyed to identify the poorest children below the age of six, and expectant or nursing mothers. Three hundred days a year, supplementary food is prepared and distributed to them at the anganwadi. The type of food varies from State to State but usually consists of a food item (that can be easily prepared at the anganwadi) containing cereals, pulses, oil and sugar. Some states provide a ready-to-eat snack containing the same basic ingredients.

In Andhra Pradesh, for example, a ready-to-eat (RTE) powder is made from wheat flour, defatted soya flour (flour of soyabean from which fat has been removed) milk powder and sugar. This powder is then used to prepare a supplement. For infants and very young children, the powder is mixed with clean drinking water and fed. This is why the powder is also called a ready-to-mix (RTM) powder.

Special care is taken to reach children below the age of three and to encourage parents and siblings to bring them to the anganwadi for feeding. By providing about 300 calories a day to children under 6 years, the anganwadi attempts to bridge the calorie-gap i.e., deficit in calories that exists between the home diet they consume and what they require for healthy living. Food consumption surveys have shown that on an average, an Indian preschool child eats food which supplies 800-900 calories while he/she requires 1240 calories per day. This means the gap is around 300 calories per day.

Additionally, specific nutrients are supplied to take care of individual deficiencies: vitamin A for blindness, iron and folic acid for anaemia and iodized salt in areas where iodine deficiency is present. Energy and protein content of the supplementary food supplied to different target beneficiary groups is as follows:

Target group	Energy (Kcal)	Protein (g)
Infants (6-12 months)	200	8-10
Children (1-6 years)	300	15
Adolescents	500	20
Pregnant and nursing women	500	25

Double the daily supplement is provided to the 'severely' malnourished children. How does the anganwadi worker decide whether a child is severely malnourished? Read the next unit for details. Generally the anganwadi worker measures the weight of the child and the mid upper arm circumference. The lower the weight and the lower the mid arm circumference, the more the degree of malnutrition.

A variety of foods are used in the feeding programmes. A few examples are given in Table 24.1.

Table 24.1 : Supplementary Foods Used in Feeding Programmes

Supplement	Beneficiaries	Ingredients	Type of processing/ preparation	Consistency	Location of processing	Accept-ability	Shelf life
Ready to Consume							
Bread	Preschool children	Wheat/skim milk, vitamins & minerals	Baking	Soft slices	Central	Good	2-3 days
Muruku/Sev	School children and preschool children	Corn/soya/ skim-milk or groundnut meal, vegetable oil	Extruded processing	Hard/brittle	Central	Good*	40 days
Sukhadi/ Panjeeri	School/pre-school children	Cereal/ jaggery/oil	Roasting	Granular powder	Central	Good*	4 months
Miltone	School/pre-school children	Veg. protein isolate/milk and vitamins	Special processing/ pasteurization	Liquid	Central	Good	1-2 days

Supplement	Beneficiaries	Ingredients	Type of processing/ preparation	Consistency	Location of processing	Acceptability	Shelf life
Others:							
Balahar	School/pre-school children	Wheat, groundnut meal & vitamins	Cooked with vegetable oil	Variety-semisolid meal	Central	Good	1 day**
Energy Food	Preschool children	Cereal, pulse oil, oilseed	Roasting/ blending	Variety-porridge	Central	Good	1 day**
Soya-fortified bulgar Wheat (grits)	School/pre-school children	Bulgar wheat/ soya grits and vitamins butter or veg. oil	Cooked with oil	Variety porridge to semi-solid meal	Local	Good*	1 day**
Common cereal/ pulse mixes	School/ preschool children	Cereal/pulse/ Jaggery/oil	Cooked with oil	Variety-semi-solid meal	Local	Good*	1 day**

*The consistency and bulk affects consumption by young infants.
**After cooking.

Some terms used : groundnut meal (groundnuts which have been ground) isolate (protein isolate is the protein portion taken out of the food); extruded (a product prepared by extruding through small holes i.e. pushing a dough like mixture through a sieve like equipment under pressure); soya fortified bulgar (bulgar is a form of wheat; soya fortified bulgar is bulgar wheat to which soya has been added); soya grits (soybean pieces) vitamins and minirals (used to refer to added vitamins and minirals)

B) **Immunization :** All infants in the project area are immunized against infectious diseases such as diphtheria, whooping cough, tetanus, poliomyelitis and tuberculosis (Fig. 24.2). Measles vaccinations are also provided. All pregnant women are immunized against tetanus (Fig. 24.3).

Fig. 24.2 : Immunization of infants

Highlight-3 indicates the recommended immunization schedule.

Highlight 3
Immunization Schedule

Immunization plays a crucial role in preventing serious childhood diseases. These diseases include tuberculosis (TB), diphtheria, whooping cough, poliomyelitis (polio), measles, tetanus and typhoid. In the last block we have already mentioned that some of these diseases e.g. measles can result in severe malnutrition. They can also kill the young child.

The recommended immunization schedule is given here .

For the pregnant woman		
Early in pregnancy	(TT–1)	First injection against tetanus
One month after TT–1	TT–2	Booster injection against tetanus

For the Infant		
At 1½ months	BCG	Injection against tuberculosis.
	DPT–1	Injection against diphtheria, Whooping cough and tetanus
	OPV–1	Oral dose against polio
At 2½ months	DPT–2	Injection
	OPV–2	Oral dose
At 3½ months	DPT–3	Injection
	OPV–3	
At 9 months	Measles	Injection
At 16-24 months	DPT Booster	Injection
	OPV Booster	Oral dose
Between 5-6 years	Booster DPT	Injection
	Typhoid vaccine	Two injections at an interval of 1-2 months.

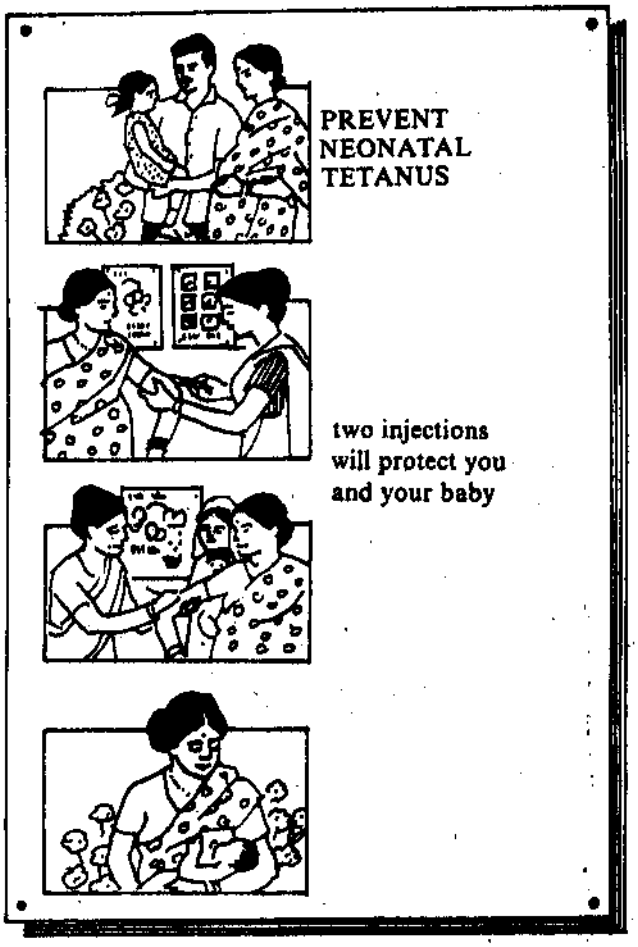

Fig. 24.3 Immunizing pregnant women against tetanus. (Courtesy : UNICEF, India)

C) Health check-up, treatment of minor ailments and referral services—At the anganwadi, children, adolescent girls and pregnant and lactating mothers are examined and treated at regular intervals by the local health personnel, such as the Lady Health Visitor (LHV) and Auxiliary Nurse Midwife (ANM). The Lady Health Visitor is also called the Health Assistant (Female). They provide a link between the village and the Primary Health Centre and sub-centres. In addition, the Anganwadi worker diagnoses minor ailments and distributes simple medicines provided in a medical kit. Children/women requiring special investigations and treatment are referred to doctors at the PHC or district hospital.

D) **Growth Monitoring**—The word 'Monitoring' means 'keeping a close watch'. Growth monitoring, therefore, means keeping an eye on physical growth in terms of height and weight of a person or groups of persons. In the context of the ICDS programme, growth monitoring, in fact is weight monitoring of children.

Weight is a good indicator of a child's growth. Since it is more simple to measure and interpret than height, it is used in the AW for watching the progress of the child's health/nutritional status. This monitoring is done with the help of special growth charts. These are also known as weight-for-age charts. As shown in the figure, the chart (Fig. 24.4) consists of a card presenting in graphic form the weight-for-age curves drawn across. Each curve denotes a particular level of nutrition/growth status. Children whose body weights are equal to or above, the 80% value of 'standard' are considered as 'normal', those weighing less than 80% and more than or equal to 70% as suffering from I grade/degree malnutrition, between 70% and 60% as II grade malnutrition, between 60% and 50% as III grade malnutrition and below 50% as IV grade malnutrition. It is obvious that the grades are in increasing order of severity—Grade I being mild and grade IV severe. At times these grades of malnutrition are denoted by different colours on the growth charts. The growth charts are utilized to educate the mothers regarding the health status of their children and the growth pattern. And more important, they help the mother/anganwadi worker to quickly identify signs of malnutrition and take prompt action. You will find more details in the next unit.

E) **Non-formal opportunities for preschool learning**—The main purpose of the preschool education component, particularly for those between 3 and 5 years is to stimulate and satisfy the curiosity of the child rather than follow any rigid learning curriculum. Children are taught songs and games. Toys are indigenous and are imaginatively produced from inexpensive locally available materials. Since there is no formally structured curriculum, and flexibility is encouraged, the anganwadi worker often responds to parental demands to teach the alphabet and elementary numeracy

F) **Nutrition education for women and adolescent girls.**

Check Your Progress Exercise 1

1) Why do you think an integrated approach is better in providing services to a population? Answer in 4-5 lines.

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2) Differentiate between the following three terms :
   * Supplementary feeding of infants
   * Mutual supplementation
   * Supplementary feeding programmes

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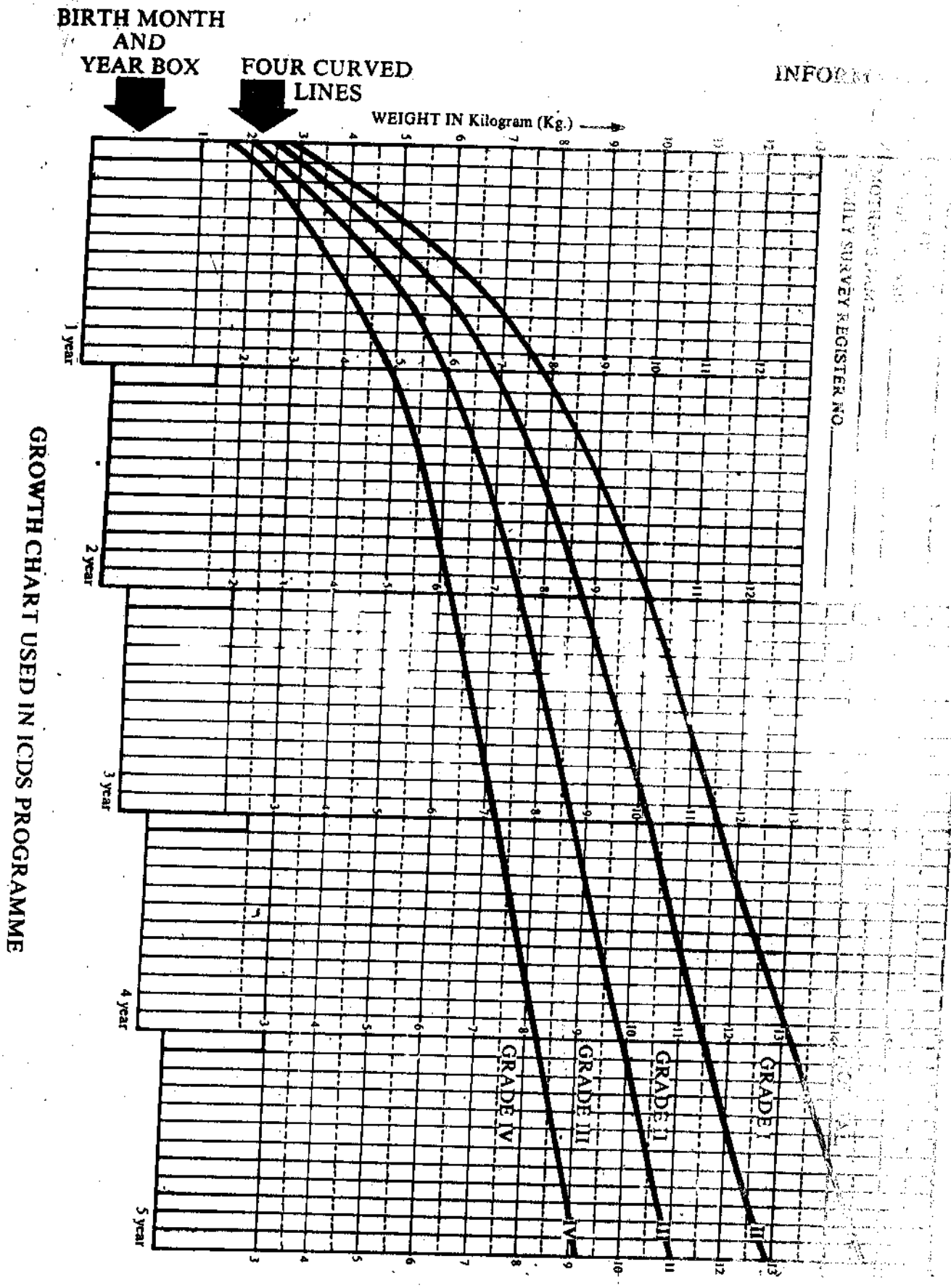


Fig. 24.4 A Growth Chart

Target Groups (Beneficiaries) of ICDS

The target groups include

- Infants under 1 year
- Children 1-6 years
- Pregnant and lactating women
- All women upto 45 years and adolescent girls.

Some of the special schemes for adolescent girls are given in Appendix 5.

The success of any programme depends on its organization and implementation. The previous discussion focussed on the advantages of integration of services. But how is this integration actually achieved? You will find the answer as you read on.

To understand the organization and implementation of a programme you must have some idea of how India as a country is administered.

Our country consists, as you know, of states. The states are guided by a Central authority i.e. the Ministers of the Central Government. Each state is divided into districts and the districts into blocks. In some states blocks are also called tahukas. Blocks are further subdivided into sectors. Sectors are made up of several villages or other human settlements. You will find that there are people at each of these levels who are assigned specific tasks.

We must add here that our health services are also provided through the same administrative structure. However the block level unit offering health services is called the primary health centre. At the sectoral level there are subcentres. And, each subcentre caters to a group of villages.

Now let us return to the ICDS programme itself.

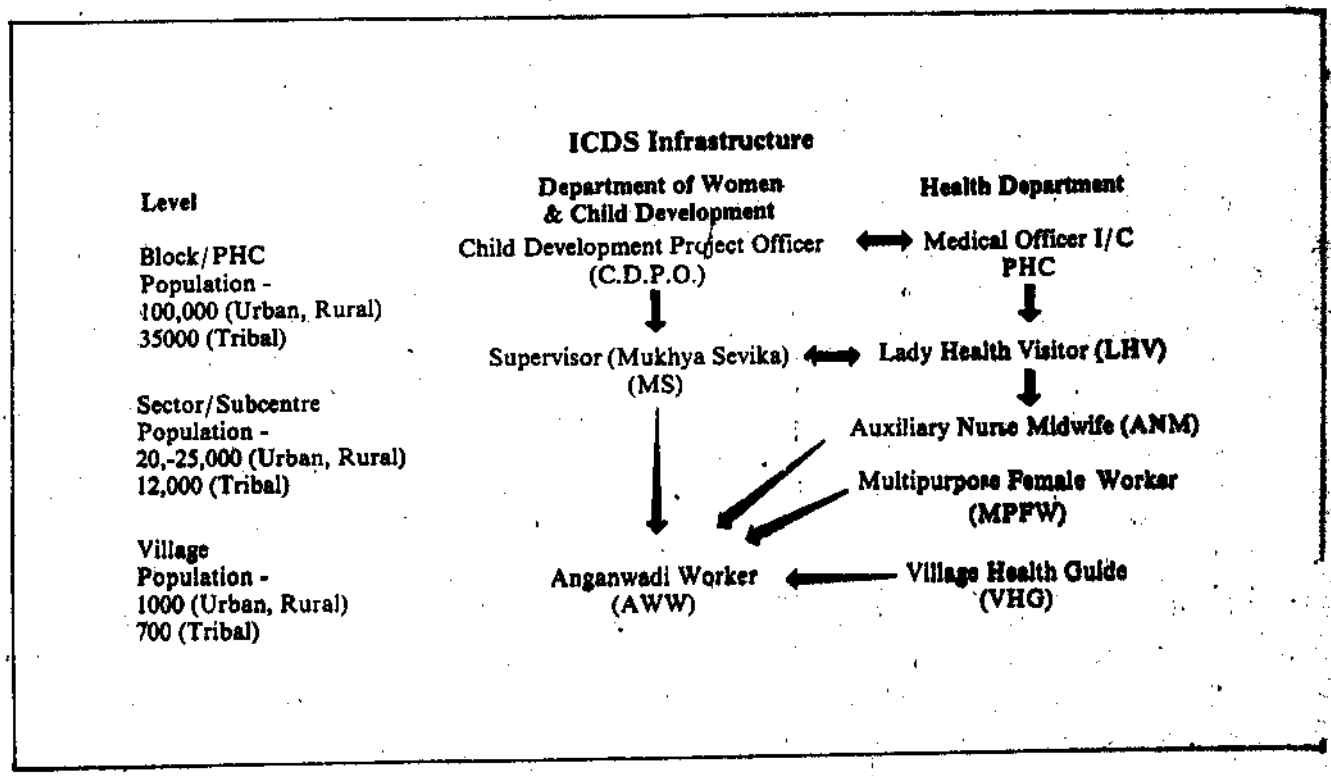


Fig. 24.5 : ICDS infrastructure

The ICDS programme is implemented by the Department of Women and Child Development at the Central level in coordination with the Ministry of Health. At the state level, implementation is the responsibility of either the Department of Social Welfare/Women and Child Development/Health or a separate Directorate of ICDS. The flow chart in Figure 24.5 gives you an idea of the infrastructure through which the programme is organized. The designations of ICDS functionaries at the Block to village or community level and the corresponding health functionaries with lines of control and communication are also shown. The functions of each of the functionaries are described here and depicted in Fig. 24.6.

THE ROLE OF KEY PROJECT STAFF

GOVERNMENT ADMINISTRATION

Child Development Project Officer (CDPO)

- Provides link between ICDS and government administration.
- Secures anganwadi premises.
- Incharge of 4 Supervisors and 100 AWWs
- Identifies beneficiaries and ensures supply of food to centre, and flow of health services.
- Monitors programme and reports to State Government.

Supervisor

- Responsible for 20-25 anganwadis.
- Acts as mentor to to AWWs.
- Assists in record keeping, organizing community visits, visits of health personnel.
- Provides on-the-job training to AWWs.

The AWW assumes a pivotal role in the ICDS structure due to her close and continuous contact with the community. As the crucial link between the village population and the government administration, she becomes a central figure in ascertaining and meeting the needs of the community she lives in

Anganwadi Worker (AWW)

- Is multi-purpose agent of change.
- Selected from the community.
- Provides direct link to children and mothers.
- Assists CDPO in survey of community and beneficiaries.
- Organises non-formal education sessions.
- Provides health and nutrition education to mothers.
- Assists PHC staff in providing health services.
- Maintains records of immunization, feeding and pre-school attendance.
- Liaises with block administration, local school, health staff and community.
- Other community-based activities, e.g. family planning.

Fig. 24.6 : Function of the Project Staff

A) Anganwadi Worker (AWW)

AWW is usually a woman from the same village, slum or tribal area where the centre is located. She plays a pivotal role in the ICDS structure due to her close and continuous contact with the community. As the crucial link between the village population and the Government administration, she becomes a central figure in assessing and meeting the needs of the community she lives in. In other words the AWW:

— Is a person with multiple duties and is expected to bring about a change in the community's knowledge and behaviour in respect of child health and nutrition

— Is selected from the community
— Provides a direct link with children and mothers
— Assists block level functionaries in surveying the community and beneficiaries
— Organizes non-formal education sessions for preschool children
— Provides health and nutrition education to mothers
— Assists PHC staff in providing health services including family planning
— Maintains records of immunization, feeding and preschool attendance.

B) **Supervisor (Mukhya Sevika)**

For every 20 to 25 anganwadis, one senior person invariably a lady is appointed to supervise and guide the AWW in her day-to-day activities. She is called a Mukhya Sevika (MS) and is trained for three months at Home Science Colleges or Departments of Social Work in the universities. Her functions are:

— To act as mentor and guide to AWWs
— To assist in record keeping, organizing community visits, visits of health personnel
— To provide on-the-job training to AWWs.

C) **Child Development Project Officer (CDPO)**

At the block level a senior officer, designated as CDPO, is appointed to oversee the programme. He/She is responsible for the implementation of the programme within the Block. CDPOs are given special two months training in child development, accounting, finance management and survey techniques. Their duties are:

— To provide a link between the ICDS and PHC and Block administration
— To secure premises for Anganwadis
— To regularly supervise the work of Mukhya Sevikas and AWWs and provide guidance
— To identify beneficiaries and ensure supply of food to centre, and flow of health services
— To monitor the programme and send reports to the State Government.

24.4 MID-DAY MEAL PROGRAMME (MDM)

You have just learnt several important facts about the ICDS programme. More important, you would have begun to appreciate the advantages of an integrated approach—giving a package of services rather than just a food supplement.

Let us now look at another supplementary feeding programme—the mid day meal programme.

24.4.1 Concept, Relevance and Objectives

The Mid-Day Meal Programme (MDM) is also called the school lunch or school meal programme. As the name indicates, the children attending elementary sections of schools are the chief beneficiaries. Supply of one supplementary meal is the main purpose of this programme. The reason why the MDM programme was started was that the home diets of these children are often inadequate from the nutritional viewpoint. Many, especially in rural areas, come to school partly hungry and some even on an empty stomach, trekking long distances. They will, therefore, hardly be able to concentrate on the studies and benefit from the education, which is being provided at great cost to the exchequer.

Further, school age children are in the phase of rapid growth and development and hence their nutritional needs are considerable as you learnt in Unit 10, Block 3.

The schools provide easy access to a large number of vulnerable children for any organized welfare action, be it health or nutrition or education. As such there is justification for this programme.

Objectives

The programme has both health and educational objectives. There are :

a) To improve the nutritional status and the attentiveness of school children attending primary sections (I to V classes).

b) To improve school enrolment and attendance on one hand and to reduce dropout rates on the other.

Apart from the above clear cut objectives, this feeding programme, when run in conjunction with nutrition/health education programmes, is expected to increase awareness among children about balanced diets, good eating habits and personal hygiene and their importance in maintaining good health. Also, the facts about good nutrition taught to children are expected to reach the parents and thus improve the food habits of the entire family.

24.4.2 Components of MDM

We have so far discussed the major aims and objectives of the MDM programme. Did you notice the difference in approach as compared to ICDS?

You would have realized that nutrition and health education are not an integral part of the MDM programmes. The major component, therefore, is a food supplement.

Who are the target beneficiaries?

The main beneficiaries of the programme are children between 6 and 11 years attending elementary/primary schools.

The menu provided in this programme is varied. The raw food material supplied by international agencies includes corn soya meal (CSM), wheat soya blend, soya fortified bulgar wheat-SFB and salad oil.

The raw ingredients are cooked into 'upma' or 'khichri' or some other forms, which are convenient to eat. They are also incorporated into ready-to-eat foods along with flavouring agents and condiments. Even milk powder in some places forms part of the supplies.

In Tamil Nadu, traditional 'rice-sambar' preparations are used in the programme.

The meal provides roughly 450-500 Kcal and 20-30 g protein per child per day, which is expected to meet one-third of the energy and half of the protein RDIs.

24.4.3 Organization and Implementation

The feeding is usually carried out within the school premises. The school teacher is responsible for the preparation and distribution of food and maintenance of records such as food stock registers, health cards and attendance registers relevant to the programme. A helper is provided of assist him/her in organizing the feeding.

The programme is operated by the Education department. Special budgetary provisions are made to meet the cost of fuel, condiments and other incidentals. We must mention here that health services are also provided to the same target group as part of a separate programme. The Medical Officer of the local Primary Health Centre (PHC) is expected to periodically undertake the health check up of the children and maintain records of height, weight and clinical (health) status of children. In some States, the Departments of Health run special school health programmes, under which a team of medical officers and paramedicals regularly visit Government schools and conduct health check ups of children. The health examination includes vision testing and dental examination. Children requiring specialized treatment are referred to hospitals with Eye (Opthalmology), Ear, Nose, Throat (ENT) and Dental specialists and Pediatricians (specialists in children's diseases).

We must mention here that both ICDS and MDM are supported by several national and international agencies.

Highlight 4 presents a brief summary of the nature and work of three international agencies.

Highlight 4

Agencies with a mission

UNICEF : The UNICEF is a specialised agency of the United Nations (UN) concerned mainly with the welfare of children and women. It was started in 1946 by the UN general assembly to deal with rehabilitation of children displaced by World War II. In fact, it took over the functions of the health division of another UN organization called UN Relief and Rehabilitation Administration (UNRRA), which did outstanding work in the area of control and prevention of the spread of epidemic diseases which broke out during and after the world war. In 1953, when the emergency functions were over, the word 'emergency' was dropped and it came to be known as "UN Children's Fund", but continued to have the initials UNICEF.

The major areas in which UNICEF provides assistance are: a) Child health b) Nutrition of mother and child c) Family and Child Welfare, and d) Education. In the area of health, the UNICEF has been assisting India in development of rural health services, control of communicable diseases and in the field of medical education and training of nurses, midwives and auxiliaries.

World Food Programme (WFP) : The World Food Programme founded in 1963 is another international body formed in order to provide food aid to the nations affected by chronic food scarcity and malnutrition. WFP acts as a channel for food distribution from multiple donors to the needy countries. WFP expects that the recipient countries utilize the food aid for the purpose of public feeding programmes, which apart from satisfying hunger aim at a long-term solution to the problem of food availability and access. In other words, the 'targeted' release of the food for vulnerable segments of population is the guiding principle on which WFP works.

In India, however, WFP food aid has been mainly in the form of SFB (Soya fortified bulgar wheat) and oil which is being distributed to supplementary feeding programmes conducted under SNP and ICDS.

The headquarters of WFP is located in Rome where FAO is also situated.

CARE : CARE is an acronym (abbreviation) for an American Organization called 'Cooperative for American Relief Everywhere'. It is a voluntary organization created in 1946 to send food from American donors to people living in war-affected Europe. Subsequently, its activities extended to other parts of the World and the scope has been expanded to include other kinds of aid such as gardening tools, seeds, pumpsets etc. for developing school gardens; provision of mobile medical vans, X-ray machines, diagnostic sets, books and training materials for updating medical/health facilities in developing countries. In India, CARE's significant contribution is in the shape of food for the supplementary feeding programmes for school children (MDM programme), as well as for preschool children and women as part of ICDS.

It also produces imaginative and effective nutrition educational materials for use in schools and communities.

Check Your Progress Exercise 2

1) Fill up the blanks

a) In the ICDS programme nutrition, health and educational services are ..... delivered as a ..... to its target beneficiaries.

b) Target ..... of ICDS programme are children under 6 years and ..... women.

c) MDM ..... provides one meal for children attending ..... sections.

d) The ..... programme is to improve the ..... and ..... children.

2) Match the following.

a) Anganwadi Worker	i) Mid-day meal programme
b) School teacher	ii) Growth monitoring
c) CDPO	iii) ICDS programme
	iv) Referral services
	v) Formal preschool education

24.5 LET US SUM UP

The major supplementary feeding programmes include :

i) Integrated Child Development Services (ICDS) and
ii) Mid Day Meal (MDM) Programme

The Integrated Child Development Services is a comprehensive programme of child development. It combines health, nutrition and education services and delivers them as a package to a child before and after birth and through his/her early childhood period. In other words pregnant women, nursing mothers, infants and preschool children and adolescents are the beneficiaries of this programme. The package (integrated) approach is considered to work out not only cheaper but also more effective and easier to organize. The programme is operated by Ministry of Human Resource Development, Department of Women and Child Development, Government of India.

The main components of ICDS are :
Supplementary nutrition
Immunization
Periodic health check ups, treatment of minor ailments and referral services
Growth monitoring
Non-formal preschool education
Health/nutrition education for women.

The services are delivered at the community level through the Anganwadi Centre—a facility where children are encouraged to gather and participate in different health and educational activities. The centre is managed by the Anganwadi Worker and a helper. The centre's work is supervised by the Mukhya Sevika and Child Development Project Officer (CDPO). At the district level, the Collector or District Planning Officer is overall incharge of the programme. Doctors and other health staff of PHCs perform health check ups, immunization and referral services. Thus the Department of Social Welfare in coordination with Health department organizes the activities of the programme.

The Mid Day Meal Programme aims at providing an additional meal to children, attending primary sections of school. The purpose is not only to improve nutritional status of children but also to attract more poor children to school and sustain their interest in learning so that drop out rates are lowered and school attendance improves. The food supplement is expected to provide at least a third of the energy RDI and one half of the protein RDI of each child every day. A number of recipes including rice, dal, oil, vegetables have been formulated for use in the programme.

The programme is organized by the Department of Education. Health functionaries of the local PHC or school health services are expected to provide health care to children participating in MDM. Thus efforts are made to have built in nutrition education and health service components.

24.6 GLOSSARY

Integrated Services or package of services : A number of relevant services are combined and made available at the same time to same set of beneficiaries.

Primary Health Centre : A vital part of the health system in our country operating at the level of a block.

Ready-to-eat snack : Snack which can be eaten without further (cooking) processing.

Single purpose programme : Programme having only one aim/objective, e.g. vitamin A prophylaxis programme aims at preventing nutritional blindness.

24.7 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) Integrating services greatly enhances the effectiveness of each; providing a food supplement alone will not solve the problem if no action is taken to control and treat infections through say immunization and providing safe drinking water. On the other hand, if a child is seriously ill or already has a nutritional deficiency immediate medical attention is required i.e. referral services.

2) 'Supplementary feeding of infants' means slowly substituting breast milk with solid and semi-solid foods. Breast feeding is continued but the baby slowly gets accustomed to an adult diet with less dependence on breast milk.

'Mutual supplementation' means including food combinations in the diet with good protein quality. Such combinations provide essential amino acids in adequate amounts and make up for the deficiencies of individual foods e.g. cereal-pulse combinations are an example of mutual supplementation.

Supplementary feeding means giving extra food to make up for the lack of energy and protein in a diet in order to prevent nutritional deficiencies.

Check Your Progress Exercise 2

1) a) 'Integrated', 'Package'
   b) Pregnant and lactating women
   c) Primary
   d) Health, educational

2) a and (ii)
   b and (i)
   c and (iii)

UNIT 25 ASSESSMENT OF NUTRITIONAL STATUS

Structure

25.1 INTRODUCTION

Health and nutritional status of an individual depends on the food he eats. This is a fact and it must be evident to you from the study of nutrition so far. Another aspect that is crucial and should be of interest to us all is — how to find out whether the individual is in a state of good nutrition or not? You may recall reading about the good signs of health in Unit 1, Block 1. Examination or appraisal of the individual according to these signs could be one way of assessing the nutritional status. What are the others? Collecting food intake data of individuals could be the other. Sometimes, you may remember being asked by your doctor to get your blood or urine sample examined for specific diagnosis. For example measuring the level of Haemoglobin (Hb) in the blood or measuring the level of glucose in the urine. These tests also constitute the assessment of nutritional status. How? In this unit we will learn about the various different methods and their application in assessing nutritional status of an individual or group of individuals in the community. How to measure growth (since growth is a measure of nutritional status)? What are the specific signs and symptoms one should look for during assessment? How does measuring the constituents of body fluids (i.e. blood, urine) help in assessing nutritional status? How to collect food intake data? These are the other set of questions which this unit attempts to answer.

Objectives

After studying this unit, you will be able to:

- describe the methods used in assessment of nutritional status and
- discuss the relative significance of each method used.

25.2 METHODS OF ASSESSING NUTRITIONAL STATUS

How do we determine the nutritional status of individuals? Before we discuss the techniques, let us quickly recall the meaning of nutritional status. *Nutritional status, we know, refers to the state of health of an individual as it is affected by the intake and utilisation of nutrients.* From this definition, it seems that evaluation of nutrient intake alone can help judge the nutritional status of individuals. Would you agree? Well, it is not all that simple. Consider the example of a child who is not growing adequately. The child's failure to achieve an adequate rate of growth, for instance, may be caused due to heredity factors, infections/other diseases, dietary lack or any other factor. Hence, evaluating the food intake alone may not give sufficient evidence for judging the nutritional status. What might be helpful would be to put together information about the type of illness, if any, including the observable signs of ill health the child is suffering from; the level of nutrients and other substances in the blood and urine. This information you would notice would help confirm whether the growth failure is caused by inadequate nutrient intake or some other factor. Examining the child's food intake pattern, for example, may suggest the existence of

nutritional deficiency but measuring the particular nutrient (or its compounds) concentration in the blood/urine may confirm the tentative diagnosis. Measuring the level of nutrients and other substances in the body fluid on one hand can indicate tissue depletion of nutrients before clinical signs are observable, on the other hand, a study of food intake pattern may strengthen the argument.

From our discussion above it is, therefore, evident that there is and can be no one simple procedure for assessing nutritional status. Because a particular finding may be due to any of the several causes, a variety of standard assessment techniques may be used to determine nutritional status. There are four major methods used to assess nutritional status of individuals and population groups which include.

— Anthropometric measurement
— Clinical method
— Biochemical analysis
— Diet survey

What are these methods? What information do they provide? How and when to use these techniques in assessing nutritional status. These are some of the aspects discussed in the next section. *Remember each of these methods has an unique contribution as well as inherent limitations that needs to be considered in the interpretation of data, but taken together they can confirm suspicions and provide factual basis for corrective measures.*

We begin the study of the techniques with anthropometric measurements.

25.2.1 Anthropometric Measurements

Anthrbpom:tric measures simply refer to the measurements of body size. You may recall reading earlier in Block 3 that measuring body weight and height provide useful data for analysing growth and for determining body size and composition. Growth as measured in terms of weight for age or height for age, reflects the sum total of what has occurred up to that point in time. Besides height and weight, measuring body circumference facilitates identification of the degree of body fat and the amount of lean body tissues i.e. muscles in the body. It aids in the identification of PEM and obesity. Th : four most commonly used and simple body measurements (which serve as good indicators of nutritional status), therefore, are:

- Weight for age
- Height for age
- Arm circumference for age
- Weight for height.

This section presents a detailed study on these anthropometric measurements. A brief discussion on various other measurements (i.e. head circumference, chest circumference and skinfold thickness) is also presented in Highlight 5, which will give a complete picture of anthropometric measurements and their role in assessing nutritional status. Before we begin, we would like to draw your attention to the fact that the use of anthropometric measurements specially height and weight depends on two factors : 1) Accurate age assessment and 2) Appropriate normal values or standards for comparison.

Accurate age assessment is necessary simply, because the body measures (i.e. height, weight, body circumference) increase with age. If the correct age is not known, it might not be possible to have an accurate assessment. Furthermore, the use of body measurements become useful only if, the actual measurements obtained on an individual are compared with known values or standards. What do we mean by standards? *The average body measurements of well-nourished and healthy children (belonging to the well-to-do societies) who are medically and socially well-protected are referred to as standards and these values are used for the purpose of comparison.* If the body measurements for age are comparable with those of well-to-do and healthy children, the child is considered nutritionally healthy. Tables providing standard measurement values of well nourished children are available. For example, Indian standards (data compiled by National Institute of Nutrition, NIN) and NCHS standards (USA). We will be using NCHS (National Centre for Health Statistics) standards for comparison, since studies conducted in India have shown that at least until adolescence, the growth pattern of well-to-do Indian children is comparable with

that of American children. Tables providing standard measurement values are given in Appendix 2 at the end of the block.

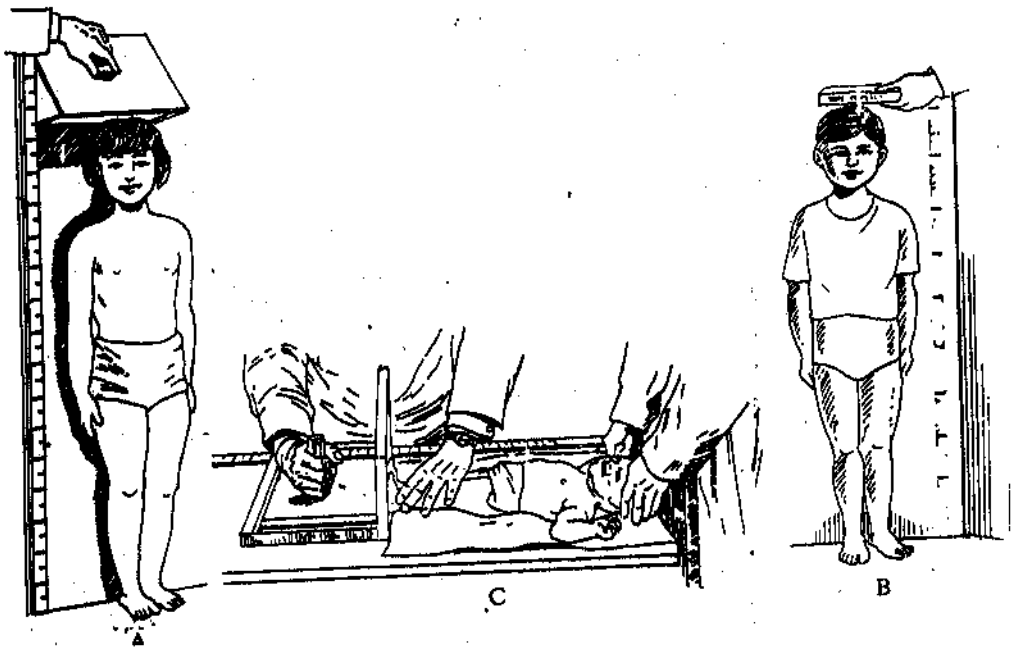
With this knowledge let us begin our study of anthropometric measures.

a) **Height for age :** Length or height is a very reliable measure that *reflects the total increase in size of the individual up to the moment it is determined* (and could indicate adequate nutritional status). For example, we know that normally a baby measures 50 cm at birth. This birth length increased to 75 cm at one year of age. By the age of four years the child is 100 cm tall. Thereafter, the child gains about 5 cm in height every year, until the age of 10 years. Recording the height would, therefore, help us to know whether the child is growing normally and is in good health or not. But it is also important to note that height changes too slowly to be used by itself to detect changes in growth pattern within a short time interval. In other terms, it is not a very sensitive measure for short duration malnutrition (i.e. the condition of the body resulting within a short time interval due to relative or absolute deficiency of one or more essential nutrients).

Furthermore, height does not decrease and, therefore, cannot indicate a deterioration in health. Height for age, therefore, is only a measure of long duration malnutrition (i.e. the condition resulting from a relative or absolute deficiency of one or more nutrients over a very long period of time.

LOW HEIGHT FOR AGE is indicative of STUNTING and of chronic malnutrition.

Next we come to the question how to measure height? A vertical measuring tape scale fixed on the wall can be used to record height of older children and adults as indicated in Figure 25.1a. Alternatively height measurement can be taken against a wall (Figure 25.1b). The individual should stand with barefeet on a flat floor against a perpendicular wall with feet parallel and with heels, buttocks, shoulders and back of the head touching the wall. The head should be held erect and a mark should be made on the wall with a flat object touching the top of the head horizontally and its vertical edge flat against the wall. Height can then be measured using a good measuring tape.



In the case of infants, an infantometer (Fig. 25.1c) can be used. This is a specially prepared wooden scale on which the infant is made to lie down, with the head touching the fixed head piece. The legs are extended fully by pressure on the knees and the movable sliding piece is allowed to touch the flat of the soles of the feet and the measurement is recorded.

b) **Weight for age** : *Weight for age is a commonly used indicator of body size, and it reflects the level of food intake.* The relative change of weight with age is more rapid than that of height and is much more sensitive to changes in the growth pattern of the individual. Significant changes can be observed over periods of few days. Therefore, unlike height for age, weight for age is, a very sensitive measure of short duration malnutrition. The weight of children should be recorded regularly to check if there is regular gain in weight. The weight, recorded can then be compared with standard values or alternatively the weight can be plotted against age on a graph to see if the pattern of growth is normal (by comparing it with the normal curve). We will learn more about this aspect later in this unit.

A LOW WEIGHT FOR AGE is called UNDERWEIGHT.

How do we measure weight? Weight can be measured with a beam balance (platform scale) as indicated in Figure 25.2a. More recently for weighing children Salter scales (Fig. 25.2b) are being extensively used. The Salter scale can be hung from a roof or a tree as shown in the figure. The child is placed in the sling and then the weight is recorded.

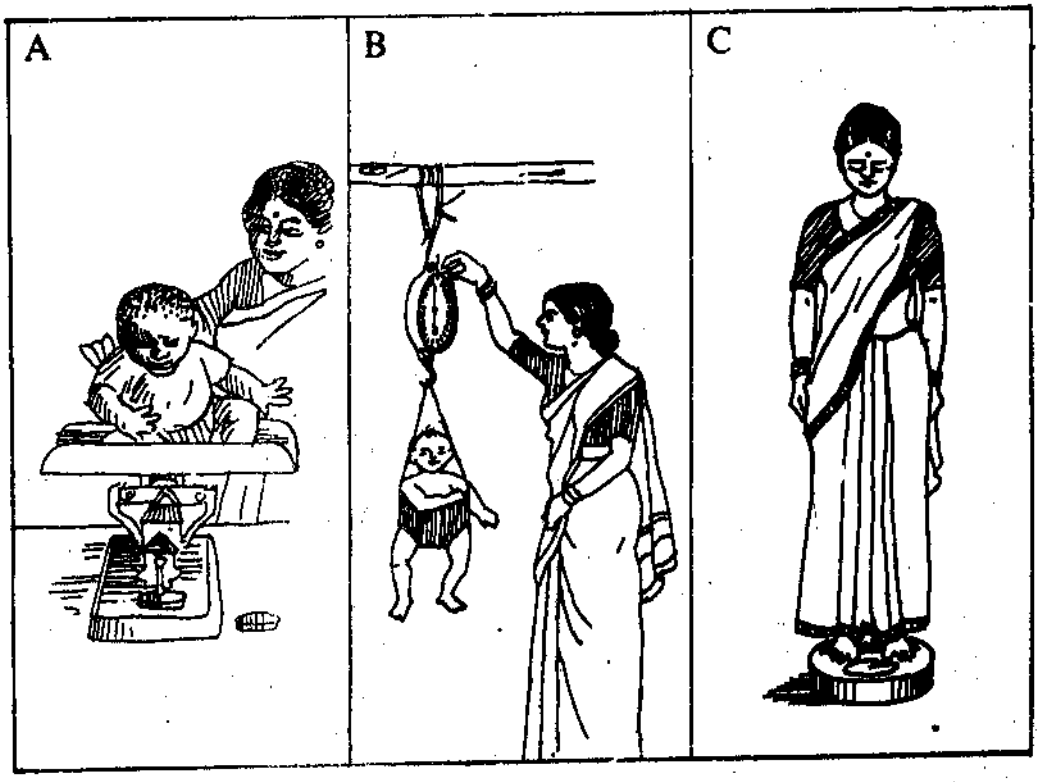


Fig. 25.2 Weight Measurements

One can also use the ordinary weighing balance as shown in Figure 25.2c to measure weight. But for measuring the weight of children using this balance we need to be more careful. First the weight of the mother and child together should be recorded and then the mother should be weighed alone. The difference in the two weights is the weight of the child. This measure, however, may not give very accurate results. So it should be used with caution.

c) **Weight for height** : By relating *the weight of a child to its height or length, an objective measure of the child's degree of thinness can be obtained.* Weight for height basically is a very good index for short duration malnutrition. This measurement is of value specially in situations where child health services are not available to carry

out periodic monitoring and children are seen irregularly say once in a while. The measure has an added advantage that accurate age assessment is not required and, therefore, it is age-independent and can be easily used in populations where the child's age is not known.

A too LOW WEIGHT FOR HEIGHT is called WASTING.

Weight for height standards are available which are given in Appendix 2 (Table IV) at the end of the block.

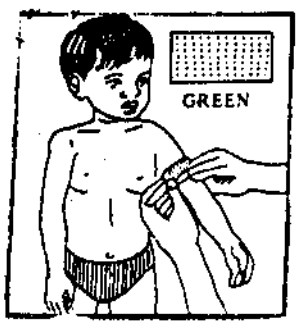
d) **Mid upper arm circumference (MUAC)** : The mid upper arm circumference is an useful indicator of nutritional status of individuals and communities. How does this measure reflect the nutritional status of individuals is what we shall study first Arm circumference, you might be aware basically includes bone, fat and muscle. Fat and muscle, you know, are the body's energy and protein reserves. These reserves are reduced in the body if the body does not absorb or take enough food as appears in the case of protein energy malnutrition thus resulting in reduced arm circumference.

Arm circumference normally increase with age, but between one to five years it does not change much and remains fairly constant. At this time the baby fat is replaced by muscle. Measuring the arm circumference of this age group would, therefore, give a good idea whether the child is in good health or not. The mid arm circumference for age of well nourished Indian children is given in Table III in Appendix 2 at the end of the block. *A measurement below 80 per cent of the normal i.e. < 12.5 cm indicates severe malnutrition and a measure between 12.5 cm and 13.5 cm indicates moderate malnutrition.*

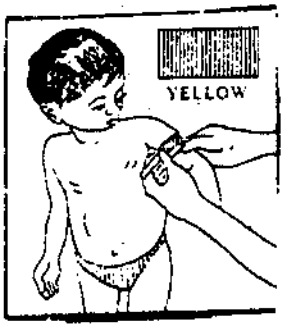
The MUAC is, therefore, an easy and useful measure for assessing thinness or muscle wasting in children in the age group 1-5 years. Like weight for height this measure too has an advantage that one does not need to know the exact age of the child in order to know the nutritional status. We move with the assumption that the mid arm circumference of children between the age one to five years remains fairly constant at about 15-16 cm. Any reduction in this measure is, therefore, indicative of advanced malnutrition.

MUAC is of value particularly in field situations; when weighing is impractical or not possible, yet one needs to identify children in greater need of nutritional assistance It is used primarily as a screening tool to measure changes in broad categories, rather than for precise assessment.

We come to the next crucial question that is, how do we measure arm circumference? One can measure the roundness/fatness of a child's arm, using any ordinary measuring tape by placing it around the middle part of the child's left arm and recording the value. However, in the field situation the arm circumference measurement is most commonly taken using a tricoloured strip called the *tricolour arm tape.* The tricoloured strip is a flexible but a non-stretchable plastic tape. A specimen tape is given in the margin alongside. The tape has three colours—red, yellow, green—in that order at appropriate cut off points. The red zone is 12.5 cm long, the yellow zone is 1 cm long and the remaining portion is green. What do these colours on the tape indicate? This can be best understood, by practically using the tape. Get hold of a child in the age group 1-5 years. Now place the tape around the middle part of the child's left upper arm. Next put the red end beside the green or yellow part of the strip. See which colour the red end comes opposite to.

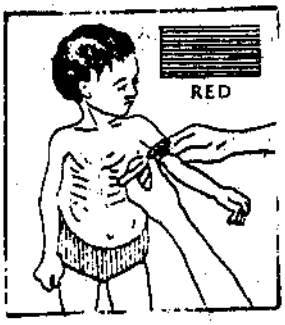


If the RED end comes opposite the GREEN it indicates that the child is NORMAL AND HEALTHY and getting enough food.
* Keep feeding the child enough food.



If the RED end of the strip comes opposite the YELLOW, it indicates that the child is MODERATELY MALNOURISHED

* The child needs more food every day.
* Give supplementary nutrition (providing 300 Kcal and 8-10g protein) to the child
* Weigh this child every month.



If the RED end of the strip comes in RED itself it indicates that child is SEVERELY MALNOURISHED.

* The child needs more food. If he does not get enough food, he may die.
* Give double amounts of supplementary food to the child.
* Feed the child at least 5-6 times a day.
* Weigh the child every month.
* Take advice of health staff.

This exercise must have demonstrated how easy it is to assess the nutritional status of children using the MUAC tape and what corrective measures to take. This measurement is one of the commonly used measures in the field situation specially in the Integrated Child Development Services programme. Under this programme, MUAC tape is quite often used to screen normal children from moderately and severely malnourished children and provide supplementary nutrition to the malnourished children.

So far we have studied about weight, height and arm circumference. Besides these measures certain other measures are also useful in the assessment of nutritional status. An idea about some of these measures is given in Highlight 5.

Highlight 5
Other Anthropometric Measures

Earlier in this block we talked about the height measurement as a means to note the gross increase in the size of the body. Height is a linear measurement. In addition to height (length), certain circumferences, particularly of the head and chest are the two other linear measurements which are useful to study the growth pattern in children. You have also studied about the arm circumference, which you may recall is a measure of the soft tissues in the body namely muscle and fat. There is yet another measure used to study the soft tissue (particularly fat) which is called skinfold measurement. Let us get to know what are these measurements and how to record them. We begin with head circumference.

a) **Head circumference :** *The head circumference is mainly related to brain size.* You would have noticed that the infants have a large head at birth as compared to the rest of the body. The head circumference increases rapidly during the first six months after birth, and thereafter, it increases slowly. The brain size, however, can vary with nutritional status and the head circumference is slightly affected specially in the second year of life in protein energy malnutrition. Measuring the head circumference, therefore, is a good indicator of nutritional status. How does one measure the head circumference? An ordinary measuring tape can be used to measure head circumference as indicated in Figure 25.3a. However, make sure that the tape used is narrow (less than 1 cm wide), flexible of non-stretch quality preferably made of steel or fibre-glass. The measurement should be taken carefully ensuring that the *greatest circumference* of the head is measured.

b) **Chest circumference :** It is a practical and useful indicator of growth in the second and perhaps the third year of life. *The chest circumference measurement*

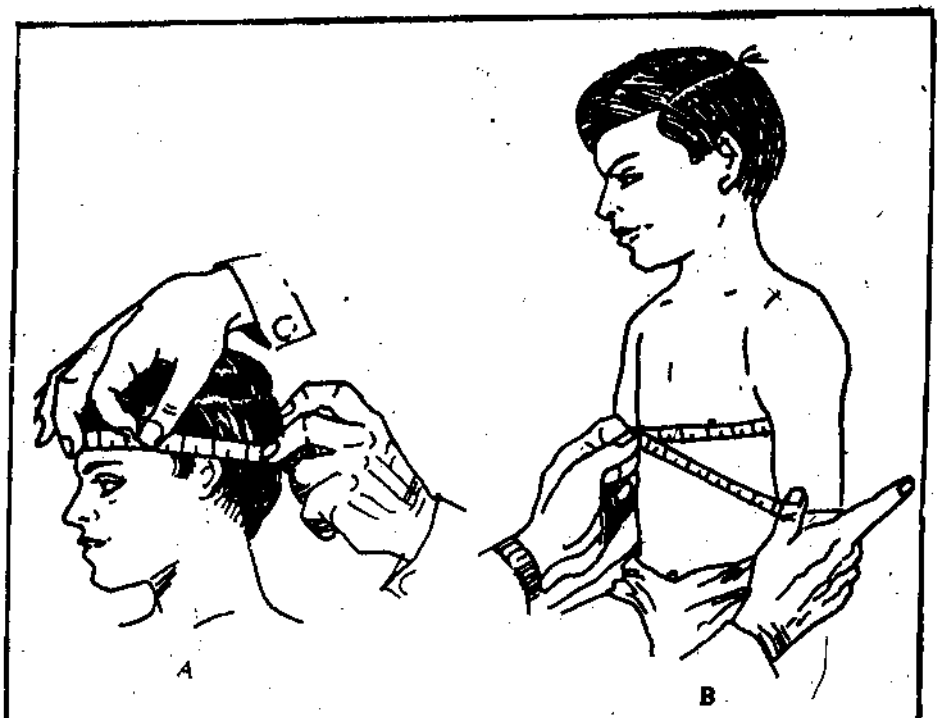


Fig. 25.3 Measurement of head and chest circumference

along with the head circumference is useful to detect malnutrition in children. At six months of age you would notice that the head and the chest circumference of the infant are about the same. After this the chest grows more rapidly as compared to the skull as can be seen from Figure 25.4. A chest/head circumference ratio of less than one taken between the ages of six months and five years would be indicative of malnutrition in children.

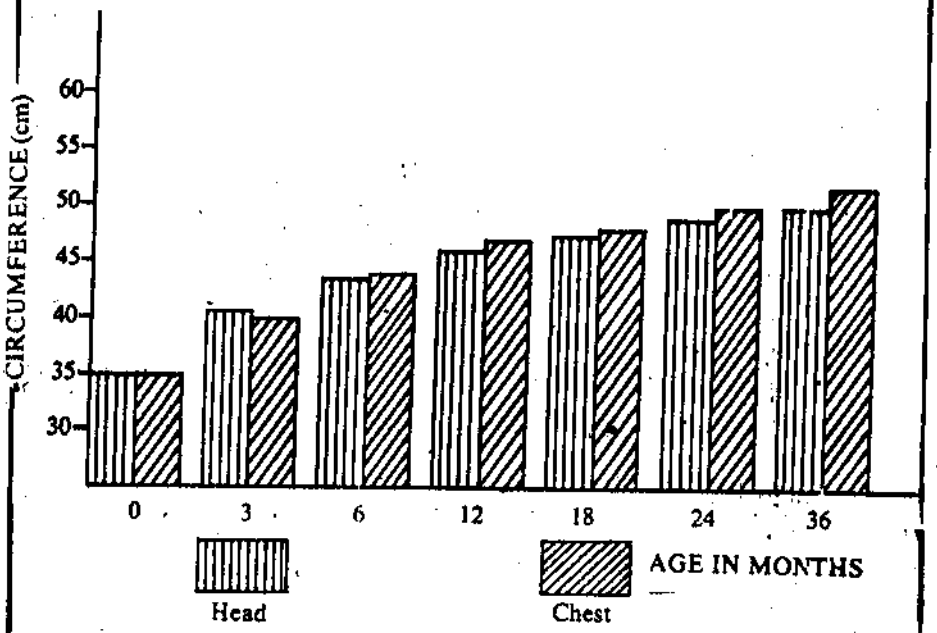


Fig. 25.4 Comparison of the head and chest circumference in the first five years

We could use the same measuring tape used for measuring head circumference to measure the chest circumference. The measurement should be made at the nipple level of the chest (Figure 25.3b) with the child preferably resting on the mothers lap. Avoid taking measurement when the child is crying, screaming or breathing irregularly.

We could use the same measuring tape used for measuring head circumference to measure the chest circumference. The measurement should be made at the nipple level of the chest, with the child preferably resting on the mothers lap (Figure 25.3B). Avoid taking measurement when the child is crying, screaming or breathing irregularly.

c) **Skinfold measurement** : *It is a simple means of measuring subcutaneous fat i.e. fat under the skin, which is also known as skinfold thickness and, therefore, is an index of fat reserves in the body*. Under conditions when there is insufficient intake of calories over a long period of time there is reduction in the thickness of the fat layer under the skin, thus indicative of undernutrition. How do we measure skinfold thickness? Skinfold calipers like the one shown in Figure 25.5 is used for measuring skinfold thickness. The best site for skinfold measurement specially in children is over the triceps (a muscle found in the upper arm region). The skinfold measurement requires more training and expertise than measuring weight and height.

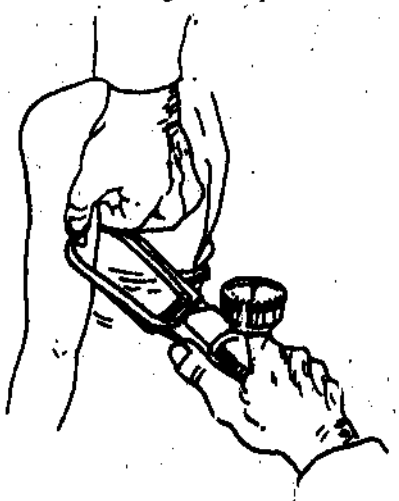


Fig. 25.5 Measuring skinfold thickness using calipers.

The discussion above presented a detailed study of the various anthropometric measurements that can be undertaken to assess nutritional status. Table 25.1 summarizes the above discussion and tabulates the specific body measurement in nutrition survey that can be used for different age groups.

Table 25.1 : Recommended body measurements in nutrition survey

	AGE GROUP			
	0–1	1–5	5–20	Over 20
Practical field measurements	• Weight • Height	• Weight • Height • Skinfold over triceps • Arm circumference.	• Weight • Height • Skinfold over triceps	• Weight • Height • Skinfold over triceps

Check Your Progress Exercise 1

1) State whether the following statements are true or false. Correct the false statements.

a) Weight for age is the most sensitive measure for any change in the growth pattern of the child.
(True/False)

.....

.....

b) A low height for age is indicative of wasting. (True/False)

.....

.....

c) Weight for height is an objective measure of the child's degree of fatness. (True/False)

.....

.....

d) Arm circumference between one to five years increases considerably. (True/False)

.....

.....

e) At six months of age the chest circumference is much more than the head circumference (True/False)

.....

.....

2) Match the items in Column A with the Items in Column B.

Column A	Column B
1) Accurate age assessment	a) Moderately-severe malnutrition.
2) Height for age	b) Wasting
3) Less than 12.5 cm arm circumference	c) Not affected by short duration malnutrition
4) Low weight for height	d) Adequate nutrition
5) A steady increase in growth	e) Interpretation of anthropometric measurement
	f) Skinfold thickness
	g) Underweight

After a detailed study of anthropometric measurements let us now shift our attention to the clinical method of assessing nutritional status. What is clinical assessment? The discussion below will help you understand this concept.

25.2.2 Clinical Method

Consider a situation, where you come across an infant who is not growing well. His body weight is very low. There is tremendous muscle wasting and the infant is generally irritable. If you were asked to comment on the nutritional status of this infant what would be your assessment. Yes, undoubtedly you would say that the child is in a state of poor nutrition and is possibly suffering from Marasmus.

How did you come to this conclusion? Sure enough you detected the obvious clinical signs/symptoms common to marasmus i.e. muscle wasting, low body weight, irritability. Clinical examination, therefore, is one of the simplest methods to assess nutritional status. *It involves looking for changes* (clinical signs/symptoms) *in the body which are indicative of a particular deficiency*. For example you might look for bitot spots and night blindness in children to suggest the possibility of vitamin A deficiency, paleness, lethargy in women to suggest the possibility of anaemia.

What is important here is to have knowledge about specific nutritional deficiency signs and symptoms and an observing eye to detect the same. With careful training we can learn to recognise certain crucial clinical signs. What are the signs one should look for? Table 25.2 summarizes some signs which would help in clinical examination. You have already learnt about these signs earlier in Block 5.

It is, however, important to remember that survey work based on clinical signs alone may not give a very true picture of the problem. A correlation with complete diet and medical history, a thorough physical examination (anthropometry) and biochemical testing is necessary for good assessment. For example, an individual who is not getting enough sleep (6-8 hours daily) may complain of irritability, lack of

Table 25.2 : Classified list of signs used in Nutrition Survey

Area of examination	Signs known to be of value in surveys
1) Hair	• Lack of lustre : dull, dry hair • Sparseness • Discolouration : the hair loses its black colour and appears reddish brown • Easy pluckability
2) Face	• Moonface : the face appear puffy with the cheeks sagging
3) Eyes	• Conjunctival xerosis : dryness of the transparent membrane that covers the cornea and lines inside of the eyelid, the conjunctive becomes discoloured (muddy coloured; and looses its brightness) • Xerophthalmia (including keratomalacia) : Cornea becomes soft and raw and easily infected • Bitot's spot : dry foamy, triangular spots appearing on the temporal side of the eye • Night blindness : inability to see in dim light
4) Lips	• Angular stomatitis : lesions (cracks) appearing on both the sides of the mouth • Angular scars : healed lesions of angular stomatitis • Cheiosis : lips develop cracks and become red
5) Tongue	• Oedema • Red and raw (tongue is bright red in colour and very painful) • Magenta tongue (tongue is purplish red in colour) • Atrophic papillae (papillae have disappeared giving the tongue an extremely smooth appearance)
6) Teeth	• Mottled enamel : mottled teeth with chalky white and brown patches with or without erosion of the enamel
7) Gums	• Spongy, bleeding gums, purplish, swelling of the gums, bleeding on slight pressure
8) Glands	• Thyroid enlargement : gland is visible and enlarged. Enlargement may be diffused or nodular • Parotid enlargement : chronic visible, non-inflammatory swelling of the parotids
9) Skin	• Xerosis : generalized dryness with desquamation • Dermatosis : Skin lesions which are symmetrical and are evident mainly on the parts of the body exposed to the sun (like forearm, legs, exposed part of the neck). The skin becomes dry and scaly
10) Nails	• Brittle and spoon-shaped
11) Skeletal system	• Beading of ribs • Pigeon chest : protruding breast-bone • Knock-knees or bowlegs
12) Internal Systems : a) Gastrointestinal	• Enlargement of liver (soft, firm, hard) • Enlargement of spleen
b) Nervous	• Irritability • Forgetfulness, headache, sleeplessness • Mental depression • Loss of orientation (not being able to relate to [illegible])

concentration, laziness. These symptoms you know are also characteristic of a continuing lack of iron in the diet. So correlating these clinical findings with biochemical tests, dietary survey will help lead to the correct diagnosis. What is biochemical assessment? What is its role in the assessment of the nutritional status of the community? We shall learn about these aspects in the next section.

25.2.3 Biochemical Assessment

Biochemical assessment deals with measuring the level of essential dietary constituents (nutrient concentration, metabolite) in the body fluids (blood and urine normally)

which is helpful in evaluating the possibility of malnutrition. For example, a measure of the level of Hb in the blood is helpful in evaluating the possibility of iron deficiency anaemia, a measure of the level of thiamine in the urine reflects the intake of thiamine in the diet, a measure of the level of vitamin A in blood reflects intake and reserve of vitamin A in the body.

How do biochemical tests help in the assessment of nutritional status? *Biochemical assessment basically works on the principle that any variation in the quantity and composition of the diet is reflected by changes in the concentration of nutrients or their compounds in tissues and body fluids, and/or by appearance or disappearance of specific substances (i.e. metabolites).* Measuring these essential dietary constituents would, therefore, help assess nutritional status. The following example will help us to understand this aspect. In the last section, you remember we considered the example of an individual complaining of lack of concentration, laziness, irritability. In such a case, measuring the level of Hb in the blood, would help relate the clinical findings to iron deficiency. If the level of Hb falls below 14 mg/ 100 ml blood (in males) it is indicative of iron deficiency manifesting as lethargy, irritability and lack of concentration.

Biochemical assessment, therefore, is very useful for assessing nutritional status as well as for the purpose of diagnosis. Correlating clinical findings with biochemical tests can surely lead to right diagnosis.

In this unit our attempt has been only to help you understand, how correlating biochemical tests with clinical findings help lead to correct diagnosis. No attempt has been made to discuss the various tests/techniques used in biochemical assessment, as this requires deeper knowledge and training, which is not within the scope of this unit.

Next, let us discuss diet survey as a method of assessing nutritional status.

25.2.4 Diet Survey

The term survey you might be aware commonly refers to the systematic inquiry into something. When *a systematic inquiry into the food supplies and food consumption of individuals and population groups is made, we call it a Diet Survey.*

The dietary intake data can be collected covering a whole nation from families (of different economic classes) or from individuals of special age group or occupation, depending on the need, What is the kind of information that can be obtained from Diet Surveys ? This question surely is of interest to us. You may be surprised to know that information may range from a gross measure of intake such as the national per capita consumption of a commodity—wheat, sugar etc. or a very precise evaluation of an individual nutrient intake, such as, the mg of vitamin C or iron in the meal in a day. The accuracy of the data, however, depends on the method used to collect the information. From this statement arises the next question that is what are the different methods used in diet surveys? There are wide range of methods used in diet surveys. A list of these methods with a brief mention about the nature of information obtained from each is presented in Chart 1. A detail study of each of these methods is not required at this stage and also it is beyond the scope of this unit to develop this thought. What should be of interest to us at this stage is to have simple practical knowledge about diet surveys and if required, be able to conduct a diet survey using one simple method. To help achieve this objective, here is a brief discussion on one of the most commonly used and simple method of collecting dietary intake data namely the 24 hour recall method.

Chart 1 : Methods of Diet Survey

Methods of Diet Survey	Nature of information obtained
1) Agricultural data food balance sheet	Trend in food consumption of large population groups (at national level) can be identified. Gross estimate of agricultural production, food imports and exports, agricultural methods can be made. The data obtained, however, is only a gross estimate.
2) Weighment method	Most accurate method for obtaining dietary intake data of individuals. In this case all foods—liquids and solids—consumed by an individual is carefully weighed prior to ingestion. Also a record of plate waste (i.e. amount of food not eaten by the subject) s kept. Then through simple calculations dietary intake of individual, is worked out.

3) **Food record or diary**	Provides food consumption data of individuals. The subject has to keep a written record of all the foods and beverages ingested over a given period of time. Portion sizes are estimated using food models and standard measuring instruments or food items are actually weighed.
4) **Diet history**	Yields a retrospective estimate of food and nutrient intake of an individual over a period of time. The period covered ranges back from 3 months to one year at the most. Information regarding food practice is obtained through interviews or questionnaires addressed to the individuals themselves or to some other person for instance, the mother in the case of children.
5) **24-hour recall method**	Used in large scale nutritional surveys to collect dietary intake data of individuals. The subject is asked to recall in as much detail as possible the food intake for the past 24 hours (by interview or by completing a questionnaire). The interview is conducted by trained personnel using food models as well as standard measuring instruments.
6) **Food frequency**	This consists of asking the individuals (by interview or by a check list) how often (daily, monthly, weekly) specific foods are eaten. Usually, the foods are grouped into categories (based on similarity of nutritive value, function in the diet etc.) and the frequency with which these food groups are consumed is recorded which is used as an index of diet pattern of population groups.

The 24-hour recall : The 24-hour recall method is probably the most widely used method of dietary assessment. Under this method, the subject/individual is asked to recall/describe, in as much detail as possible the food intake for the past 24 hours. The individual recalls what was eaten, how much food was eaten, how was the food prepared, when was it eaten and other such details related to food intake.

While conducting the survey, what we would need to do is to contact the housewife and ask her to recall amounts of foodstuffs used, preparations made and distributed to individual members in the family. To help the housewife recall this information, standard measuring instruments like the cup, spoon, glass are used (**Figure 25.6**). Where can one get these standard measures from? Well, we need not worry on this account. You may recall that a set of standard measures have been provided in the practical kit. These measures may be used for the purpose. (Illustration & Caption)

Fig. 25.6 Standard Measures used in Diet Survey

(Simple guidelines on how to conduct the survey (using this methods) have been listed in Appendix 3A which when followed will help you assess nutritional status of individuals and population groups.)

A schedule for 24-hour recall method of diet survey is attached for your information in Appendix 3B at the end of the block.

A Word of Caution : The 24-hour recall i.e. dietary/intake data of one day is not very well suited for correlation with biochemical or clinical findings. When such analysis are required repeated 24-hour recall (i.e. dietary intake data for 2-3 consecutive days) may be administered.

Check Your Progress Exercise 2

1) Match the items in column A with the items in column B.

Column A	Column B
1) Nutritional deficiency signs and symptoms	a) Anthropometric measurements
2) Food supply and dietary intake data	b) Biochemical assessment
3) Growth status	c) Clinical method
4) Measure of nutrient concentration in body fluids	d) Diet survey

2) What is the purpose of diet survey?

.....

.....

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3) How is dietary data collected from the housewife in 24-hour recall method?

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With the understanding of diet survey, our study of the assessment of nutritional status is complete. Is it so? Well not really. A study of nutritional assessment cannot be complete without a discussion on Growth Monitoring. What is Growth Monitoring? Remember while reading about weight for age (as a tool of assessing nutritional status) in Section 25.2.1 we talked about recording weight and plotting it against age on a graph to help visualize the pattern of growth. We were referring to Growth Monitoring then.

Growth Monitoring of children from birth to five years (by weight for age) is one of the important methods of assessing nutritional status of children and taking appropriate measures for reducing incidence of malnutrition, What is the concept of growth monitoring? How is it useful in promoting good health of children? What are the steps in growth monitoring? The subsequent section presents a detailed discussion on these aspects.

25.3 GROWTH MONITORING

Growth you know is the regular increase in the size or weight of living thing. The early years of childhood are the most rapid growth periods. If the child is growing normally we say the child is healthy. But because of the rapid growth the child is also most vulnerable to factors like inadequate diet and illness, which may *slow or stop growth. In other terms growth faltering may occur.* Growth faltering indicates that there is something wrong with the child, which needs to be detected and corrected. *Monitoring or measuring the growth is, therefore, a good way of assessing whether the child is in good health or not.* But how do we measure growth? You have learnt earlier in this block that the most accurate and sensitive measure of growth is weight gain. *Weighing the child regularly would give a good idea of the growth pattern.* This is the principle behind growth monitoring. Let us get to understand this concept.

What is Growth Monitoring?

Monitoring in a simple layman's terminology means keeping a regular track or check on something, like every week or every month. *Keeping a regular track of the change in weight over a period of time* (i.e. every month) *can, therefore, be referred to as growth monitoring*. From this, statement it might however appear that growth monitoring is only an assessment (i.e. weighing) tool but this is not true. Growth monitoring is the regular measurement, recording and interpretation of a child's growth change in order to counsel, act and follow up results. In other terms assessment (weight) and action (consequence of results) are linked by relevant interpretation in growth monitoring. These activities are best described by the term Growth Monitoring and Promotion (GMP). The term promotion has been added because monitoring alone emphasizes assessment rather than action.

Growth Monitoring has been defined in many ways. The Integrated Child Development Services (ICDS) programme defines growth monitoring as under :

Growth Monitoring is a regular measurement of growth which enables mothers to visualise growth, or lack of it, and obtain specific relevant and practical guidance to ensure continued regular growth and health of children.

What Growth Monitoring is expected to do and how?

In most developing countries children suffer from malnutrition, which you know is associated with poverty, compounded by repeated infections (like diarrhoea, measles) and illnesses. The resulting feature is — weight loss or lack of weight gain (i.e. growth faltering). Growth faltering, therefore, can best be detected at an early phase through growth monitoring and promotion.

The purpose of Growth Monitoring is to help identify the at-risk child, take action on the first sign of inadequate growth and integrate nutrition intervention (breast feeding, supplementary feeding etc.) *with other health interventions* (Immunization, ORT) *to restore health and proper growth of children.* Growth Monitoring is a preventive and promotive strategy aimed at action before malnutrition occurs. By creating concern and demand for growth and enabling it to be visualized, Growth Monitoring uses regular monitoring of growth to establish a regular, recurring, effective communication with each mother. In fact, it acts as a tool for health and nutrition education to mothers thus promoting optimal health of the child

Now we come to the crucial question How do we monitor growth? Let us consider

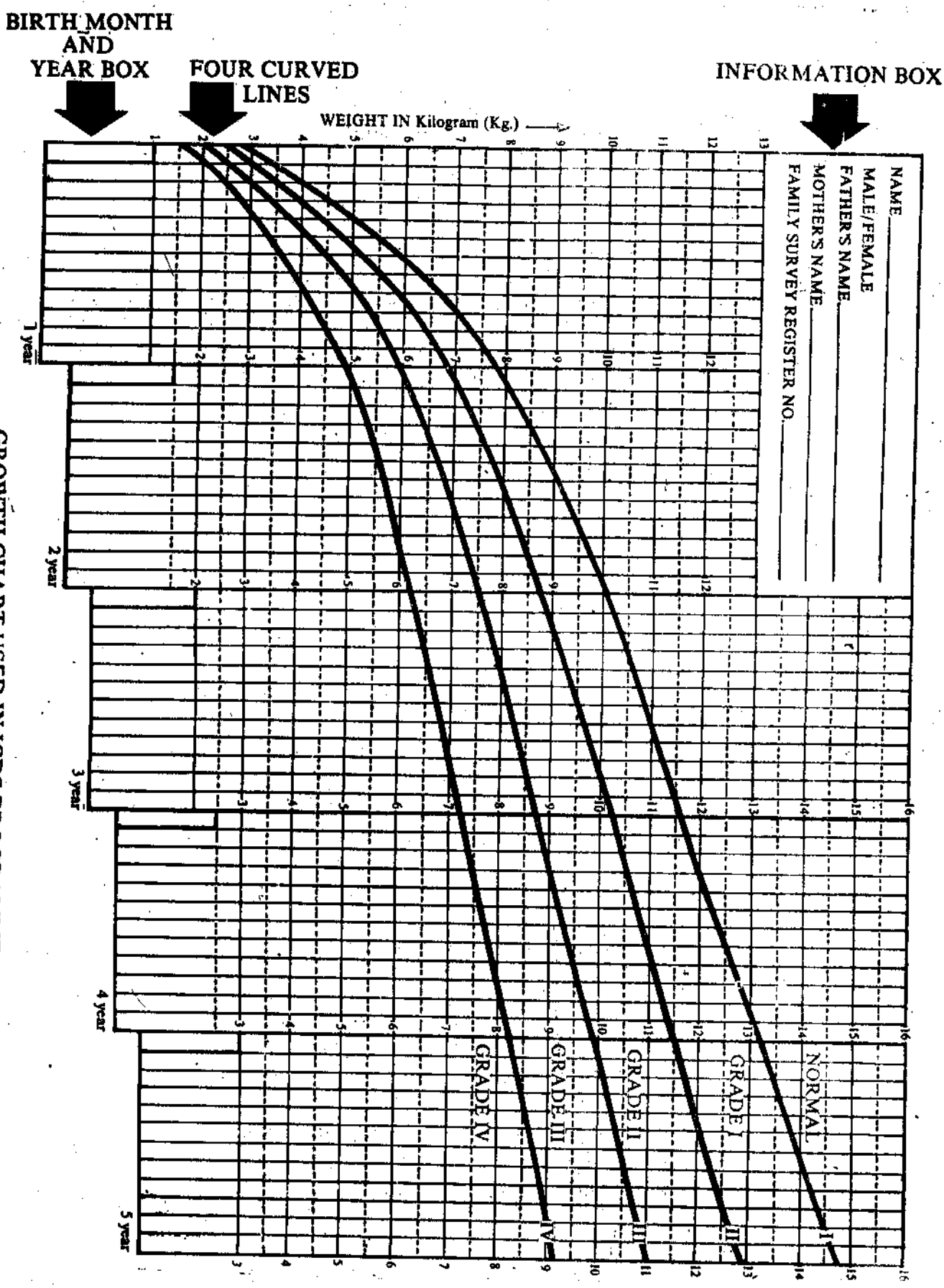
How do we monitor growth?

You are aware that weighing is the usual assessment tool for monitoring growth. Alternatives to using weight includes other anthropometric measures such as arm circumference or clinical signs such as thinness. Whatever be the method used, remember it must be sensitive and specific enough to detect changes in growth and must be linked with appropriate interpretation and action. One such simple assessment tool is the growth chart. What is growth chart? You may recall reading about growth charts in Unit 24. *Growth chart is primarily designed as a means of monitoring and interpreting changes in weight over time. The essential feature of a growth chart is a graph* (Figure 25.7) on which weight is plotted against age so that growth can be followed graphically in comparison with reference standards. Let us understand the growth chart.

Observe the growth chart given in Figure 25.7.

- On the extreme upper left hand side you see a box. This is the information box, where the child's name, sex, fathers/mothers name etc. is filled.
- The growth chart has horizontal lines going side to side and vertical lines going top to bottom. The vertical line represent the age of the child and the horizontal line represent the weight. Along the Y axis is the weight written in kg.
- At the bottom of the chart are five steps, each of which represent one year in the child's life starting from 0 to 5 years. Each step is further sub-divided into 12 lines which represent the 12 months of the year. The first box on the extreme left has a thick dark outline. This is for birth month and year of the child.

In addition, you would have noticed four curved lines on the growth chart. What do these lines indicate? These curved lines represent children in different nutritional grades. Children who are healthy with normal body weights (i.e. body weight equal



GROWTH CHART USED IN ICDS PROGRAMME

Fig. 25.7 Growth Chart

to or above 80% value of standard would usually fall above the top line labelled 'normal'. If the child's weight falls below the first line, the child is considered undernourished. The lower the weight the more undernourished the child.

— When the weight is between the top line and the second line (i.e. when weight is less than 80 per cent and more than or equal to 70 per cent value of standard) it would indicate the child is suffering from I grade/degree malnutrition. (For example, at four years the child should weigh approximately 15-16 kg. If the actual weight is less than 13.4 kg (i.e. 80 per cent of 16) or equal to 11.2 kg. (i.e. 70 per cent of 16) it would indicate that the child is suffering from Grade I malnutrition.

— When the weight is between the second and third line (weight between 70 per cent and 60 per cent value of standard) the child is in Grade II.

— When the weight is between the third and the fourth line (weighing between 60 pe cent and 50 per cent value of standard) the child is in Grade III malnutrition.

— When the weight falls below the fourth line (weight below 50 per cent value of standard) it is a danger signal indicating the child is severely malnourished and in Grade IV.

Check Your Progress Exercise 3

1) Define the following in 2-3 lines :

a) Growth faltering

.....

.....

b) Growth Monitoring

.....

.....

c) Growth chart

.....

.....

2) What is the purpose of Growth Monitoring?

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.....

With the understanding of the growth chart let us now move on to study the steps involved in plotting the growth chart.

Steps in Growth Monitoring

The five steps involved in growth monitoring are :

Step 1 : Determining correct age of child.

Step 2 : Accurate weighing of each child.

Step 3 : Plotting the weight accurately on the growth chart.

Step 4 : Interpreting the direction of the growth curve.

Step 5 : Analysis and follow up action.

Each of these steps are discussed in details below.

1) **Determining the correct age :** Growth monitoring, you know is based on comparing the weight of the child with his age. So the very first thing we need to do is to find out the age of the child. If the correct age is not known, it might not be possible to have an accurate growth chart. Therefore, knowing the correct age is essential to growth monitoring. How do we get to know the correct age of the child? Can you suggest. Yes, we could look at the records of the child's birth

(birthday, month and year) with the parents or alternatively we can consult the local official register of birth with a village panchayat (in case of rural area) or the hospital card (in case of both urban and rural areas) depending on where the child was born. At times you might come across a child, who does not have a birth record. So, then how would we estimate the age of this child. We can estimate age using a local events calendar. An example of such a local events calendar is given in Appendix 4. As the name suggests a local events calendar is a record of all the dates on which important events took place during the past few (five) years, in a specific area. For example, local festivals, phases of the moon (full moon, new moon), different seasons, general elections, flood or cyclone in the area etc.

By questioning the mother/family members regarding the season, crop harvests, events, festivals etc. which occurred soon after or before the child was born, we can look up the local event calendar to find out the exact birth month. But remember the calendar should be local i.e. specific to the area and should cover all events for the last five years of that area.

2) **Accurate weighing of the child :** Along with age, accurate weighing is also essential in growth monitoring. Measuring the weight gain of the child every month is a measure of growth. Hence, accurate and sensitive weighing scales should be used to weigh children. You may recall reading earlier in the block about using Salter weighing scales or beam balances to weigh children. Using whatever is easily available, accurately weigh the child.

3) **Plotting the weight accurately on the growth chart :** After determining the correct age and accurate weight of the child, the next step is to plot the same on to the growth chart. Let us see how it is done.

- First, write down the child's name, sex and other information asked for in the information box given in the growth chart.

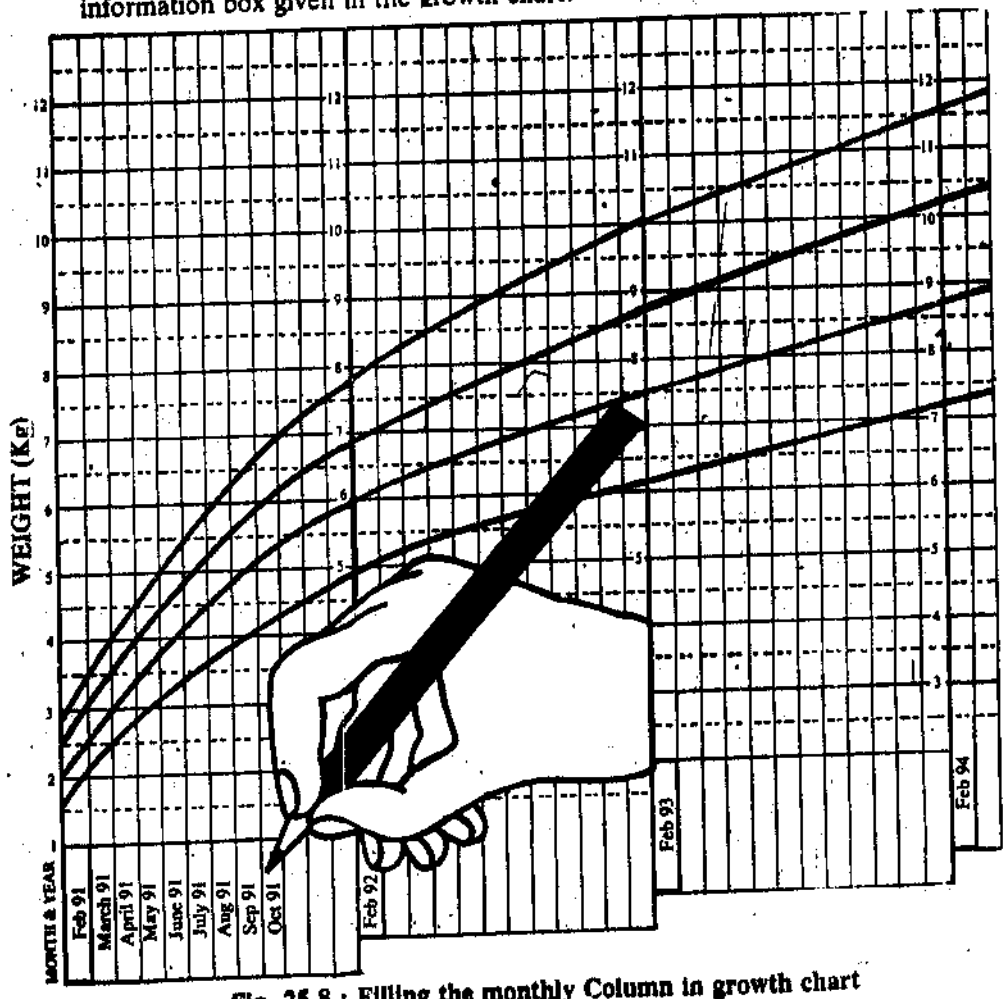


Fig. 25.8 : Filling the monthly Column in growth chart

Fill up the month and year box. To understand this better let us suppose we are preparing the growth chart for Ravi. If we assume Ravi was born in February 1991, write Feb'91 in the first thickly outlined box as indicated in Figure 25.8. In the next box write March 91, and in the next April 91 and continue till you reach January 92. So far you have filled up the month and year for the first year box. Repeat the same procedure in the second year box. But remember to change the year. The marking will read—Feb 92, March 92 ..... January 93. Likewise, fill in all the monthly boxes for the five years. You may be wondering why we need to fill up the year and month boxes right in the beginning. This exercise, you would see will be helpful later while plotting.

With this spade work done let us now learn how to plot the weight, taken every month on the growth chart. Figure 25.9 shows the growth chart of Ravi. Ravi we know was born in February 91. He weighed 4.0 kg in March 91 i.e. at one month of age. Write the weight below the box for March 91. Now to plot this weight on the growth chart, move your finger up the March 91 column, until you come to the solid line which represents 4.0 kg. weight. Make a dot in the centre of the column as indicated in the figure and encircle it. Next we move to the second month. In April, Ravi weighed 4.5 kg. In the same fashion as described above, write the weight below the box for April 91. Then move up your finger up the April 91 column, until you reach the 4.5 kg dotted line. Make a dot in the centre of the column and encircle it. Now connect this dot with the dot made on the chart for the previous month by drawing a line. *This line is called the growth curve.* By plotting Ravi's weight every month on the chart the growth curve can be determined.

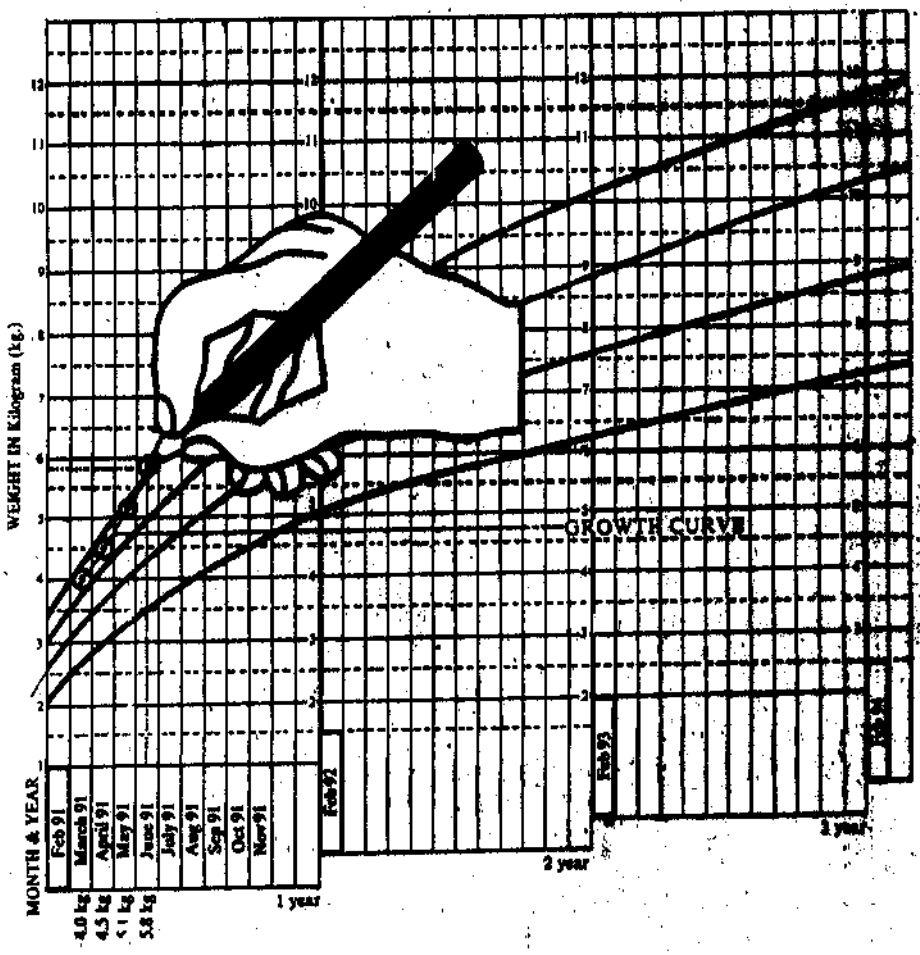
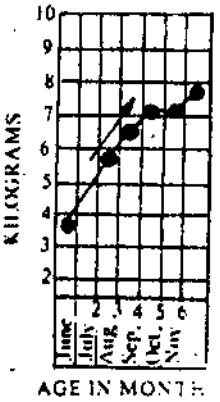


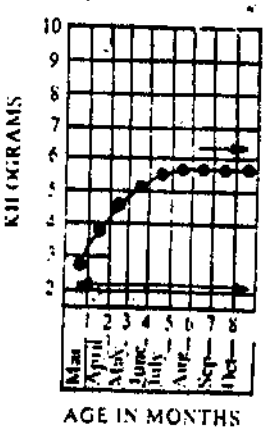
Fig. 25.9 Plotting weight on the growth chart

4) **Interpreting the direction of the growth curve :** The data plotted on a growth chart provides useful information for recognizing whether the child is growing properly or not. How? Let us understand.

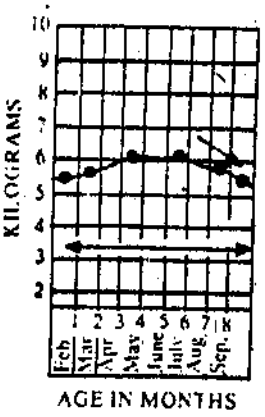
In the last step we saw how connecting the dots creates the growth curve which makes growth visible. It is, in fact, the direction of the line (growth curve), which is most important to interpret and discuss. Let us understand this concept taking few examples. The first example is of Ravi. Look at the margin illustration. It shows the growth curve of Ravi. A clear look at the growth curve shows that Ravi had a steady weight gain per month. This weight gain is adequate for his age, and the growth curve is moving in an upward direction. What can one interpret from this upward growth curve? *An upward growth curve (↗) indicates that Ravi is gaining weight and is growing and is healthy.*



Let us now consider the example of Meena. From the growth chart of Meena given in the margin alongside, it can be seen that from March to July; there was a steady weight gain and the direction of the curve is upwards. However, after July, the growth curve is flat. What does it indicate? *A flat growth curve (→) indicates that Meena has not gained weight in that period, which means no growth. In other words faltering growth. A flat growth curve is an indication that there is something wrong with Meena.*



The last example is of Shamu. The growth chart of Shamu, given in the margin alongside shows that he was growing well from February to May. The direction of growth curve is upwards. After May till July, the direction of the growth curve is flat and the rate of growth has slowed down. After July, however, the direction of the growth curve is downward. What does this indicate? *A downward growth curve (↘) indicates that Shamu has lost weight which is a source of great concern. It represents that Shamu is not growing well and is possibly suffering from some illness.* So what we need to do next is to find why Shamu is loosing weight, and take appropriate action.



From our discussion above it can be summarized that depending on the patterns of monthly growth of a child the direction of the growth curve may be upward, flat or downwards.

- An upward growth curve indicates that the child is growing and is healthy
- A flat growth curve indicates no weight gain, which is no good and requires attention and
- A downward growth curve indicates loss of weight, which is a matter of concern and requires prompt action.

Another aspect that needs interpretation is the nutritional grade the curve falls in. You are aware that the growth chart has four lines dividing the chart into nutritional grades. We need to check the position of the growth curve in relation to these grades. The curve should move in the upward direction towards the area called 'normal'. If the curve falls below the normal line, it indicates that the child is undernourished and in need of help. Lower the position of the curve, the higher the degree of malnourishment. Plotting weight on the growth chart, therefore, helps to determine the grade of malnutrition of the child.

Note : Remember, no matter in which grade the child is in, it is the weight gain each month (indicated by an upward curve) which is important. A child who is not gaining weight every month, no matter what nutritional grade he/she is in, needs attention.

The next important task in growth monitoring is to analyze the pattern of growth and take appropriate action, as is discussed in the following step.

5) **Analysis and follow up action :** After plotting and determining the trend of the growth curve (whether the child is growing normally or not) the last and the most important step of growth monitoring is Analysis *i.e. to find out what has happened to the child during the last month(s) to make the child's growth pattern happen that way and take remedial action.* For example, if the child's growth curve is flat or downward find out from the mother what has happened to the child in the last month which has lead to growth faltering. There can be many different reasons for poor growth namely an episode of illness such as diarrhoea, measles, fever, cold, cough etc. or just plain unwillingness on the part of the child to eat anything or delayed introduction of supplementary foods etc. Find out from the mother the exact reason which caused poor growth in this child at this very time. Suppose if the mother describes an illness next ask what she did for the child. Did she provide proper treatment for the illness. Did she continue feeding during illness. Did she give the child extra food to eat when the illness was over. Information on these aspects will be useful in planning specific remedial action which when followed will promote child's growth. This task may seem simple but you have to take extra care to seek full participation of the mothers in this respect i.e in the recognition of growth faltering and the action she can take to correct it. Show the growth chart to the mother, explain the growth curve, discuss the growth trend with her, find out what has happened to the child and accordingly plan the specific action(s) that she can take to promote health.

For instance, if the child had diarrhoea, ask the mother if she gave the child adequate fluids to drink to prevent dehydration. Make sure that she understands how to make and use oral rehydration mixture and the importance of continued feeding even when the child is sick. If she has withheld the food to the child during illness, explain to her showing the growth curve how this has caused the growth to falter or go downwards. Impress upon her to give extra food to the child each day so that the child recovers the lost growth and is on the road to good health.

On the other hand if growth is favourable, as indicated by an upward growth curve, what are we expected to do? Once again the principle is the same. Show the growth curve to the mother and tell her this is good. Next find out what factors during the last few months have contributed towards the childs growth being so good. Applaud the mother and encourage her to continue following the same child-rearing practices.

From our discussion above it must be evident that measurement (i.e. monitoring) must always be followed by action (i.e. promotion). It is only through interpretation and relevant action one can help support the mother whose child is growing adequately and assist her when faltering occur.

Data plotted on a growth chart also provides an excellent base for analyzing and identifying beneficiaries (children) for supplementary nutrition under the government's feeding programmes (specially the ICDS). Let us consider.

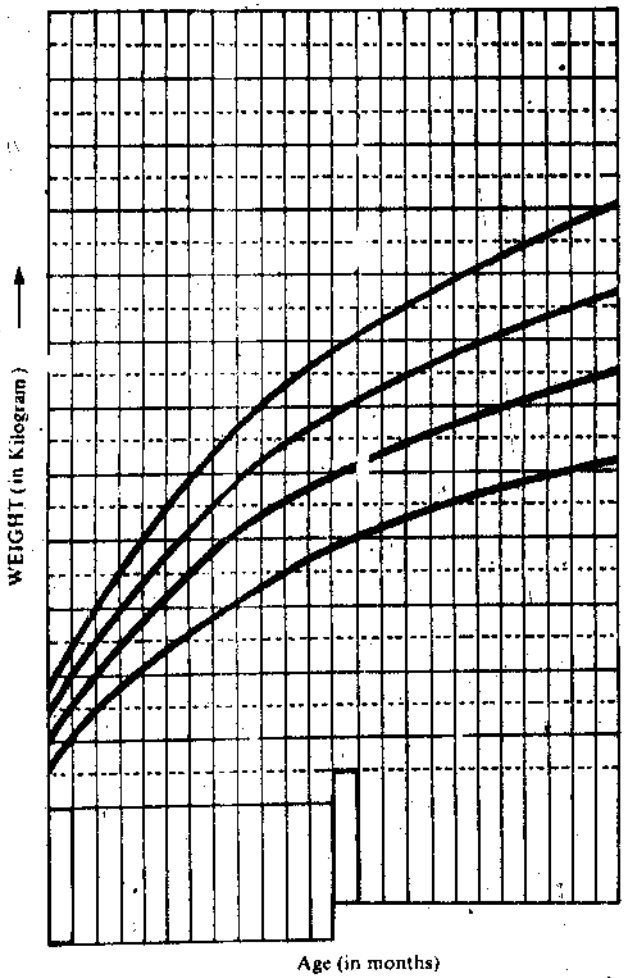
- Children who have not gained weight for three consecutive months are given supplementary food (providing 300 kcal and 8-10 g protein).
- Children whose weight are in Grade II of malnutrition on the growth chart are also given one helping of supplementary feeding.
- Children who are in Grade III and IV of malnutrition are given double quantities of supplementary food at the Anganwadi in addition to being referred to the Primary Health Centre (PHC).

Check Your Progress Exercise 4

1) Fill out the growth chart for Ali Mirza who was born in January 1991.

   a) His weight for the first three month is as follows :
   January 2.8 kg
   February 3.5 kg
   March 4.2 kg

   Plot these weight on the growth chart given below.



i) What is the direction of the growth curve from birth until March 1991?

.....

.....

ii) Is this good, not good or dangerous? Why?

.....

.....

b) In April 91, Ali had a bout of diarrhoea. His weight when recorded was only 4.3 kg. In May 91, Ali once again weighed 4.3 kg. Plot this weight on the growth chart above.

2) Comment on the direction of the growth curve from March to May '91.

.....

.....

3) What advise will you give to Ali's mother?

.....

.....

25.4 LET US SUM UP

In this unit we learnt about the different techniques used to assess nutritional status namely—anthropometric measurements, clinical method, biochemical assessment, diet survey and growth monitoring.

Body measurements or anthropometric measurements we learnt are the most simple and widely used method to assess nutritional status of different population groups specially children. Measuring parameters like weight for age, height for age, mid upper arm circumference and comparing the values with standards give a good indication whether a child is malnourished or normal.

Clinical examination, on the other hand, is based on the principle of recognizing certain physical signs in the body which are indicative of particular deficiency. This method of assessment requires specific knowledge regarding the various nutrition deficiency diseases and their clinical signs. With careful training one can learn to recognize these crucial clinical signs and assess the nutritional status.

Biochemical assessment deals with measuring the level of essential dietary constituents in the body fluids which is helpful in evaluating the possibility of malnutrition. This technique is very specific and usually medically trained people undertake this job.

Diet survey is the technique used to collect data on supplies and intake of foodstuffs at different levels namely national, regional, family and individual. The 24-hour recall method has been described in same details with simple guidelines provided for collection of data.

Growth monitoring is a process of sequential measurements for the assessment of physical growth and development of the child. The process involves regular weighing for early identification of growth faltering with appropriate and prompt follow up action.

25.5 GLOSSARY

25.5 GLOSSARY

At-risk children : Children prone to infections and diseases

Linear Measurement : A system of measures of length

Metabolite : A nutrient or compound used in normal biological processes, especially intermediary metabolism.

National per-capita consumption : The total amount of the commodity consumed per head (on average, by each person) in the country over a certain period of time

Triceps : A muscle found in the upper arm region

Parotid gland : A salivary gland located anterior to the ear, its duct opening into the mouth cavity.

Wasting : Emaciation or thinness of the body

25.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) a) True
   b) False; a low height for age is indicative of stunting
   c) False; weight for height is a measure of the child's degree of thinness.
   d) False; arm circumference remains fairly constant between one to five years of age.
   e) False; at six months the head and chest circumference are about the same.
2) 1 – e; 2 – c; 3 – a; 4 – b; 5 – d

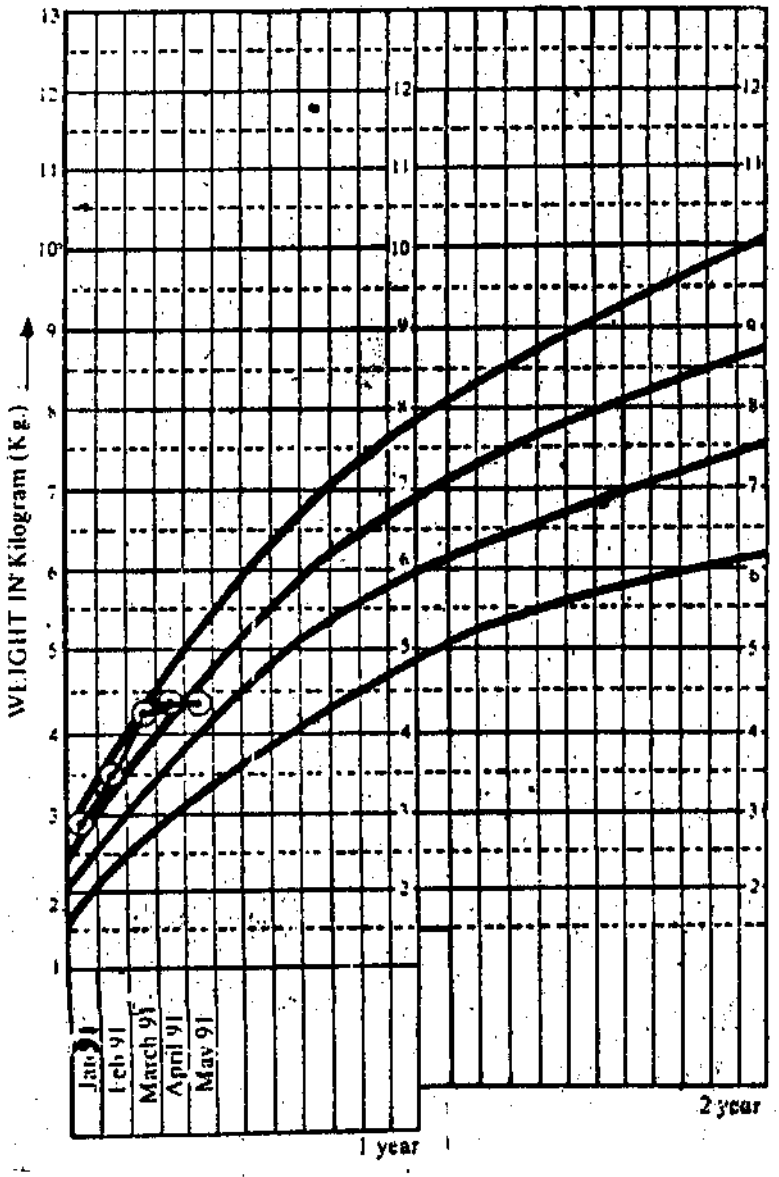
Check Your Progress Exercise 2

1) 1 – c; 2 – d; 3 – a; 4 – b
2) • to collect information about food supplies and food consumption of individuals and population groups.
   • to find out inadequacies in the existing diet pattern.
3) The data is collected using the standard measuring equipment—cup, glass, spoon.

Check Your Progress Exercise 3

1) a) When growth slows down or stops we refer to it as growth faltering.
   b) A regular check on the change in weight over a period of time, and giving advice to the mother based on this weight change is called Growth Monitoring.
   c) It is a graph on which weight is plotted against age so that growth can be followed graphically.
2) a) To help identify at-risk children.
   b) To take action at the first sign of inadequate growth.
   c) To establish a regular, effective communication with the mother—act as a tool for health and nutrition education to mothers.
   d) To determine the grade of malnutrition of child.

Check Your Prograss Exercise 4



a) i) Upward growth curve.
ii) It is good as it indicates that the child is growing normally. But inspite of the upward growth curve, Ali is still underweight. He is in grade malnutrition. This needs to the taken care of.

b) i) Flat growth curve indicates growth faltering.
ii) a) Give adequate fluids (water, beverages etc.) to drink to the child.
b) Prepare ORS and serve to the child.
c) Continue breastfeeding.
d) Serve soft thin supplementary foods to the child.
e) Maintain good hygienic conditions around the child.

NUTRITION EDUCATION : TOOLS AND TECHNIQUES

You have already been introduced to the importance of nutrition education in promoting people's interest in improving their own health and nutritional status. It is true that no nutrition programme can be sustained without the awareness among members of the target group that it provides useful and beneficial services.

- **What is Nutrition Education?**

Nutrition education has been formally defined in several ways. One such definition says that nutrition education is a

> *"Planned effort* to improve *nutritional status* by promoting *modifications in behaviour."*

As you can see, the modification of behaviour is the key to a successful nutrition education programme. In fact any such programme tries to encourage a few selected and clearly defined behaviours such as breast feeding, adding oil to supplementary foods for infants or giving a larger share of the family food to preschoolers.

- **How can we plan a nutrition education programme?**

There are several points that practised nutrition educators generally keep in mind. They plan nutrition education programmes as follows:

Step 1) *Identifying the problem to be tackled*

Step 2) *Talking to community members to assess*

- — knowledge, attitudes and practices
- — key persons in the group who should make the behaviour change i.e. target group
- — influence of community leaders

Step 3) *Assessing the time, money, personnel and facilities required for carrying out the programme*

Once these initial steps are over we would have enough information for the next step.

Step 4) *Establishing educational objectives*
In other words, this means writing out clearly the answer to the question:

What do we want to achieve?

An educational objective must always be stated in terms of the action to be carried out. It is also a good idea to say where the programme will be conducted (geographical boundaries), how much is likely to be achieved in a given period of time (progress of the programme) and how many people would be reached (coverage).

Now we are ready with an educational objective. We must next begin with Step 5.

Step 5) *Developing a detailed plan of action*

We know what we want to achieve. (Remember that being over ambitious can cause problems). Our next step is to answer the following questions as clearly as we can

- — What do we need to communicate?
- — Whom should we communicate with i.e. who is the target group?
- — Who will communicate—a nutritionist, a health worker, a nurse etc.?
- — What will be the channel of education? Will it be through hospitals, schools, clinics, clubs or through exhibitions, fairs or through talking to individuals and groups?
- — How will we communicate? What tools and techniques will we use?

While doing this useful exercise we must remember that:

> NUTRITION EDUCATION IS LIKELY TO BE SUCCESSFUL IF WE TALK TO PEOPLE DIRECTLY AND LET THEM TALK TO US

This emphasizes the fact that we must allow *opportunities for group discussion and decision. Basing our action on what people want* is important. We must try to keep out our own prejudices and notions of what we think they should learn.

Now just to illustrate these steps in planning let us consider the following example.

Suppose we visit a rural area and find the problem to be that children are not growing well because of repeated attacks of diarrhoea and poor supplementary foods which are not balanced. We also find that the mothers would much rather learn about poultry keeping than child health.

What should we do?

It's quite obvious that we have to talk to the mothers about the health of their children and try to give them practical suggestions bringing about the minimum changes in their existing diets. But the fact of the matter is that this is a need that we identify but not the mothers. They may not even be interested in hearing what we say.

It makes sense, therefore, to start with what they are interested in — poultry keeping. We could call them for a meeting and given them as much information as we can that might be helpful. This would make the group more receptive to us and more open to anything we say. We can now tell them that there is something important we want to share with them about child health. When everybody meets we can introduce the problem. Once the group is convinced that there is a problem which must be solved, we can begin with our programme. (A small-scale programme like this should not present problems of time, money, personnel and facilities, so let us assume that we have what we need).

We should first set out our educational objectives like this:

At the end of the programme 60 per cent of the mothers in the village Daurala should be giving well balanced supplementary foods based on cheap, locally available foods prepared in a hygienic way to their infants aged 4-6 months and above.

We must now decide on

i) Exactly what is to be communicated

ii) Who is to communicate and

iii) What the channel will be.

We may decide that Sheela who is a member of our group, would be the best person to communicate because she is the anganwadi worker in that village and liked and respected by the mothers.

We may also decide that a group discussion would work best. The channel would therefore be a group meeting.

That leaves the question of what is to be communicated.

Sheela and the other members of our group could sit together and think through the 'content' of the programme. We may list the main points like this :

- Balanced supplementary foods with emphasis on the three food groups
- Identifying deficiencies of currently used supplementary foods
- Suitable foods for infants aged 4-6 months, 6-9 months and 9-12 months
- Preparation of foods in a hygienic manner.

Now how should all this be communicated? For people belonging to a rural area who are unable to read, demonstrations with real foods is best. They may have difficulty interpreting illustrations.

So Sheela and the group decided to begin with a demonstration of the foods in the three food groups and how they can be combined in the form of a supplementary food.

The group of mothers can now have a discussion or evaluation of their own supplementary foods in the light of what they have learnt. Sheela can just gently put in a word once in a while to lead the discussion.

In the next session Sheela can talk about suitable foods for infants and demonstrate how to make one or two supplementary foods stressing cheaper, locally available foods.

While making the foods she can emphasize aspects of hygiene such as cleaning utensils and hands and keeping the foods covered. This can be linked to preventing diarrhoea. The mothers can also be given practical advice on how to keep their homes and surroundings clean.

Then Sheela and the mothers can taste the foods prepared and feed it to the infants. Sheela can also invite comments and suggestions from the group of mothers.

Finally, Sheela and other members of our group can begin to evaluate the programme. The mothers can be individually asked whether they had introduced any changes in the supplementary foods they were offering. They can even be encouraged to work out suitable foods themselves. The support of mothers who had changed their behaviour can then be enlisted to convince others.

This example has clearly brought out the usefulness of two particular *techniques* in nutrition education—demonstrations and group discussion. The *tools* we used were real life objects—food items and dishes. This is usually very effective since they present reality and minimize misunderstanding.

For a target group which is not literate we can also use techniques such as local games, songs and plays. This can be very effective because it demands local participation and inserts the 'message' or 'content' we want to convey in the local language.

- **Which techniques can we use?**

We have just used two terms—techniques and tools. By technique we mean the way in which a particular message is communicated. A tool, on the other hand, is an object which we use in order to add to the impact of the words spoken by the communicator or person who communicates.

Let us first list some of the common techniques used in nutrition education.

*i) **Demonstrations***

We have already talked about these. It is important to use only utensils and foods similar to those the community is familiar with. Time consuming tasks such as chopping, cutting and prolonged boiling should be done in advance. The person conducting the demonstration should be friendly and should encourage participation of the group.

*ii) **Group discussion and decision***

There is considerable research to suggest that group discussion leading to a collective decision may be one of the best ways to make people change their behaviour. The feeling of belonging and the support of others make it easier for a person to decide to change his or her attitudes and practices. There is also the feeling of responsibility to the group. Therefore decisions taken by a group after full discussion are more likely to be carried out than those made by individuals.

A larger group can be divided into smaller groups with group leaders. These smaller groups can then discuss a topic separately and then discuss it with the whole group after the group leaders present the views expressed by members of their respective groups.

iii) Drama

Drama can take different forms. It may be a skit or short play. In some parts of India puppets are popular. However one particularly effective form of drama is *role play*. It consists of acting the various roles in a real situation in order to create deeper understanding of its implications and the relationships involved in it. The members of a group themselves play the parts in the scene.

The role play technique brings a situation to life for those who are acting and for those who are watching it. It is a useful starting point for discussion leading to subsequent improvements.

Role plays and puppets are particularly good for work with children. Role plays are very useful in interactions with a group of mothers.

The usual procedure is to :
— set the scene by presenting the problem
— act the scene
— analyze the scene in discussion
— act the scene again if necessary including any suggestions for improvement and
— promote discussion of behaviour witnessed and its implications

iv) Story telling

There is nothing to compare with the impact of a good story and a good story teller. In fact this is one of the ancient traditions of our country.

To encourage participation and to bring out the views and perceptions of the group we can use open ended stories. The communicator can begin a story and let the group members complete it. After the story telling session is over, discussion is important to emphasize the major points that need to be learned.

v) Brain storming

This is a particularly useful technique in encouraging people to come out with solutions to their own problems.

The person conducting the group session may present a problem and ask for ideas about solving it. As people respond, their ideas can be listed.

The group may then decide to take up the ideas which seem most practical and act on them.

vi) Community self survey

A self survey technique involves people in studying the problems which exist among them and working out solutions to these problems.

It has been found that when people participate in such a study they become much more aware of the problems and also much more prepared to play an active part in overcoming them.

Self surveys usually result in people wanting to take action. The role of the nutrition educator remains that of a guide who familiarizes the group with the procedure and encourages the participants to take responsibility for the programme. Local leaders should be involved in planning and carrying out a self survey.

- **Which tools should we use?**

The tools we have talked about earlier help to convey a message. They are in fact aids to education. However they cannot replace personal teaching.

Several tools have been used alone or in combination. These include:

- pamphlets, booklets or leaflets
- charts
- posters
- exhibits
- models
- flannelgraphs or flannelboards
- flip charts
- flash cards or illustrations

Box 1 describes how you can prepare flannelgraphs, flip charts and flash cards.

BOX 1 MAKING EDUCATIONAL AIDS AND TOOLS

Flip Charts

Materials you will need :
2 pieces of plywood or thin (5 mm) hardwood measuring 45 cm × 50 cm
2 strips of wood measuring 38 mm × 40 cm × 8 mm
2 hinge joints
2 bolts and 2 wing nuts
piece of cord 3 mm thick × 28 cm long
ruler, pencil, paper

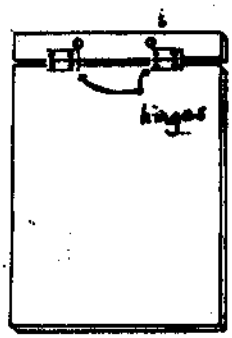
How to make flip charts

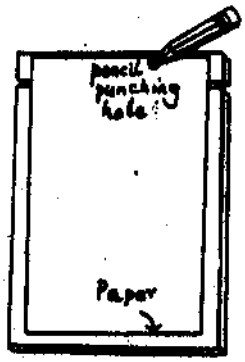
1) Drill two holes in each long wooden strip at approximately 13 cm from each end.

2) Hinge each strip to a piece of plywood.

3) Place a sheet of paper, the size that you will be inserting in the flip chart on one of the joined wooden strips and plywood boards.

4) Position the paper in the middle of the top edge of the wooden strips. With a pencil, gently punch a hole through the paper that corresponds to the holes in the wooden strip.



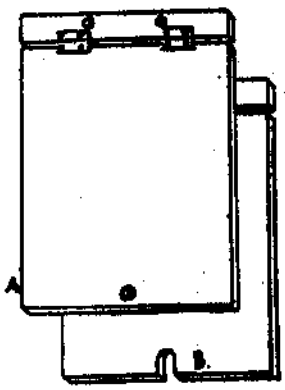


5) Remove the paper and measure the distance from the side and top of each hole. These are the measurements you will use in punching holes in the papers you will be inserting in your flip chart.

6) Punch holes in all papers you are going to use. Use plain paper which you can easily flip *not* cardboard.

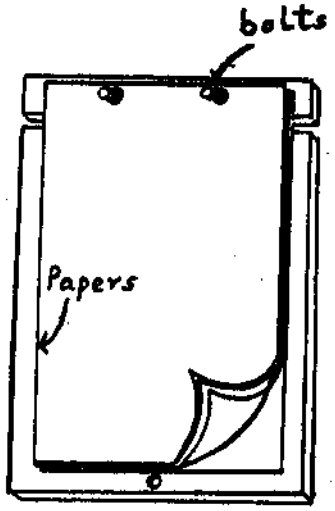
7) In the middle of the bottom edge of one plywood board, drill a 3 mm hole. (This now becomes cover A).

8) In the middle of the bottom edge of the other plywood board, cut a vertical slot 2 mm wide and 1.5 cm long. (This now becomes cover B.)



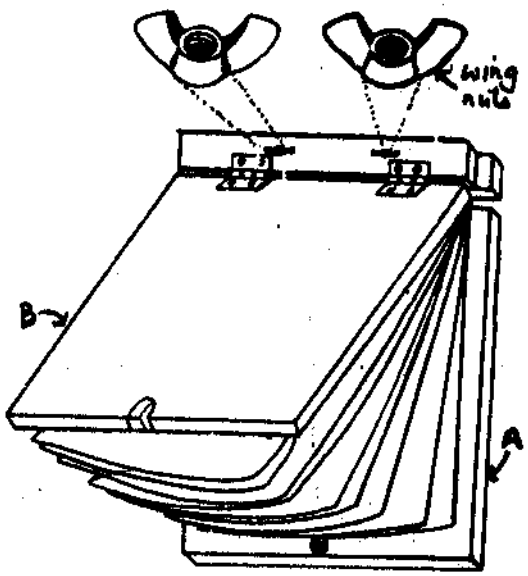
9) Stack your papers together evenly. If the holes have been punched accurately you should be able to see through the holes.

10) Insert a bolt through the back of each hole in the wooden strip of cover A. Place cover A flat with the bolts sticking up (the hinged joints should be flat against the table). Insert punched papers (face up) over bolts.



11) With the hinged surface of cover B facing you, place it over the punched papers, inserting the bolts through the holes in the wooden strip of cover B. Fasten securely with wing nuts.

12) Pass the cord through the hole at the bottom of cover A. Make a knot at both ends of the cord large enough so that it will not slip through the hole. To keep the flip chart open while you use it, pull the cord through the vertical slot, until the second knot catches in it. The flip chart will now stand up (^).



Generally there should be no more than 10-12 cards in a flip chart as more than this number will make the presentation too lengthy. The cards should be stacked in order and no more than one card stacked at time. The illustration should always face the students with the written message facing the person presenting the flip chart. If the teacher is presenting the materials, it is a good idea to allow one of the students to flip the charts. This helps to involve the students in the presentation.

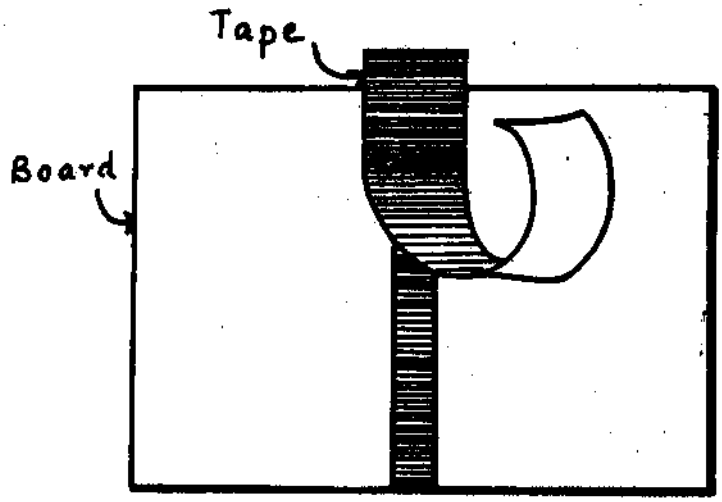
Flannelgraph

The flannelgraph is essentially a piece of cloth fastened to a stiff backing. The cloth may be felt, flannel, suede or cotton cutting, burlap flour or potato sacks, a rough weave blanket, turkish towel, or any other roughly napped material. The backing may be wallboard, masonite, plywood or heavy cardboard. The following instructions are for making a portable flannelgraph.

Materials you will need:
2 pieces of plywood or cardboard each 75 × 50 cm
1 piece of flannel 75 × 100 cm
canvas hinges or heavy masking tape

How to make a flannelgraph

1) Join 2 pieces of board together by using canvas (or metal) hinges or by using heavy masking tape.



2) Flannel (or similar material) may be stretched over boards on one side and glued in place, or it may be tacked to the board only when used and folded under the arm for travelling purposes.

Tips on using flannel boards

- **Plan the steps of the presentation** : Know in advance which flannelgraphs should be placed on the board, and in which order. It may be helpful to make a rough sketch of the finished flannel board picture in order to avoid missing any important additions to the board.
- **Rehearse the presentation in advance** : Be sure you are familiar with the steps in your presentation, and feel comfortable with the topic. A rehearsal gives you an opportunity to revise the presentation if necessary.
- **Use figures and words which are easy to see** : Make sure that all flannelgraphs (and words, if they are used) are large enough to be seen by all, and clear enough to be easily understood.
- **Lean the flannel board back slightly** : Flannelgraphs are less likely to fall off if the board is placed at a slight angle. Also avoid windy locations, since the materials may blow away.
- **Stand besides the board, not in front of it** : Be sure that the group can see the board at all times.
- **Leave figures on the board only as long as necessary** : Remove figures once they are no longer needed, as they tend to distract from the message of the presentation. After the presentation, the flannel board display can be left up in another part of the room, if possible, to remind the people about the lesson.

Flash Cards

Flash Cards are cards on which a simple illustration is drawn. On the back side you should write a few words or phrases about what you will say while showing the flash cards. This can be used to encourage discussion about a certain topic or method, or to help the group to recall information. Use flash cards one at a time, and hold them in the hand in front of the group.

Guidelines for planning flash cards

- **Keep them simple** : Use illustrations or words that are simple and clearly understood at a glance.

- **Make the cards sturdy, neat, and interesting :** Use stiff cardboard or several sheets of heavy paper neatly glued together for the cards. Illustrations and letters should be large enough to be seen easily, and if possible, coloured for variety and emphasis.
- **Make sure the subject of the cards is appropriate to the lesson :** Cards can be made in sets, with each set of cards representing a particular topic or concept. Keep the sets separate and be sure to use them with lessons which correspond to the topic of the cards.
- **Test the cards before actual classroom use :** It is important to be sure that the illustration or drawing on the card is understood clearly and correctly. Asking others to identify the subject of the cards is a good way to find out if they are sending the intended message.

Appendix 1 prepared by Annu J. Thomas

Appendix 2

Table I : Average Weight (Kg) By Age of Healthy Children (0-18 years) (NCHS)*

Age (months)	Weight (kg)	
	Boys	Girls
Birth	3.3	3.2
6	7.8	7.2
12	10.2	9.5
18	11.5	10.8
24	12.6	11.9
30	13.7	12.9
36	14.7	14.1
42	15.7	15.1
48	16.7	16.0
54	17.7	16.8
60	18.7	17.7
66	19.7	18.6
72	20.7	19.5

Age (years)	Weight (kg)	
	Boys	Girls
7	22.9	21.8
8	25.3	24.8
9	28.1	28.5
10	31.4	32.5
11	35.3	37.0
12	39.8	41.5
13	45.0	46.1
14	50.8	50.3
15	56.7	53.7
16	62.1	55.9
17	66.3	56.7
18	68.9	56.6

* National Centre for Health Statistics, USA
Source : Measuring Change in Nutritional Status : WHO 1983 Publication.

Table II : Average Height (cm) by Age of Healthy Children (0-18 years) (NCHS)*

Age (Months)	Height (cm)	
	Boys	Girls
0	50.5	49.9
6	67.8	65.9
12	76.1	74.3
18	82.4	80.9
24	87.6	86.5
30	92.3	91.3
36	96.5	95.6
42	99.1	97.9
48	102.9	101.6
54	106.6	105.1
60	109.9	108.4
66	113.1	111.6
72	116.1	114.6

Age (years)	Height (cm)	
	Boys	Girls
7	121.7	120.0
8	127.0	126.4
9	132.2	132.2
10	137.5	138.3
11	143.3	144.8
12	149.7	151.5
13	156.5	157.1
14	163.1	160.4
15	169.0	161.8
16	173.5	162.4
17	176.2	163.1
18	176.8	163.7

* National Centre for Health Statistics, USA
Source : Measuring Change in Nutritional Status : WHO 1983 Publication

Table III : Mid-arm Circumference (cm) of well-nourished Indian Children

Age	Male	Female
1 year	14.9	14.4
2 years	15.1	14.5
3 years	15.3	14.8
4 years	15.5	15.0
5 years	15.7	15.4
6 years	16.2	15.7

* Source : Gosh S. Project No. 01-658-2, A longitudinal study of outcome of a birth cohort. 1976.

Table IV : Average weight (kg) by length of healthy children (NCHS)*

Length (cm)	Weight (kg)	
	Boys	Girls
49	3.1	3.3
50	3.3	3.4
55	4.3	4.3
61	5.9	5.8
67	7.7	7.5
73	9.3	9.1
79	10.7	10.4
82	11.3	11.0
85	11.9	11.6
88	12.5	12.2
91	13.2	12.8
94	13.9	13.5
97	14.7	14.3
100	15.5	15.2
103	16.5	16.2
106	17.4	17.0
109	18.3	17.9
112	19.3	18.9
115	20.3	19.9
118	21.4	21.0
121	22.6	22.2
127	25.2	25.1
133	28.4	28.7
139	32.3	—
145	36.9	—

*National Centre for Health Statistics, USA
Source : Measuring Change in Nutritional Status : WHO 1983 Publication.

Appendix-3 A

Guidelines for conducting a diet survey using 24-hour recall method

- First collect background information i.e. family particulars regarding age, sex, physiological status and occupational status of the members.

Collect background information

- Collect information regarding the meal pattern i.e. the type of preparation made for breakfast, lunch, tea, dinner during the previous day.
  - — Note down the name of the preparations in local term.
  - — Note down raw ingredients used in the preparation
  - — Record amount of each raw ingredient in terms of actual weight if known or approximate weight in terms of local measures or with the help of standard measures as indicated below:

Collect information regarding meal patterns

Food stuff	Local measure	Weight in gms
1) Bengal gram dal	1 pav	250
2) Onion	4 small ones	120
3) Cauliflower	3 pav	750
4) Oil	3 tsp	15
5) Spices (Corriander powder)	1 tsp	5 mg

- Record the amount of cooked preparation in terms of measuring cup. If the housewife is unable to give the amount in terms of cup, then ask them to fill the vessel used for the preparation with water upto the same level (approximate) as for the preparation. Then measure this volume for the total cooked amount.

Record the amount of cooked preparation

- Note the amount of food or portion size served to each member from each of the preparations made in the family.

Record the portion size served

  - — Note the amount in terms of cups, for each individual.
  - — If flesh foods (such as mutton, fish etc.) is considered, note the total amount cooked in terms of number of pieces and the number given to each individual
  - — In case of oil, sugar note the intake in terms of standardised spoons and ladles
  - — If the individual is an infant, make a note of breast feeding practices and/or supplementary foods given.

- After collecting this basic information, calculate the intake of the individual in terms of raw amount using the following formulae.

$$\text{Individual intake in terms of raw amounts of food} = \frac{\text{Raw quantity (g) of each preparation used by the family}}{\text{Total cooked amount (volume) of each preparation}} \times \text{individual intake}$$

Calculate individual intake data

For example 1/2 kg (i.e. 500 g) of raw rice was cooked (in 1400 ml water) for the family. The total weight of the cooked rice was estimated to be about 2000 gm. Out of this preparation an individual consumed say 100 g (measured with the standard cup), then the amount of raw rice eaten by the individual can be worked out as under:

$$\text{Amount of rice taken by the individual} = \frac{500}{2000} \times 100 = 25 \text{ g.}$$

- Once the amount of raw food is known, we can refer to the Food Composition table [given in the Practical Manual-1] and estimate the nutrient content of the food consumed by the individual.

Appendix-3 B

Assessment of dietary intake of an individual (child) in the family using 24-hour recall method of Diet Survey.

1) **Identification particulars :**
   Date
   Place (Town/City/Village) District Block State
   Name of child
   Name of Father/Guardian Age (yrs-mths) Sex
   Address

2) **Socio-economic details of family :**
   Father Mother Other sources of income
   Occupation
   Total income (Rs./pe)

   Family composition :

	Age group (yrs.)							
	0-1	1-3	3-5	5-7	7-9	9-12	12-21	21-	Total
Male									
Female									

3) **Breastfeeding status of the child :** Yes/No/Not weaned
   Relationship and age of the person feeding the child when the mother is away for work : Relationship Age(yrs)

4) **Dietary intake :**

Meal pattern	Amounts used by the family, previous day				Intake of an individual (child)	
	Name of prepa-ration	Ingre-dients used	Raw amount g/ml	Cooked quantity	Cooked quantity g/ml	Raw equivalent g/ml
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
Early morning						
Breakfast						
Mid-morning						
Lunch						
Tea & Snacks						
Dinner						
Others a) (Meals/snacks taken outside home)						
b) Supplements from any of the feedings programmes, if any (specify)						

Appendix-4

जच्चा बच्चा सिलसिले के लिए देसी कैलेन्डर

Indigenous Calendar for Mother and Child Care

Season Crops		CALENDAR Hindi	Western	Festival & Local Events	1984	1985	1986	1987	1988	1989	1990
		पौष	DEC	Amavasya अमावस्या	3 Jan		10 Jan	...	...	7 Jan	14 Jan
रबी	WINTER	पौष	JAN	Lohri लोहड़ी	14 Jan	13 Jan	13 Jan	13 Jan	13 Jan	14 Jan	4 Jan
				Guru Govind Singh B'day गुरु गोबिंद सिंह का जन्म दिन	10 Jan 20 Dec	12 Jan	17 Jan	6 Jan 26 Dec	...	14 Jan	3 Jan
				Republic Day गणतंत्र दिवस	26 Jan	26 Jan	26 Jan	26 Jan	26 Jan	26 Jan	26 Jan
				Purnima पूर्णिमा	18 Jan	7 Jan	25 Jan	15 Jan	4 Jan	21 Jan	11 Jan
		माघ	JAN	Amavasya अमावस्या	1 Feb	21 Jan	8 Feb	29 Jan	19 Jan	6 Feb	26 Jan
		माघ	FEB	Basant Panchami बसंत पंचमी	7 Feb	...	13 Feb	3 Feb	23 Jan	10 Feb	31 Jan
				Purnima पूर्णिमा	16 Feb	5 Feb	24 Feb	13 Feb	2 Feb	20 Feb	9 Feb
		फाल्गुन	FEB	Shiv Ratri शिव रात्री	29 Feb	17 Feb	8/9 Mar	26 Feb	16 Feb	6 Mar	24 Feb
			MAR	Amavasya अमावस्या	2 Mar	19 Feb	10 Mar	27 Feb	17 Feb	7 Mar	25 Feb
बसंत	SPRING			Holi (PURNIMA) होली (पूर्णिमा)	16 Mar	7 Mar	26 Mar	15 Mar	3 Mar	21 Mar	10 Mar
				Dhulendi (HOLA) धुलेंडी (होला)	17 Mar	7/8 Mar	27 Mar	16 Mar	4 Mar	22 Mar	11 Mar
		चैत्र	MAR	Amavasya अमावस्या	1 Apr	21 Mar	9 Apr	29 Mar	18 Mar	6 Apr	26 Mar
			APR	Good Friday गुड फ्राईडे	20 Apr	5 Apr	28 Mar	17 Apr	1 Apr	24 Mar	13 Apr
				Ram Navami राम नवमी	10 Apr	30 Mar	18 Apr	7 Apr	26 Mar	14 Apr	3 Apr
				Mahavir Jayanti महावीर जयंती	14 Apr	3 Apr	22 Apr	12 Apr	31 Mar	18 Apr	7 Apr
				Purnima पूर्णिमा	15 Apr	5 Apr	24 Apr	14 Apr	2 Apr	21 Apr	10 Apr
		वैसाख	APR	Baisakhi बैसाखी	13 Apr	13 Apr	13 Apr	13 Apr	13 Apr	13 Apr	13 Apr
			MAY	Amavasya अमावस्या	1 May	20 Apr	8 May	28 Apr	16 Apr	5 May	25 Apr
				Budh Purnima बुद्ध पूर्णिमा	15 May	5 May	23 May	13 May	1 May	20 May	8 May
		ज्येष्ठ	MAY	Amavasya अमावस्या	30 May	19 May	7 June	27 May	15 May	3 June	24 May
			JUNE	Guru Arjan Dev's Shahidi Din गुरु अर्जन देव का शहीदी दिन	3 June	24 May	11 June	31 May	19 May	7 June	28 May
				Nirjala Ekadashi निर्जला एकादशी	9 June	30 May	18 June	8 June	26 June	14/15 June	3/4 June
गर्मी	SUMMER			Purnima पूर्णिमा	13 June	3 June	22 June	11 June	31 May	19 June	8 June
		आषाढ़	JUNE	Amavasya अमावस्या	29 June	18 June	7 July	26 June	14 June	3 July	22 June
			JULY	Purnima पूर्णिमा	13 July	2 July	21 July	11 July	29 June	18 July	8 July
				Amavasya अमावस्या	28 July	17 July	5 Aug	25 July	13 July	1 Aug	22 July
				Teej तीज	31 July	19 Aug	8 Aug	29 July	15 Aug	4 Aug	24 July
				Purnima पूर्णिमा	11 Aug	31 July	...	...	29 July	...	...
		सावन	JULY	Amavasya अमावस्या	...	16 Aug	...	...	12 Aug	...	...
			AUG	Independence Day स्वतंत्रता दिवस	15 Aug	15 Aug	15 Aug	15 Aug	15 Aug	15 Aug	15 Aug
वर्षा	RAINY			Naag Panchami नागपंचमी	1 Aug	20 Aug	10 Aug	31 July	17 Aug	6 Aug	26 Aug
				Raksha Bandhan (PURNIMA) रक्षा बंधन (पूर्णिमा)	11 Aug	30 Aug	19 Aug	9 Aug	27 Aug	17 Aug	6 Aug
				Janam Ashtami जन्म अष्टमी	20 Aug	7 Sept	Aug	16 Aug	3 Sept	24 Aug	13 Aug
		भादव	AUG	Amavasya अमावस्या	26 Aug	14 Sept	Sept	24 Aug	11 Sept	31 Aug	29 Aug
SEASON		पदरा	SEP	Anant Chaudasi अनंत चौदसी	9 Sept	27 Sept	17 Sept	6 Sept	24 Sept	14 Sept	4 Sept
				Purnima पूर्णिमा	10 Sept	28 Sep	18 Sept	7 Sept	25 Sept	15 Sept	5 Sept
		आश्विन	SEP	Amavasya अमावस्या	25 Sept	14 Oct	3 Oct	23 Sept	10 Oct	29 Sept	18 Sept
		असोज	OCT	Gandhi Jayanti गांधी जयंती	2 Oct	2 Oct	2 Oct	2 Oct	2 Oct	2 Oct	2 Oct
				Shradh श्राद्ध	25 Sept	14 Oct	3 Oct	22 Sept	10 Oct	29 Sept	18 Sept
				Navratri नवरात्री	19 Sept	...	12 Oct	20 Oct	19 Sept	8 Oct	27 Sept
पतझड़	AUTUMN			Dussehra दशहरा	...	20 Oct	Oct	2 Oct	20 Oct	10 Oct	28 Sept
				Amavasya अमावस्या	...	...	...	...	...	...	4 Oct
				Purnima (Maharishi Valmiki's B'day) वाल्मिकी का जन्म दिन	9 Oct	28 Oct	17 Oct	7 Oct	25 Oct	14 Oct	4 Oct
		कार्तिक	OCT	Diwali (Amavasya) दीपावली (अमावस्या)	24 Oct	12 Nov	1 Nov	22 Oct	9 Nov	29 Oct	18 Oct

Nutrition Programmes										
		NOV	Goberdhan Pooja गोवर्धन पूजा	25 Oct	13 Nov	2 Nov	23 Oct	10 Nov	30 Oct	1st [illegible]
			Bhaiya Dooj भैया दूज	26 Oct	14 Nov	3 Nov	24 Oct	11 Nov	31 Oct	20 Oct
			Guru Nanak B'day गुरु नानक का जन्म दिन	3 Nov	27 Nov	16 Nov	5 Nov	23 Nov	13 Nov	2 Nov
	कार्तिक	NOV	Ganga Snan गंगा स्नान	8 Nov	27 Nov	16 Nov	5 Nov	23 Nov	13 Nov	2 Nov
	कात्तिक	DEC	Amavasya अमावस्या	22 Nov	11 Dec	1 Dec	21 Nov	9 Dec	28 Nov	17 Nov
			Purnima पूर्णिमा	8 Dec	27 Dec	17 Dec	5 Dec	23 Dec	12 Dec	2 Dec
	पौष	DEC	Guru Teg Bahadur's Shahid Din गुरु तेग बहादुर शहीदी दिन	27 Nov	16 Dec	5 Dec	25 Nov	13 Dec	3 Dec	22 Nov
		JAN	Christmas Day क्रिसमस डे	25 Dec	25 Dec	25 Dec	25 Dec	25 Dec	25 Dec	25 Dec
			Amavasya अमावस्या	22 Dec	...	31 Dec	20 Dec	...	28 Dec	17 Dec
		MUSLIM	Muharram मुहर्रम	27 Sept	17 Sept	7 Sept	27 Aug	15 Aug	4 Aug	24 Jul
		HOLIDAY	Id-ul-Fittar (Ramzan Id) ईद-उल-फितर	30 Jun	20 Jun	11 Jun	30 May	18 May	7 May	27 Apr
			Id-ul-Zuha (Bakrid) ईद-उल-जुहा	6 Sept	27 Aug	17 Aug	7 Aug	26 Jul	18 Jul	8 Jul

Source : Anganwadi Workers Training Centre, Delhi Council of Child Welfare (DCCW).

Appendix 5

SCHEMES FOR ADOLESCENT GIRLS

The Department of Women and Child Development has begun to cover the adolescent girl as part of the ICDS programme. Special measures have been taken to :

i) cover girls in the age group of 11 to 18 years

ii) improve the nutritional and health status of girls in this age group

iii) provide the required literacy and numeracy skills through the non-formal stream of education, to stimulate a desire for more social exposure and knowledge and to help them improve their decision-making capabilities.

iv) train and equip girls to improve and upgrade home-based skills and

v) promote awareness of health, hygiene, nutrition and family welfare, home management and child care, to take all other measures as would facilitate their marrying only after attaining the age of 18 and if possible even later.

Two separate schemes have also been launched. These are :

Scheme I : Girl-to-girl approach (11-15 years)

Scheme II : Balika Mandal (15-18 years)

As part of the girl-to-girl approach three girls are identified from each selected anganwadi. The girls would belong to the economically vulnerable sections of the population. These girls would receive the following services besides the services already mentioned (i—v) :

a) A meal similar to that received by pregnant and lactating women under the ICDS programme. The meal would provide 500 kcal and 20 g. protein on all six working days of the week.

b) Inservice training on how to manage the anganwadi centre for a period of six months (the training imparted by the anganwadi worker and supervisor)

The focal training areas include : health, nutrition, preschool activities, organization of Mahila Mandals and improving community participation. In this way the scheme aims to make them capable of managing the anganwadi on their own. A step towards self reliance!

For girls 15-18 years old there is the Balika Mandal Scheme. This scheme aims at involving and motivating educated adolescents to participate in non-formal education, developing literacy skills and upgradation of home-based skills in popular crafts of the area/region/state. Educational materials/programmes would stress personal hygiene, environmental sanitation, nutrition and child care. In addition these adolescent girls would also be trained to maintain and prepare documents and records. In addition facilities for recreation and entertainment would also be provided.

Training in local crafts would be provided by local artisans/skilled craftsmen or instructors in training and vocational centres.

NOTES

DHEN-04

Utter Pradesh
Rajarshi Tandon Open University

Nutrition for the Community

PRACTICAL MANUAL – PART I

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Sept 1994 (Reprint)

INTRODUCING THE MANUAL

You have learnt a number of concepts and principles in Blocks 1 to 3. The Practical Manual gives you the opportunity to learn to put it into practice. We have already laid the theoretical foundation to planning meals and diets in Blocks 2 and 3. We will build on this foundation to show you how you can plan meals and diets on your own.

To help you along we are providing you with a PRACTICAL KIT. The Kit consists of a measuring glass, measuring cups and spoons. These are the standard measures which will help you to find out how much of different food items to include in a diet. You can also use the kit to get a good idea of how much the cups, spoons, glasses and plates on your kitchen shelf can hold.

Let us now give you an idea of what specific objectives we have in mind for this Manual.

After studying the Manual, you should be able to :

- use the standard measures provided in the practical kit (Section 1)
- find out the nutritive value of foodstuffs, snacks, dishes and meals (Section 2)
- select the right cooking methods in order to conserve and maximize the nutrient content of foods (Section 3)
- identify meal patterns typical of different regions of the country (Section 4)
- perform the various steps involved in planning meals, snacks and diets for different age groups and physiological states (Sections 5 & 6).

The Manual is divided into six interesting sections based on these objectives as already indicated. We hope you will enjoy going through them. And there's one more activity to look forward to.

We wish to collaborate with you on a mini research project. Do write to us about the regional meal patterns typical of your region. When we have compiled the information sent to us, we will send a copy to all those students who have participated in this project. To help you put across the information in a systematic manner, we have included a proforma at the end of Section 4. You will be awarded 10 marks for supplying complete information to us in the required format.

Study Guide

If you just glance through the pages of this Manual you would find that the structure is a little different from the units you encountered in Blocks 1 to 3. We have divided the Manual into 6 Sections. Each section consists of subsections. These subsections will tell you all you need to know so that you can attempt the Practical Activities in each section. These Activities will help you to put your knowledge to practice. *For several activities you will need to use your Practical Kit.*

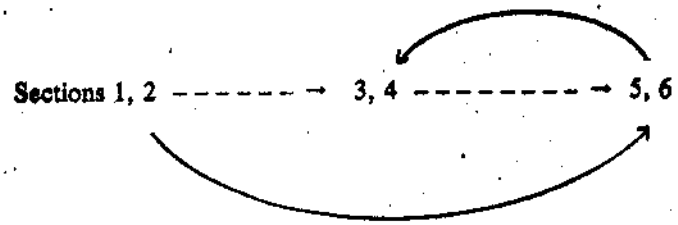
You will not find answers to all activities in the Manual. This is because we want you to be able to apply the information to your own specific conditions and needs. General hints and step-by-step instructions should help you to do the activities without much difficulty. Some difficult activities are accompanied by a discussion. The discussion attempts to give you an idea of whether you have attempted the activity in the right manner. In some cases we have provided model answers. You will find model answers related to all sections at the end of the Manual (Appendix 1).

REMEMBER TO ATTEMPT ALL PRACTICAL ACTIVITIES. YOU MAY BE ASKED TO SUBMIT YOUR ANSWERS AS PART OF A PRACTICAL ASSIGNMENT.

Unless you are specifically asked to do so do not send your answers/solutions to Activities to us or to the Study Centre/Counsellor.

You will also find boxes in certain sections to help you recall information you should know. Another interesting and useful addition is Practical Points which highlight certain important points, steps/procedures you could keep in mind.

The following flow chart will help you to organize your study. There are two possible routes we would recommend in studying this Manual.



You can go through the Manual from Sections 1 to 6. You could also go through Sections 1 and 2 and then proceed directly to Sections 5 and 6. You could then come back to Sections 3 and 4. We are suggesting this because Sections 5 and 6 must be preceded by a study of Sections 1 and 2. Sections 3 and 4 are independent and give you useful additional information. You will find more useful material in Block 4 as well.

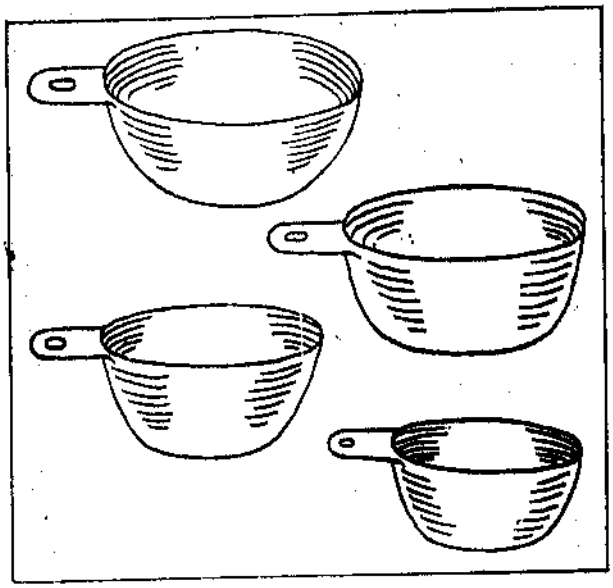
At the end of Section 4 you will find an annexure relating to a mini research project. The Appendices at the end of the Manual include model answers, a glossary of important terms and a list of names of food items in different regional languages and the RDI table. *Annexures relating to the specific sections are given at the end of the relevant section.*

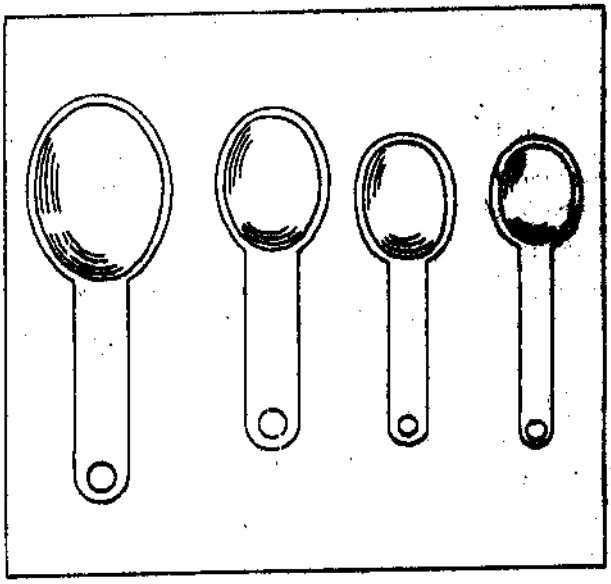
You would find the following study planner useful. The sections may take you more or less time than indicated. Don't worry about it. You can make modifications as required.

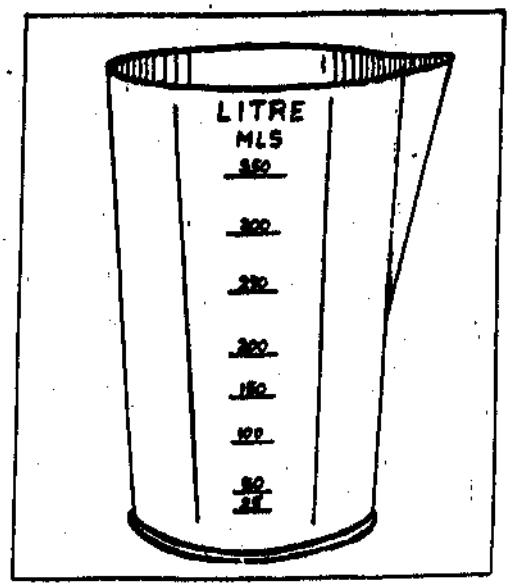
S	E	C	T	I	O	N	S
1		2	3	4	5		6
4 hours		2 hours	2 hours	2 hours (optional)	15 hours		15 hours

When you make your own study planner on the basis of this guideline, remember that Sections 5 and 6 will take you much more time. Most of the questions you would be required to answer for the practical assignment as well as some of the questions for the term-end examination will be based on Sections 5, 6. But don't forget to give enough time to Sections 1, 2 and 3 since they form the essential basis for the later sections.

DON'T WORRY ABOUT THE BULK OF THIS MANUAL. SECTION 4 IS OPTIONAL. SEVERAL TABLES AND ANNEXURES ARE ADDED FOR EASY REFERENCE. YOU HAVE TO REFER TO THEM NOT LEARN THEM.





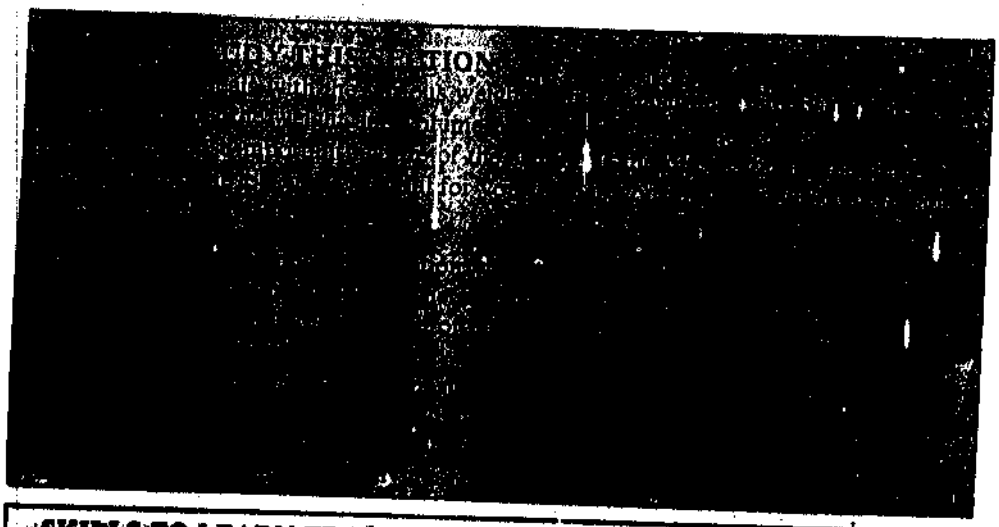


YOUR PRACTICAL KIT

SECTION

1

WEIGHTS AND MEASURES



SKILLS TO LEARN FROM THIS SECTION

This section will tell you how to

- use a household weighing balance
- use the practical kit
- find the weight of foodstuffs with the help of the practical kit and tables relating weight to standard measures
- relate household measures to items of the practical kit.

Structure

1.0 INTRODUCTION

Have you ever observed your mother while she is cooking meals for the family? You would probably have noticed that she uses a cup, glass or katori as a measure for cooking. Sometimes, she does not even need that also. She manages even with her fist/hand. She knows that a big katori of raw dal or two medium steel glasses of rice (raw), when cooked, will be enough for her family. You are sometimes surprised at how accurate she is in her estimate! She has learned this through experience. She probably won't be able to tell you the weight of a particular foodstuff she has cooked. But in her day-to-day cooking, she rarely needs this.

However, as a student of nutrition, you need to know the approximate weight/volume of foodstuffs in many situations like

- If you want to know the nutrient content of the katori of dal you ate yesterday at dinner time, you must know how much dal (raw) it contained.
- If you recommend a minimum of 500 ml of milk for a pregnant woman, you should be able to tell her which glass/cup is to be used for measuring this amount.

- If you want to cook a dish according to the recipe given in this practical manual/blocks/any other recipe book, you should know how to measure the ingredients given for a particular recipe.

Like these there are many other situations in meal planning where you might need to know the weight/volume of foodstuffs. How can you determine weight/volume of foodstuffs at home? One way which you can think of, is a weighing balance. Other things which can help are a measuring glass, measuring cups and spoons. These are known as standard measures. If you open the practical kit you have received as part of your study material, you will find these standard measures. You should note here that a weighing balance is not included in the practical kit. However, one weighing balance is provided at your study centre. You can go to your study centre and use it, if needed.

Now, the questions which may arise in your mind are — From where can you obtain a weighing balance? What should you do if you don't have a weighing balance? What is a measuring glass, cup or spoon? How are they different from the glass or katori you use at home? How can you use them for determining weight/volume of foodstuffs? In this section, you will find answers to all these questions.

Objectives

After going through this section, you will be able to:

- identify the various ways of determining weight and volume of foodstuffs
- differentiate between household measures and standard measures
- weigh foodstuffs on a household weighing balance
- use your practical kit for determining the weight/volume of foodstuffs and
- relate household measures to the items of the practical kit.

1.1 WEIGHING AND MEASURING EQUIPMENT

We are starting this subsection, with the understanding that you are familiar with terms like 'weight' and 'volume' and the units in which they are expressed. In case you need to recall, go through Box 1.1.

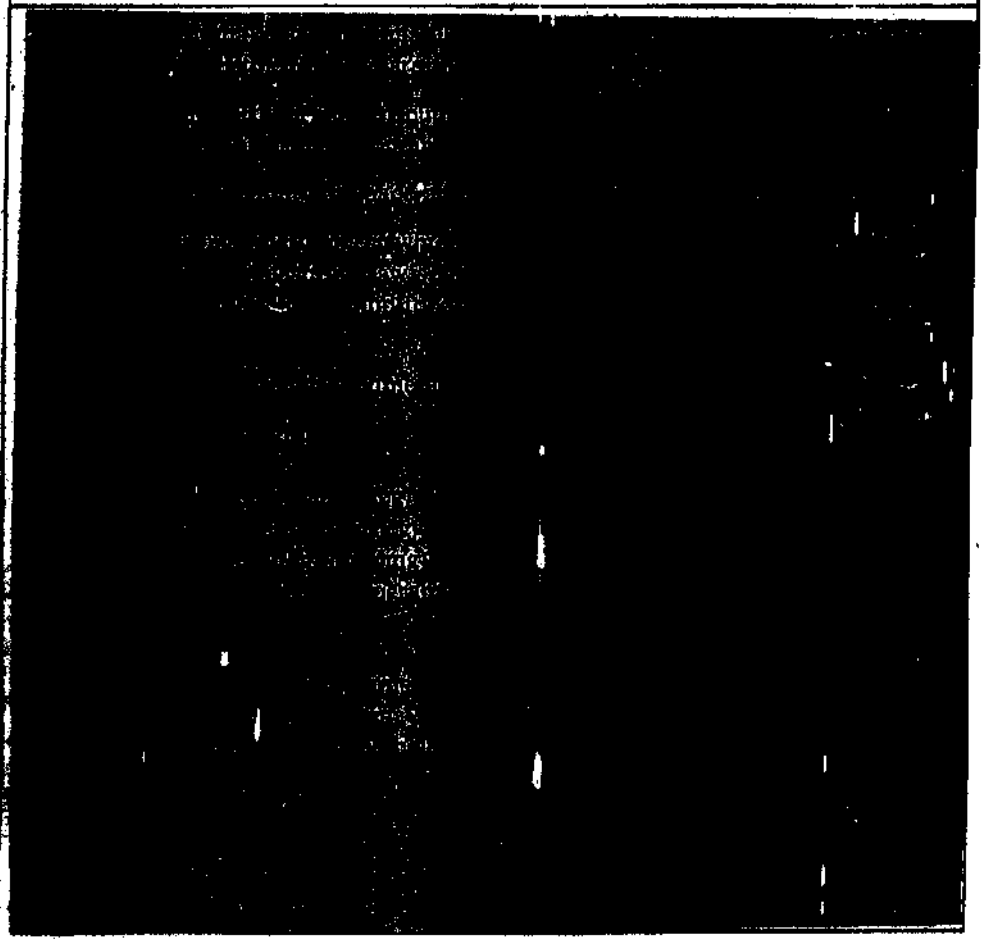
You have read that you can use a weighing balance or the measuring cups or spoons for weighing and measuring. These are known as weighing and measuring equipment. On this basis, let us try to define 'weighing equipment' and 'measuring equipment'.

Weighing Equipment: Any equipment which is used for determining weight is known as a weighing equipment or weighing balance. There are various kinds of weighing balances. You must be familiar with the weighing balance used at shops or other commercial places. The weighing balance used at the household level is different from that used at commercial places, as it is not very accurate and can measure only small quantities. However, it is suitable for the purpose of weighing at household level. You will learn more about household weighing balances on page 10 of this subsection.

Measuring Equipment: Measuring equipment or measures refer to devices which help in measuring the quantity/volume of foodstuffs. Can you think of some examples of measuring equipment? Yes, the cup, glass or katori which you use at home can be termed as measuring equipment. You can use them for determining the quantity of foodstuffs in certain measuring units — half katori/one katori/two katoris/or one small katori/two large katoris/half a medium katori. These utensils are termed as household measures. The household measures are quite useful in day-to-day cooking. However, they have one limitation. They cannot tell you the exact amount i.e. weight or volume of foodstuffs.

In such a situation, (where you want to find out weight or volume of foodstuffs), the standard measures of your practical kit may be helpful. As you know, the standard measures provided to you in your practical kit include a measuring glass, measuring cups and spoons. Can you tell the difference between the standard measures and household measures? Find out for yourself by doing the following activity.

BOX 1.1 Weight and Volume



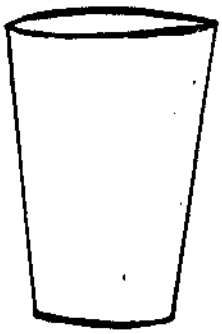
ACTIVITY 1

- TAKE OUT THE MEASURING GLASS (standard measure) FROM YOUR PRACTICAL KIT AND A STEEL TUMBLER (household measure) FROM YOUR KITCHEN SHELF. LOOK FOR THE DIFFERENCES BETWEEN THE TWO.

  .....

  .....

  .....



- FILL THE STEEL TUMBLER WITH WATER. HOW MUCH WATER DOES IT CONTAIN ?

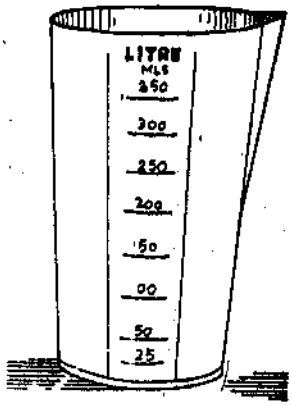
  .....

  .....

- TRANSFER THE WATER FROM THE STEEL TUMBLER TO THE MEASURING GLASS. NOW, WRITE THE VOLUME OF WATER CONTAINED IN IT

  .....

  .....



By doing this activity you will find that the measuring glass has certain markings on it, which indicate volume. You will notice similar markings on measuring cups and spoons indicating volume. Any measure which has markings/calibrations indicating volume is termed as a standard measure. According to this definition, the measuring glass and the measuring cups and spoons of your practical kit are standard measures.

Can you call any calibrated equipment a standard measure ? No, any device/ equipment is a standard measure only when the markings on it give the accurate measure of volume.

Now, you are familiar with the terms like weighing balance, standard measures household measures. Let us now come back to your problem in meal planning, wh you need to find out weight/volume of foodstuffs.

Your practical kit includes only the standard measures and not a weighing balance this situation, you would like to know the answers to questions such as the following: Are the standard measures provided to you enough for your practical activities or do you need to buy a household weighing balance. The answer is – yo need not buy a household weighing balance. A household weighing balance is need only for knowing the exact weight of foodstuffs. However, for practical purposes in meal planning you can make do even with the approximate weight/volume of foodstuffs. The standard measures i.e. measuring glass, cups and spoons, can give you sufficient information for this purpose. *However, you should note here that the standard measures can tell directly the volume of foodstuffs but not the weight.*

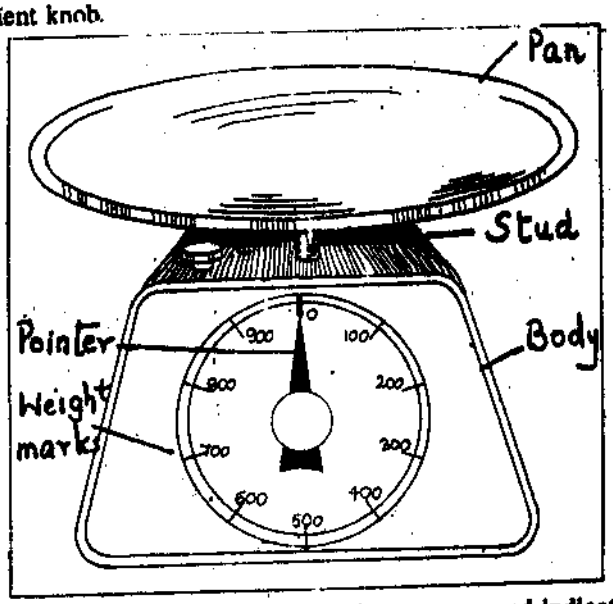
For the purpose of finding weight using the standard measures, you need some additional information. What is this additional information ? How is it used for finding the weight of foodstuffs ? You will have to wait a little while for getting the answers to these questions. The secret behind these aspects will be revealed to you in subsection 1.2. Before learning about them, let us first learn how to use a household weighing balance and the standard measures in your kit.

How to use a household weighing balance ?

It is important for you to learn the use of a household weighing balance. You can use the weighing balance provided at your study centre as a cross check for standard measures.

A household weighing balance can measure from 5–10 g to 500–2000 g depending upon its capacity. Look at the figure given below. The weighing balance shown in the figure can measure from 5 g to 1000 g. The same weighing balance is provided at your study centre. You can go to the study centre and examine it. This weighing balance has two main parts — (i) the *body* and (ii) *detachable pan*. By carefully looking at it, you will find that the body is attached to the pan by a *stud*. You will also notice three things on the body of the balance :

- markings which indicate weight
- a pointer and
- an adjustment knob.



When any object is placed on the pan, the pointer moves and indicates weight. If you want to adjust the pointer at a particular point you can use the adjustment knob.

You can weigh any foodstuff from raw to cooked on the household weighing balance. As you know, some of the foodstuffs are dry and when removed from the utensil in which they are placed, leave it clean e.g. rice, apple, guava etc. You can place these foodstuffs directly on the pan of the weighing balance. Other foodstuffs are liquidy/sticky/greasy/powdery e.g. cooked dal/atta/oil etc. You should not place these directly on the pan of the weighing balance. In fact, you can classify foodstuffs in groups as shown in Table 1.1.

Table 1.1 Classification of foodstuffs into groups for the purpose of weighing

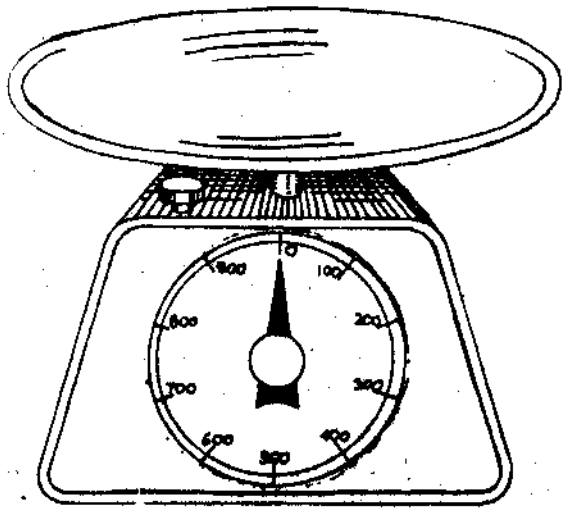
Group A Direct weighing	Group B Weighing in a separate utensil
Fruits Vegetables Bread Rice/chirwa/murmura Sugar (if dry and not sticky) Biscuits Nuts	Oil, ghee, butter Atta, maida, suji Jam/jellies Pickles Cooked foodstuffs

Let us now learn how to weigh items included in groups A and B on the weighing balance.

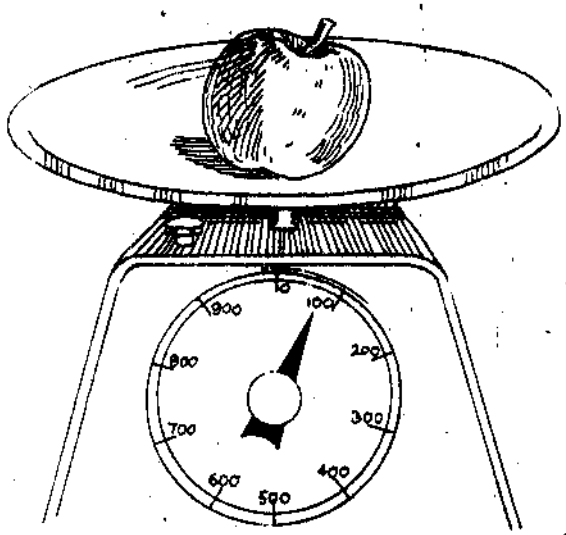
ACTIVITY 2
WEIGHING FOODSTUFFS ON A HOUSEHOLD WEIGHING BALANCE

For items included in Group A

i) BRING THE POINTER TO THE ZERO MARK USING THE ADJUSTMENT KNOB.



ii) PLACE THE FOODSTUFF DIRECTLY ON THE PAN OF THE WEIGHING BALANCE.

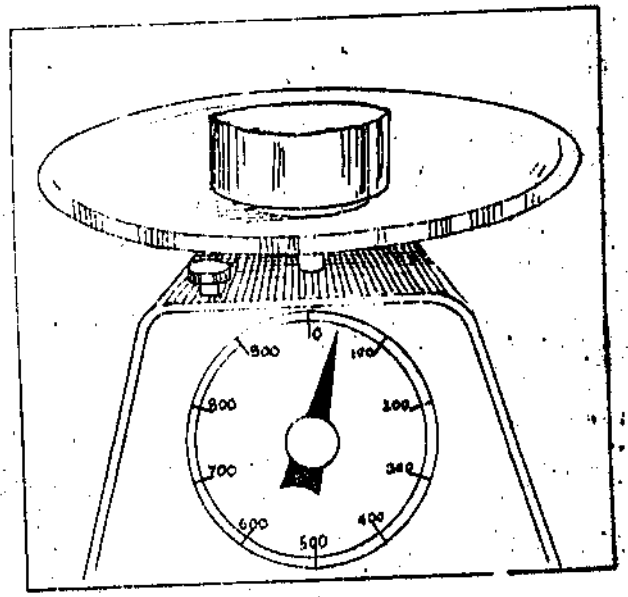


iii) NOTE DOWN THE READING INDICATED BY THE POINTER

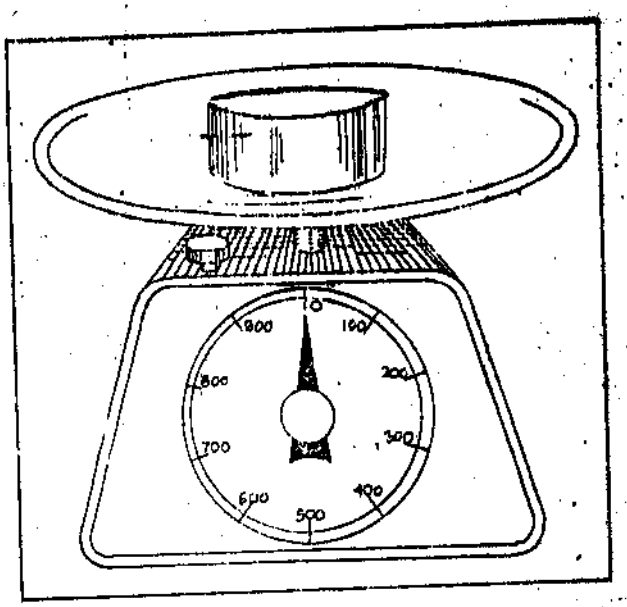
Weight of apple as indicated by the pointer is ..... g

For items included in Group B

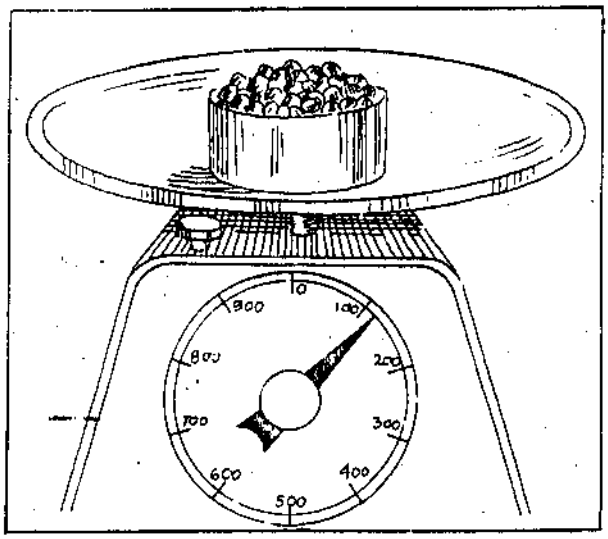
i) TAKE A KATORI/PLATE OR ANY OTHER UTENSIL WHICHEVER IS APPROPRIATE FOR THE FOODSTUFF YOU WANT TO MEASURE AND PLACE IT ON THE TOP OF THE PAN.



ii) BRING THE POINTER TO THE ZERO MARK USING THE ADJUSTMENT KNOB.



iii) PLACE THE FOODSTUFF IN THE UTENSIL.



iv) NOTE DOWN THE READING INDICATED BY THE POINTER

Weight of Bengal gram (whole) as indicated by the pointer .....

While weighing any object on the weighing balance, ensure that you have taken the following points into consideration. Make sure that :–

- the balance is placed on an even surface
- the pan of the balance is clean and dry
- very heavy objects (more than the capacity of the weighing balance) are not taken for weighing
- the pointer is set at the zero mark.

How to use the standard measures of the kit

After learning about the household weighing balance, let us now focus our attention on standard measures. As you know standard measures are part of your practical kit. Let us discuss the use of each one of them separately.

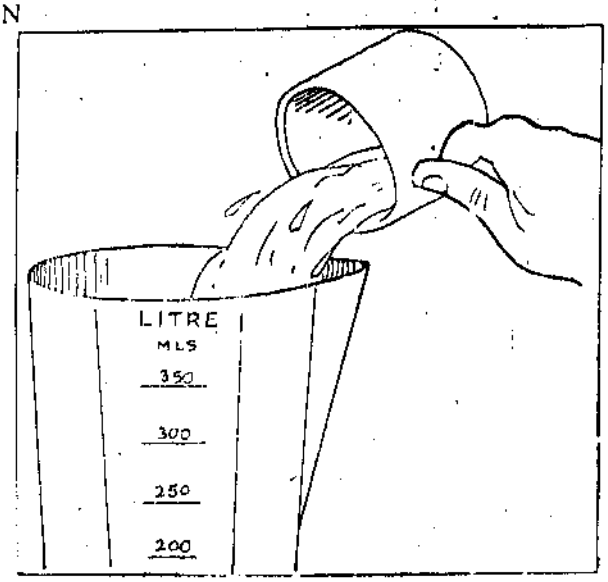
Measuring Glass : It is a calibrated plastic glass. It is used for measuring the volume of liquids such as water, milk or fruit juice. You can measure 25 ml to 300 ml of liquid in it at a time. The glass can be used to find the volume of liquid contained in the given container – cup/glass/tumbler or measure the given amount of liquid – 100 ml to 200 ml or 300 ml.

Let us learn how to use the measuring glass.

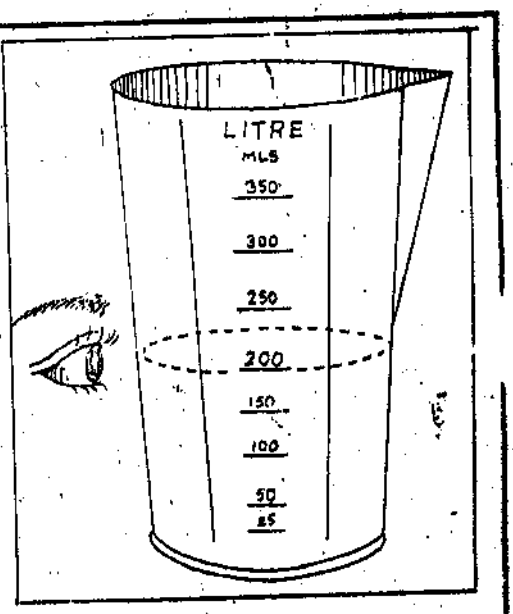
ACTIVITY 3

MEASURING VOLUME USING A MEASURING GLASS

(i) POUR THE LIQUID YOU WANT TO MEASURE IN THE GLASS.

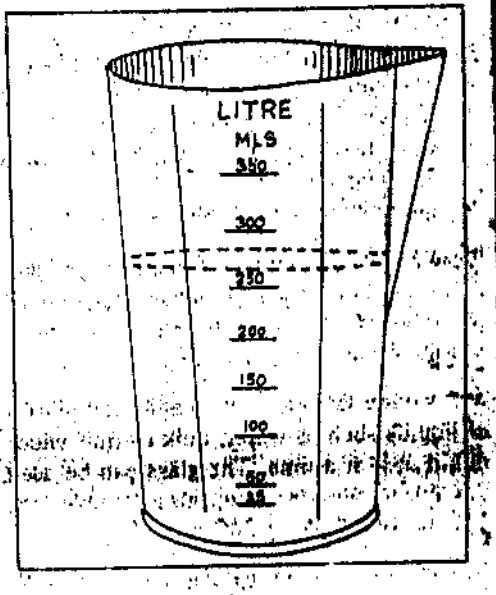


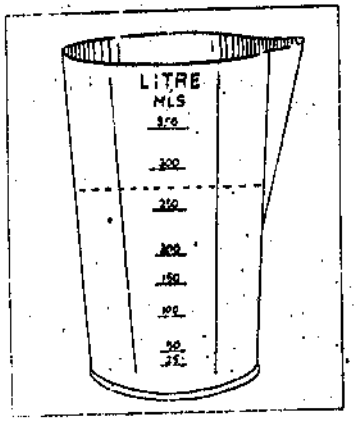
(ii) KEEP THE GLASS AT THE EYE LEVEL AND READ THE VOLUME OF LIQUID.

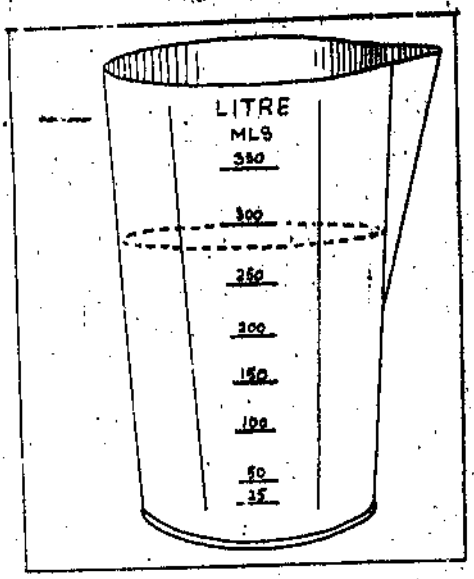


The level of liquid in the glass is .....

(iii) NOTE DOWN THE READING IF THE LEVEL OF THE LIQUID IS DIRECTLY ON THE MARK. IT IS EASY TO NOTE DOWN THE READING. IF NOT, YOU HAVE TO DECIDE THE VOLUME DEPENDING ON YOUR OWN PERCEPTION. YOU HAVE TO CHECK WHETHER THE LEVEL IS IN THE CENTRE OR MORE TOWARDS THE UPPER SIDE OR LOWER SIDE. CONSIDER THE FOLLOWING EXAMPLE. IF THE LEVEL OF THE LIQUID IS IN THE CENTRE OF 250 AND 300 ml, YOUR READING WILL BE 275 ml. IF THE LEVEL IS TOWARDS THE UPPER SIDE, THE READING WILL BE 285 ml. IF THE LEVEL IS TOWARDS THE LOWER SIDE THE READING WILL BE 265 ml.







While using the measuring glass you should make sure that the :-

- glass is clean and dry
- liquid you want to measure is not too hot

Measuring spoons : Your Practical Kit has a set of four plastic spoons. They are labelled as one tablespoon, one teaspoon, half teaspoon and one fourth teaspoon. The quantities which the spoons can measure are :-

One tablespoon (1T) = 15 g
One teaspoon (1 tsp) = 5 g
Half teaspoon (1/2 tsp) = 2.5 g
One fourth teaspoon (1/4 tsp) = 1.25 g

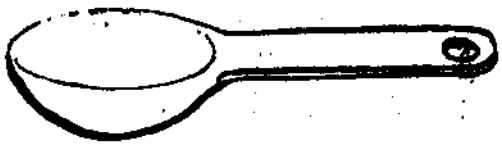
The spoons are usually used for measuring small quantities of ghee, oil, butter, and sugar.

Note : Remember that 1 teaspoon of butter, ghee, oil or sugar is not exactly 5 g. If you weigh one teaspoon of these foodstuffs on the weighing balance, you will find that the weight is close to 5 g. So you can consider that 1 teaspoon of these foodstuffs is 5 g. Same is true for other spoon measures.

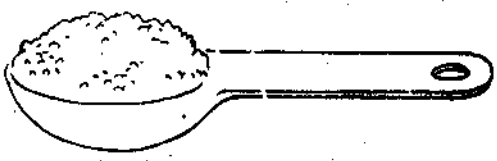
Let us learn how to use the measuring spoons.

USING MEASURING SPOONS

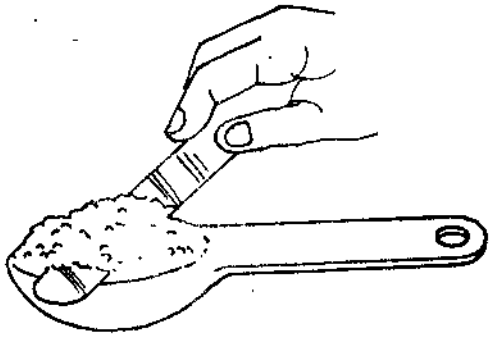
i) TAKE THE APPROPRIATE SPOON ACCORDING TO THE QUANTITY YOU WANT TO MEASURE.



ii) FILL THE SPOON WITH THE FOODSTUFF YOU WANT TO MEASURE.



iii) TAKE A FLAT KNIFE OR THE FLAT EDGE OF THE SPOON AND LEVEL THE HEAP NEATLY.



iv) THE AMOUNT LEFT IN THE SPOON IS THE AMOUNT WHICH IT CAN MEASURE.

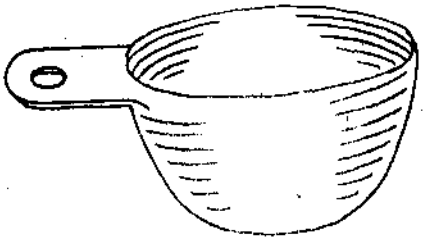
While using the spoons make sure that :

- Spoons are clean and dry
- Butter is in soft form
- Sugar is dry and not moist or sticky.

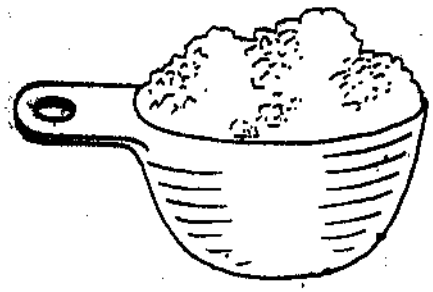
Measuring Cups : The set of measuring cups you have been provided consist of 4 cup measures – one cup (1 C), half cup (1/2 C), one third cup (1/3 C) and one fourth cup (1/4 C). Using these cups you can find out the approximate weight of raw solid foodstuffs. How to find out weight is dealt with later in subsection 1.3. Here, we will just concentrate on learning how to use the measuring cups.

USING MEASURING CUPS

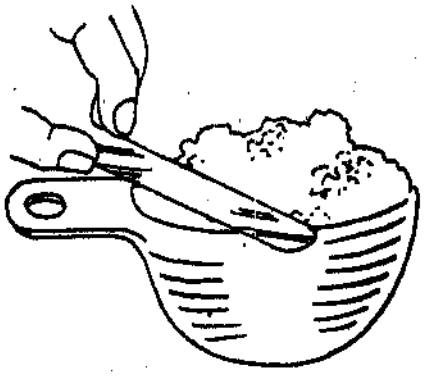
i) TAKE A MEASURING CUP (make sure that it is clean and dry).



ii) FILL IT COMPLETELY WITH THE FOODSTUFF YOU WANT TO MEASURE (make sure that you fill it lightly until it is heaped).



iii) TAKE A FLAT KNIFE OR THE FLAT EDGE OF THE SPOON OR KNIFE AND LEVEL THE HEAP NEATLY.

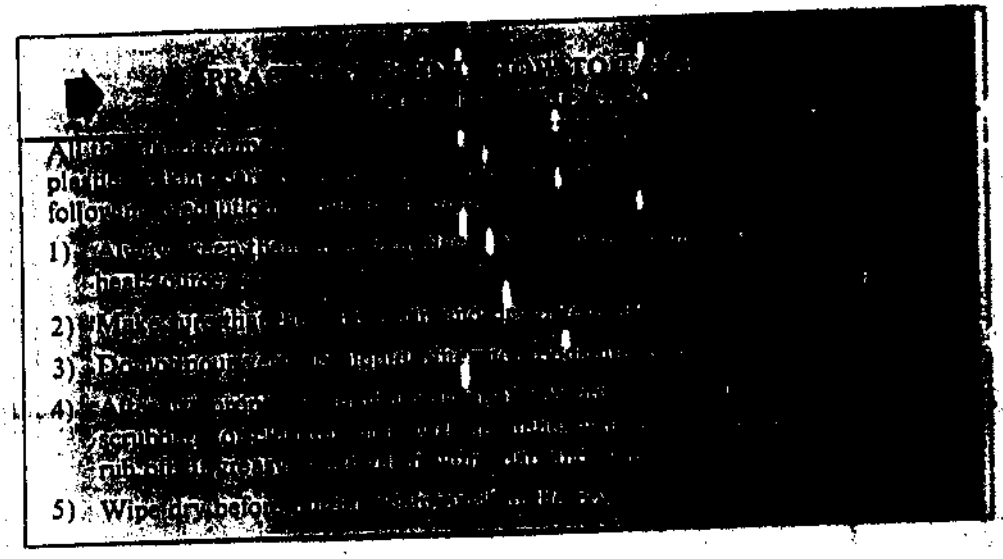


iv) THE AMOUNT LEFT IN THE CUP IS THE AMOUNT WHICH IT CAN MEASURE.

Note :

- One cup measure of all foodstuffs does not weigh the same. The cup measures the quantity (volume) of the particular foodstuff it can hold. How to relate this quantity (volume) to weight is discussed later in subsection 1.3.

- There are some markings on the cups in millilitres which indicate volume. Since you have received a measuring glass separately as a volume measure, you need not use cups for measuring volume of liquids.



1.2 RELATING WEIGHT TO STANDARD MEASURES

We hope by now you have learnt the techniques of using a household weighing balance and the standard measures. Let us now learn how to find weight using standard measures.

In meal planning you may need to know the weight of the following categories of foodstuffs.

- Cereals
- Pulses
- Flesh foods (meat, fish, poultry)
- Fats and oils
- Sugar
- Nuts and oilseeds
- Fruits and vegetables

Out of the above mentioned food categories, you can put cereals, pulses, fats and oils, sugar and nuts and oilseeds in measuring cups or spoons (standard measures) and measure them. The weight of these foodstuffs can be related to standard measures. However, it is not possible to use the standard measures for other categories of foodstuffs i.e. fruits/vegetables and flesh foods due to their size and shape. We use the relationship between weight and size/number for these foodstuffs. How to find weight by this method is the topic of discussion in the next subsection. In this subsection, we will only discuss how to relate weight to standard measures.

As you have already read, standard measures can directly tell you the volume/quantity of foodstuffs placed in them. However, for finding weight, you need additional information. What is this additional information and how is it used for finding weight? Let us try to understand this by the following example.

Consider the following two situations.

Situation I : You have been provided a household weighing balance and asked to cook 80 g of rice.

Situation II : You have been provided the standard cup measures (1 C, 1/2 C, 1/4 C and 1/3 C) and the information that one fourth cup (1/4 C measure) of rice is equal to 40 g. You have to cook 80 g of rice.

Can you measure 80 g of rice in situations I and II? Yes, in situation I, you can directly weigh 80 g of rice on the weighing balance. In situation II, you can use the additional information given and take two levelled one fourth cups (1/4 C measure) of rice for cooking. The additional information provided in situation II actually presents the relationship between a standard measure (i.e. 1/4 C measure) and weight (i.e. a weighing balance). The situation II given here illustrates the fact that if we find out the relationship between standard measures and weight for other foodstuffs also, we can easily find the weight of foodstuffs at home. The two essential things for finding this relationship is a household weighing balance and the standard measures. We have collected this information for various foodstuffs and compiled it in Charts 1, 2 and 3 (Annexure 1 – Part A).

All you have to do is to take the appropriate standard measure and refer to the right chart for a particular category of the foodstuff.

Chart 1 : gives the relationship between weight of raw cereals and pulses and the measuring cups.
Chart 2 : gives the relationship between weight of fats/oils/sugars and the measuring cups.
Chart 3 : gives the relationship between weight of nuts/oilseeds (groundnuts) and the measuring cups.

Do remember that by this method you will get only a rough idea about the weight of foodstuffs and not the exact weight.

Let us now understand how to use weight and standard measure charts for finding the weight of foodstuffs. You can do so by doing the following activity.

ACTIVITY 4(a)

Govind Ram (husband) and Sita (wife) are a newly married couple. Sita is concerned about the health and nutritional status of her family. She cooks her meals by proper meal planning. According to a meal plan prepared by her, she needs the following ingredients for preparing lunch for the two of them.

Atta	—	40 g
Rice	—	100 g
Moong dal	—	60 g
Peas	—	100 g
Tomato	—	50 g
Onion	—	50 g
Potato	—	150 g
Apple	—	16 g
Fat/oil	—	15 g
Sugar	—	20 g

How will she measure these amounts? Let us solve her problem using the standard measures. Take out your set of standard measures and the above mentioned foodstuffs and do as indicated.

- **WHICH FOODSTUFFS WOULD YOU MEASURE USING THE STANDARD MEASURES?**
  Atta, moong dal, fats and oils and sugar
- **WHICH CHART/STANDARD MEASURE IS APPROPRIATE FOR EACH OF THESE FOODSTUFFS?**
  Atta — Chart 1 and measuring cups
  Moong dal — Chart 1 and measuring cups
  Fats and oils — measuring spoons
  Sugar — measuring spoons
- **HOW WILL YOU MEASURE 40 g ATTA?**
  Refer to Chart 1. You will find that 1/3 C can measure 35 g atta. As you need **40 g** of it, you can take one levelled (1/3 cup atta) and add a little more (approximately 5 g) to it according to your own judgement/perception.

- HOW WILL YOU MEASURE 100 g RICE?
  Refer to Chart 1. Half cup can measure 90 g rice. Take little more than 1/2 cup of rice.
- HOW WILL YOU MEASURE 60 g MOONG DAL?
  Refer to Chart 1. 1/3 cup can measure 60 g of moong dal.
- HOW WILL YOU MEASURE 20 g GHEE/EDIBLE OIL?
  Smaller quantities of fats and oils can be measured directly using measuring spoons (For large quantities you need to use Chart 2 and measuring cups). Take 4 teaspoons (tsp) of ghee/edible oil.
- HOW WILL YOU MEASURE 20 g SUGAR?
  Smaller quantities of sugar, less than 50 g, can be measured using measuring spoons (For large quantities you need to use Chart 2 and measuring cups). Take four teaspoons (4 tsps) sugar.

In this way Sita can measure the cereal, pulse, fats/oil, sugar (in the amounts needed for her lunch) by using the standard measures and charts giving the relationship between standard measures and weight. But her problem is only partially solved. How will she measure the vegetables and fruits needed for the lunch? The answer to this question is provided in the next subsection.

1.3 RELATING WEIGHT TO SIZE AND NUMBER

How will you determine the weight of fruits and vegetables at home? Can you measure them in your standard cups and glass? No, obviously not. So, what is the answer to this question? The answer lies in the fact that most of the fruits and vegetables are available in the market in various sizes and shapes. You can get a banana which is very small or very large. Now, as you know, weight will be different for the various sizes of bananas. This means a relationship between size and weight can be worked out based on which you can determine the weight of fruits and vegetables. In a similar manner, weight of some nuts and oilseeds, flesh foods (like egg) can be related to number.

You can refer to weight and size figures given in Annexure 1 – Part B for finding the weight of fruits and vegetables. We have worked out these figures using a weighing balance and different fruits and vegetables of various sizes — small, medium and large. *Do remember that these figures give you only the rough idea of weight of fruits and vegetables and not the exact weight.* For example weight and size figures for onions of various sizes include the following — very small (15 g), small (25 g), medium (40 g) and large (65 g) onion. How will you measure 60 g onion using this information? You can take one large onion/two small onions/one medium and one very small onion/four very small onions. Note that these onions should be approximately of the sizes indicated in the figures. In a similar manner using information given in figures (Annexure 1 – Part B), you can find weight of other vegetables and fruits also.

Let us now study how to use the information given in Charts 4 and 5 and size-weight figures given in Annexure 1 – Part B. You can refer to Charts 4 and 5 for finding the weight of some nuts and oilseeds and flesh foods. These charts are based on the relationship between size/number and weight. For example, if you want to add 10 g almonds in a desert prepared by you, you can take 9 big almonds (Chart 4). Similarly you can take 5 medium size pieces of mutton, if you need to add 100 g mutton in a dish (Chart 5).

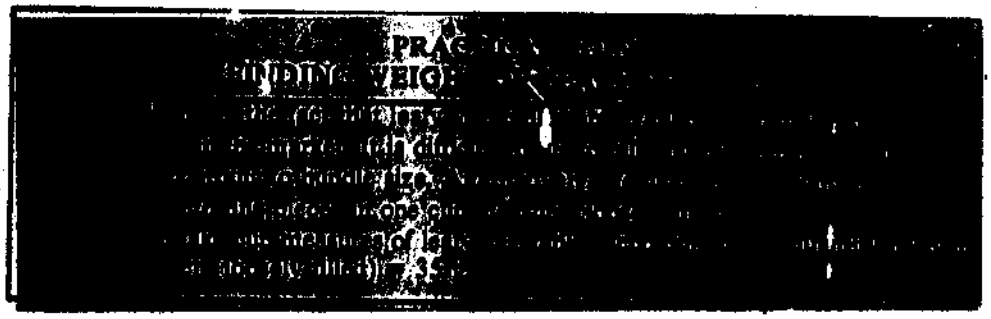
Now let us come back to Sita's problem. We have left her problem only half solved in an earlier subsection. She needs to weigh 100 g peas, 100 g potato, 50 g tomato, 50 g onion, and 160 g apple for her lunch. Refer to weight and size figures and answer the following.

ACTIVITY 4 (b)

- HOW WILL YOU MEASURE 100 g PEAS?
  As indicated in the figure for peas, 12 to 14 small peapods are 50 g. So, you can take around 24-30 small peapods.

- **HOW WILL YOU MEASURE 100 g POTATO?**
  Refer to the figure for potatoes. You can take one small potato or three fourth of a medium potato or half (a little more than half) of a large potato.
- **HOW WILL YOU MEASURE 50 g TOMATO?**
  Refer to the figure for tomatoes. You can take one medium size tomato.
- **HOW WILL YOU MEASURE 50 g ONION?**
  Refer to the figure for onions. You can take two small onions or one medium and one very small onion or three fourth of a large onion.
- **HOW WILL YOU MEASURE 160 g APPLE?**
  Refer to the figure for apples. You can take two medium size apples.

Note: In all these cases match the size of vegetables and fruits with the sizes given in figures.



1.4 RELATING HOUSEHOLD MEASURES TO STANDARD MEASURES

When you plan meals for yourself or for family members, the meal plan indicates food items in grams/litres/millilitres. You can measure the ingredients according to the meal plan using your kit/standard measures. However, you may be more used to using household measures like cup/katori/tumbler/plate in your kitchen. You may not want to bother yourself using the standard measures in your day-to-day cooking. In such a situation, you can work out a relationship between standard measures and household measures, so that if you cook a katori of dal for your family, you know how much dal (grams) it contains. In other words, you can standardize your household measures using the standard measures. For understanding this do the following interesting activity. This exercise will help you in knowing the approximate weight/volume of foodstuffs that can be measured with the household measures you have on your kitchen shelf.

ACTIVITY 5

Part A: Finding the volume of liquid that can be contained in the utensils on your kitchen shelf.

- TAKE GLASSES, STEEL TUMBLERS AND CUPS OF DIFFERENT SIZES FROM YOUR KITCHEN SHELF.
- CLASSIFY THEM INTO THREE CATEGORIES – LARGE, MEDIUM AND SMALL
- TAKE ONE SAMPLE FROM EACH
- FILL IT UP WITH WATER (You should fill it up till the level you usually put water/milk/tea for drinking)
- NOTE DOWN THE VOLUME
- SIMILARLY, FIND THE VOLUME OF WATER THAT CAN BE CONTAINED IN OTHER SAMPLES
- RECORD YOUR RESULTS

UTENSIL	SIZE	VOLUME
Steel tumbler	large	.....
	medium	.....
	small	.....

Glass tumbler	large	.....
	medium	.....
	small	.....
Cup	large	.....
	medium	.....
	small	.....

Part B : Finding the weight of foodstuffs—cereals/pulses/fats/oils/sugar — that can be contained in utensils on your kitchen shelf

STEP I TAKE A KATORI/BOWL/CUP OR ANY OTHER UTENSIL WHICH YOU USUALLY USE FOR MEASURING CEREALS/ PULSES/FATS/OILS/SUGAR.

STEP II TAKE ANY OF THESE FOODSTUFFS SAY A CEREAL (RICE) OR PULSE (MOONG DAL), IN THE AMOUNT YOU USUALLY COOK (It can be half katori/one katori/one glass/two glasses)

STEP III TRANSFER THIS AMOUNT TO MEASURING CUPS AND FIND OUT WHICH OF THE CUP MEASURES CAN ACCOMMODATE THAT AMOUNT. ONCE YOU HAVE THE AMOUNT IN TERMS OF MEASURING CUPS YOU CAN ALSO ESTIMATE THE WEIGHT (USING CHARTS 1, 2 AND 3). RECORD YOUR OBSERVATIONS IN THE SPACE PROVIDED HERE.

Name of foodstuff	Amount in terms of household measures (g)	Amount in terms of standard measures (g)	Weight (g)
Rice	small glass	—C	— g
Atta			
Pulse			
Fat/oil			
Sugar			

1.5 FINDING THE RELATIONSHIP BETWEEN THE AMOUNT OF COOKED FOODSTUFFS AND RAW FOODSTUFFS

So far, you have learnt how to measure the raw foodstuffs for preparing a dish/snack according to a recipe/meal plan. As a matter of fact weighing and measuring raw ingredients before preparing a dish is the right step towards meal planning. However, sometimes you may find yourself in a reverse situation. A cooked dish/snack is placed before you and you are asked to find out the amount of raw foodstuffs/ ingredients taken for its preparation. For example, if your sister had a katori of dal, half plate rice and two chapatis in lunch at her friend's place, can you tell her how much raw dal or atta she has consumed? It is a difficult situation. Isn't it? But let us try to find the easy way out. In this subsection we will try to establish the relationship between a cooked dish/snack and the raw ingredients used in its preparation. In the case of cooked foodstuffs, you will have to consider the size of the katori/plate in which food is served/consistency or thickness of the cooked preparation/size of served food item e.g. chapati or poori. Let us consider some cooked dishes. You will find that usually cereal, pulse and vegetable preparations are part of our main meals (to whichever region of India we may belong to). We will here discuss each one of them separately.

Cereal preparations : As you know, cereals (in one of those forms–atta, maida, suji or rava, jowar, bajra, etc.) always find a place in our main meals.

One of the most commonly used cereal preparations is chapati/phulka/roti prepared from whole wheat flour or atta (Although you can find chapatis made from jowar, bajra or maize flour). You might have observed that size and thickness of chapati is not the same in every household. In fact it is characteristic of each household. One can have small-thin, small-thick/medium-thin, medium-thick/large-thin, large thick chapatis. In size-thickness figures, Annexure I Part C, we have given various sizes of chapatis (along with the amount of raw atta used in its preparation). What you can do is – find among these which figure represents the size and thickness of chapati usually prepared in your home and accordingly decide the amount of atta used per chapati.

However, if you find significant variations in the size of chapatis eaten at your home (to the sizes mentioned in figures), you can perform the following activity. This activity is not only applicable for chapatis but for any other cereal preparation like parantha, poori, idli, dosa etc.

ACTIVITY 6

- TAKE THE KNOWN AMOUNT OF CEREAL (ATTA, MAIDA, SUJI, JOWAR, BAJRA ETC.) YOU CAN USE THE STANDARD MEASURING CUP FOR THIS PURPOSE.
- MAKE THE DOUGH/BATTER ACCORDING TO THE RECIPE/DISH.
- MAKE THE DISH (CHAPATI/POORI/IDLI/DOSA/OTHER CEREAL PREPARATION) IN THE AMOUNT YOU USUALLY CONSUME.
- COUNT THE NUMBER OF SERVINGS/PIECES PREPARED FROM THE DOUGH/BATTER.
- DIVIDE THE AMOUNT OF TOTAL CEREAL TAKEN BY THE NUMBER OF SERVINGS PREPARED. IT WILL GIVE YOU AN IDEA OF THE AMOUNT OF CEREAL TAKEN PER SERVING.

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Another commonly used cereal preparation is cooked rice (either boiled or fried). Cooked rice is usually served in plates. Are you familiar with the plate sizes? These are full plate, half plate, quarter plate and saucer. A full plate of cooked rice (levelled, not heaped) contains approximately 80 g raw rice. A half plate of cooked rice contains 60 g raw rice. While a quarter plate of cooked rice actually has 40 g raw rice. If you use similar kind of plates, you can use the above mentioned information for the purpose of meal planning. However, if you find some differences in plate sizes at your home, you can perform an activity based on the same steps mentioned in Activity 6.

Pulse preparation : Usually a pulse preparation in the form of dal/sambar/rasam also finds a place in our meals. In the case of dal, it is the consistency which varies. You can have a katori of thick dal preparation to thin liquidy dal preparation like sambar or rasam. Dal is usually served in katories. So the size of the katori is also important. Consider a 150 ml katori (it means it can hold 150 ml. of liquid in it). A medium consistency cooked dal placed in this katori (full) is actually made from 30 g raw dal. The same katori (full) of thin consistency dal like rasam contains just 10 g of raw dal. You can find a katori of similar volume from your house (though shape or size may be different) using a standard measuring glass. However, if you can not find the katori of 150 ml or the consistency of dal used in your house is not same as mentioned here, you can perform an activity by repeating the steps mentioned in Activity 6.

Vegetable preparations : There is a lot of variation in the method of preparation of vegetables from one region to another and within the same region from one house to another. So, it is difficult for us to tell you the amount of raw vegetable contained in a katori or plate of cooked vegetable preparation. You can take the known amount of raw vegetable and prepare it according to your method. Now you can determine the number of servings prepared and amount per serving.

1.6 SUMMING UP

The section provides you with a solution to the problem of weighing and measuring at household level. You have learnt about the household weighing balance, household measures and standard measures and their use.

After reading this section you would have realized that a household weighing balance is essential for finding the weight of foodstuffs at the household level. However, using a weighing balance and set of standard measures one can find a relationship between the two. Such a relationship can be used for finding the weight of foodstuffs at home. You have been provided with a set of standard measures and additional information in the form of relationship between weight and standard measures for foodstuffs like cereals and pulses; fats and oils; sugar and groundnuts (nuts and oilseeds) in Charts 1, 2 and 3 respectively. Other foodstuffs like fruits and vegetables; flesh foods; some nuts and oilseeds can be quantified using the relationship between weight and size/number.

You can simplify things further by standardizing household equipment (measures) on your kitchen shelf with the help of standard measures.

ANNEXURE 1

PART A

CHART 1. Approximate weight of cereals and pulses according to standard measuring cups

Foodstuff	The amount contained in the standard measuring cups in grams			
	1 cup	1/2 cup	1/3 cup	1/4 cup
Cereals				
Atta (whole wheat flour)	130	60	35	25
Maida (refined wheat flour)	100	60	30	25
Rice	165	90	50	35
Chirwa (rice flakes)	55	25	12	10
Murmura	25	12	8	6
Cornflakes	35	15	12	9
Pulses				
Kabuli chana	160	75	45	35
Black gram	160	80	45	35
Chana dal	160	80	50	35
Moong (whole)	180	90	60	40
Whole masoor	170	85	55	35
Masoor washed	185	95	55	40
Arhar dal	175	90	50	40

Source : Based on the work done by faculty, IGNOU.
Note : The values are rounded off to the nearest whole numbers.

CHART 2. Approximate weight of Fats/Oils/Sugar according to standard measuring cups

Foodstuff	The amount contained in standard measuring cups in grams.			
	1 cup	1/2 cup	1/3 cup	1/4 cup
Ghee	200	–	–	–
Oil	175	–	–	–
Sugar (ground)	110	55	35	25
Sugar (granulated)	185	95	60	45

Source : Based on the work done by faculty, IGNOU.
Note : The values are rounded off to the nearest whole numbers.

CHART 3. Approximate weight of nuts and oilseeds (groundnut) according to standard measuring cups

Foodstuff	The amount contained in standard measuring cups in grams			
	1 cup	1/2 cup	1/3 cup	1/4 cup
Groundnut	140	70	40	30

Source : Based on the work done by faculty, IGNOU.
Note : The values are rounded off to the nearest whole numbers.

CHART 4. Approximate weight of nuts and oilseeds according to number

Foodstuff	Measure	Weight (g)
Almond	9 big	10
Cashewnut	6 large	10
Walnut	4 halves	10
Pistachio	18 big	10

Source: These values are taken from a book titled 'Basic Food Preparation' by Department of Food and Nutrition, Lady Irwin College, Published by Orient Longman (1986).

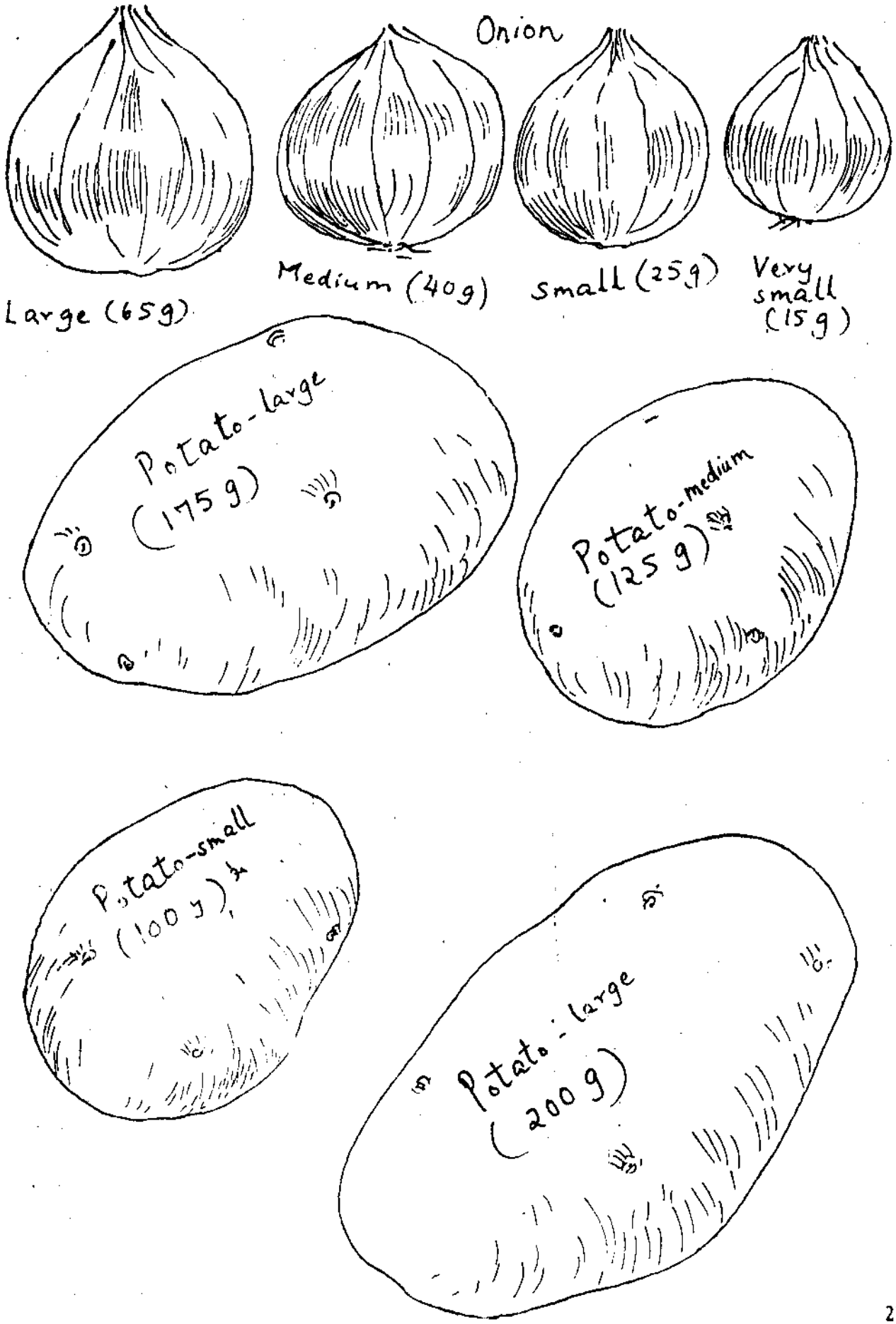
CHART 5. Approximate weight of meat/fish/poultry according to size and number

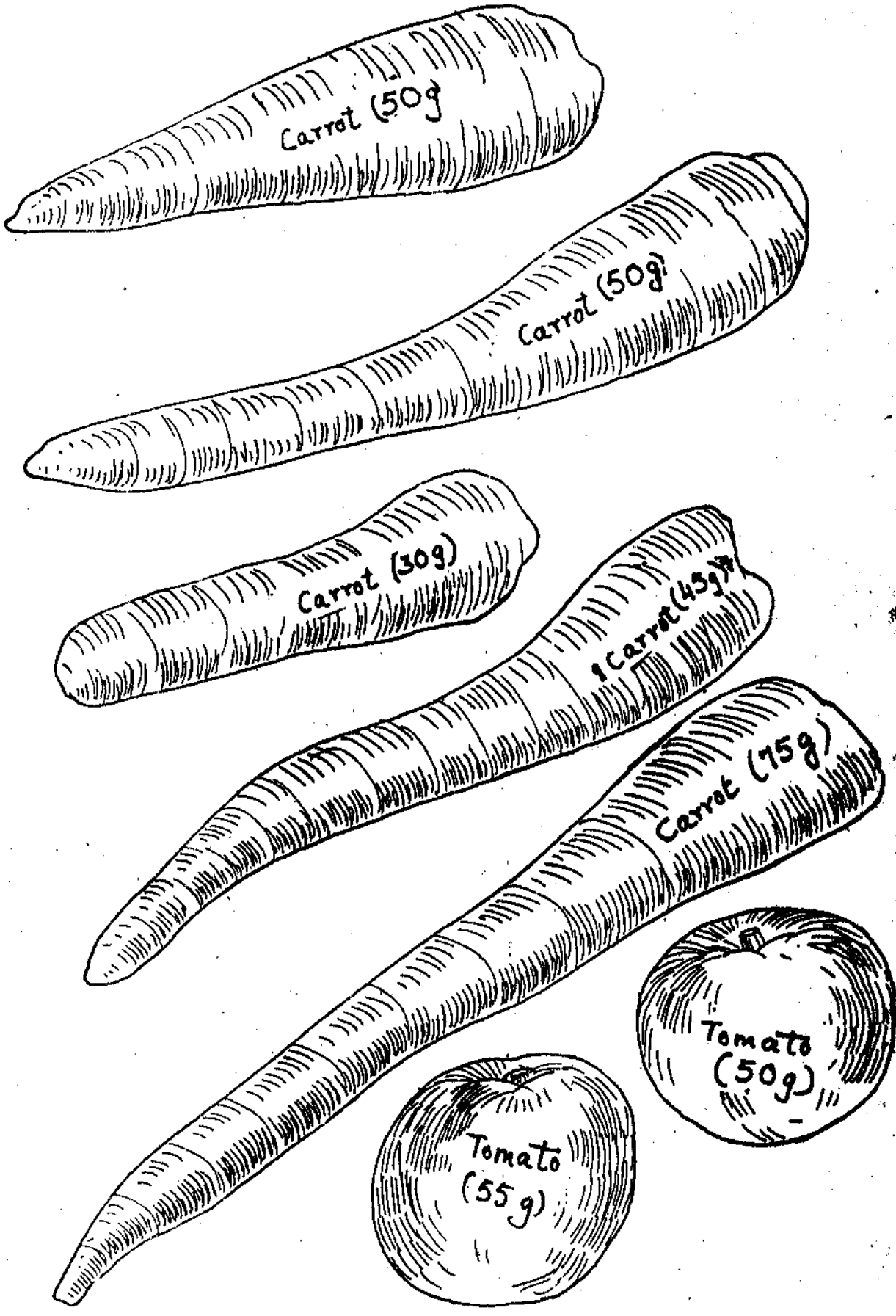
Foodstuff	Measure	Weight (g)
Egg	1 medium	55
Mutton	5 pieces (medium)	100
Chicken	1 leg	100
Pomfret	1 medium	500

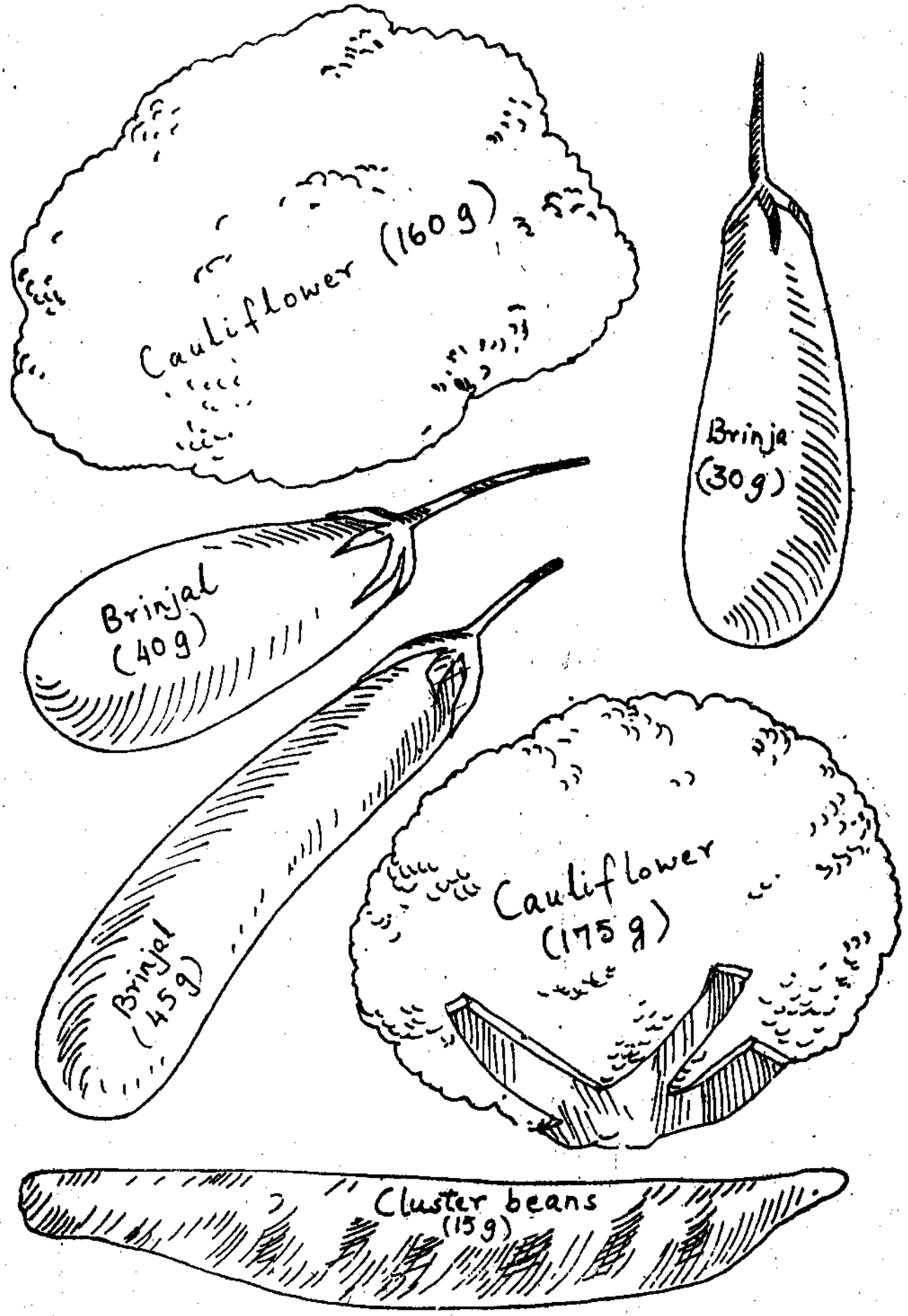
Source: These values are taken from a book titled 'Basic Food Preparation' by Department of Food and Nutrition, Lady Irwin College, Published by Orient Longman (1986).

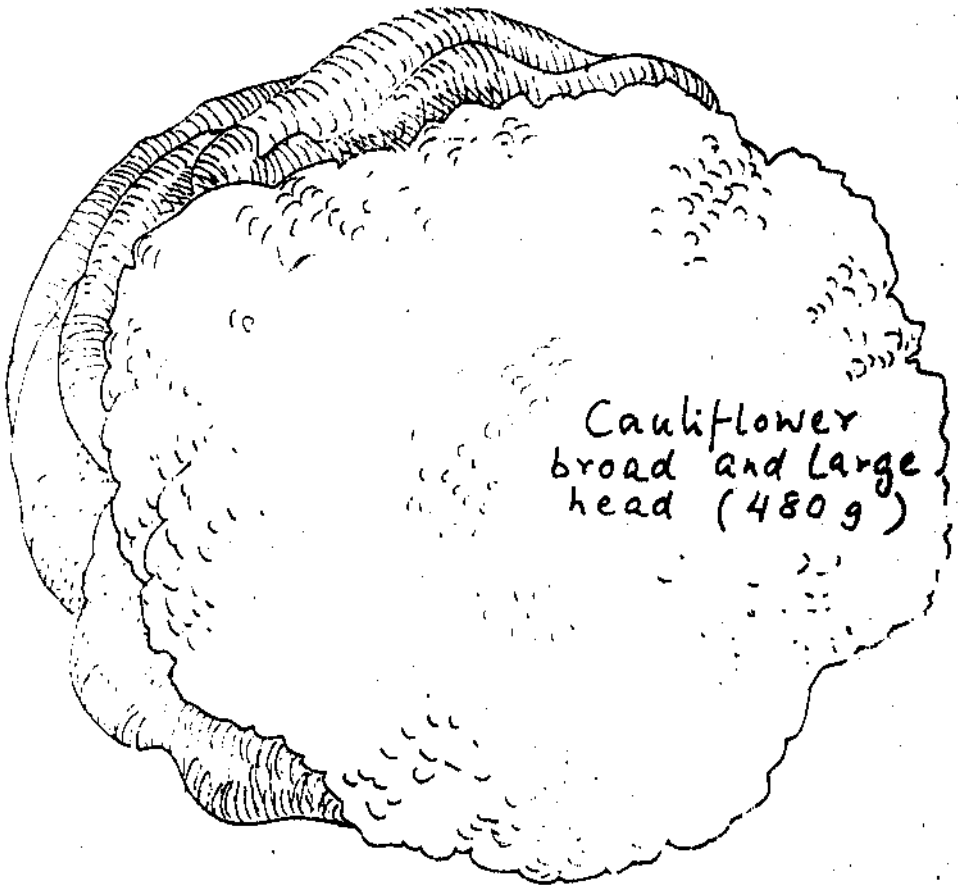
ANNEXURE 1

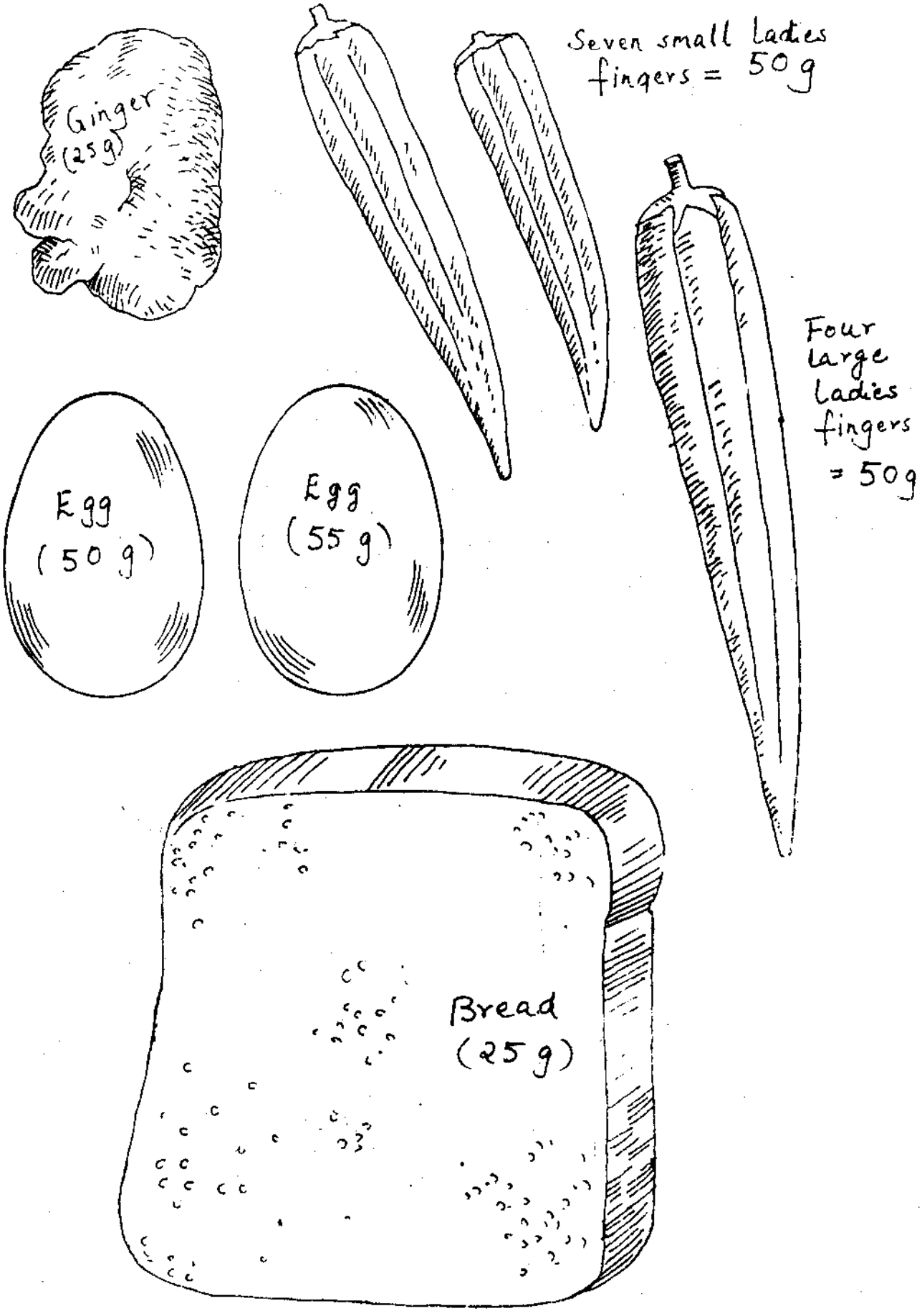
PART B WEIGHTS AND SIZES OF SELECTED FOOD ITEMS

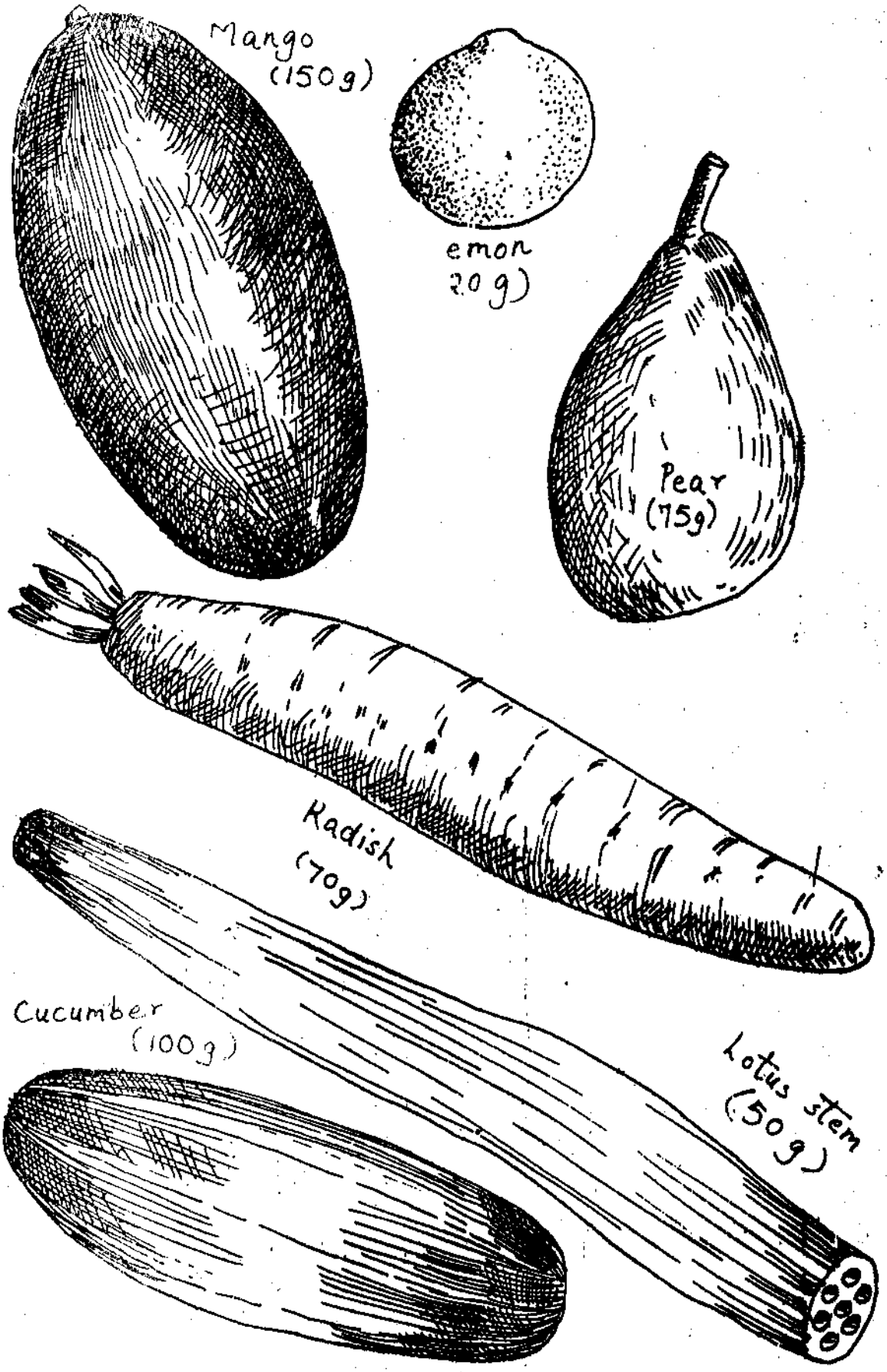


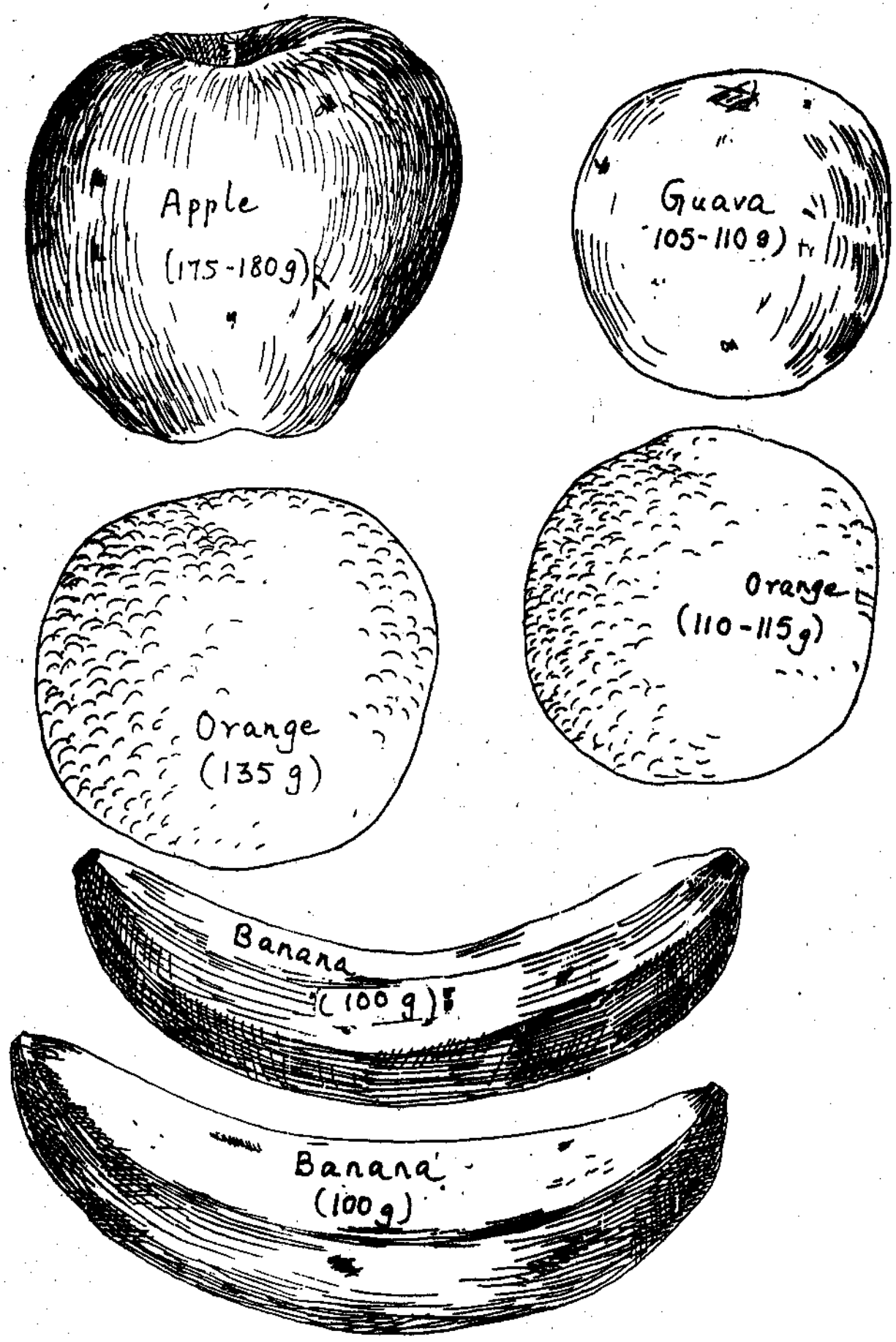










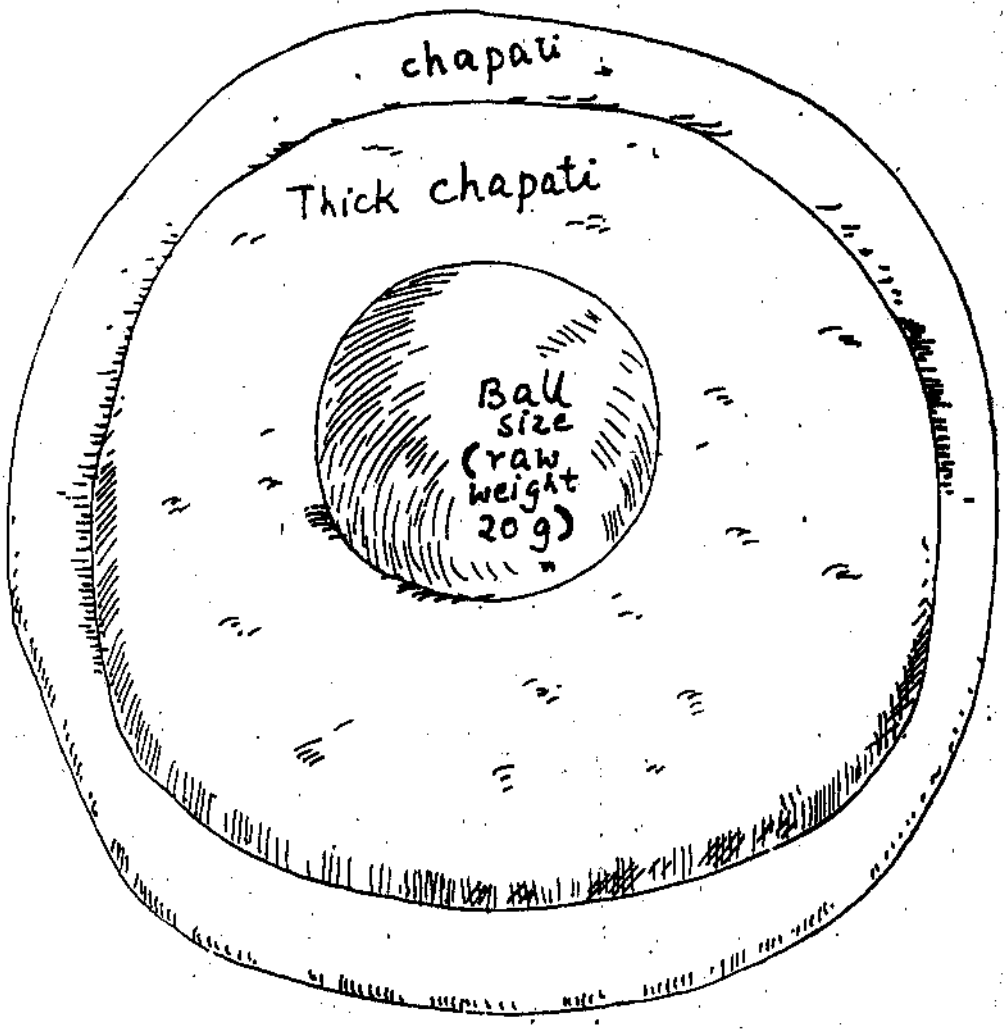


ANNEXURE 1

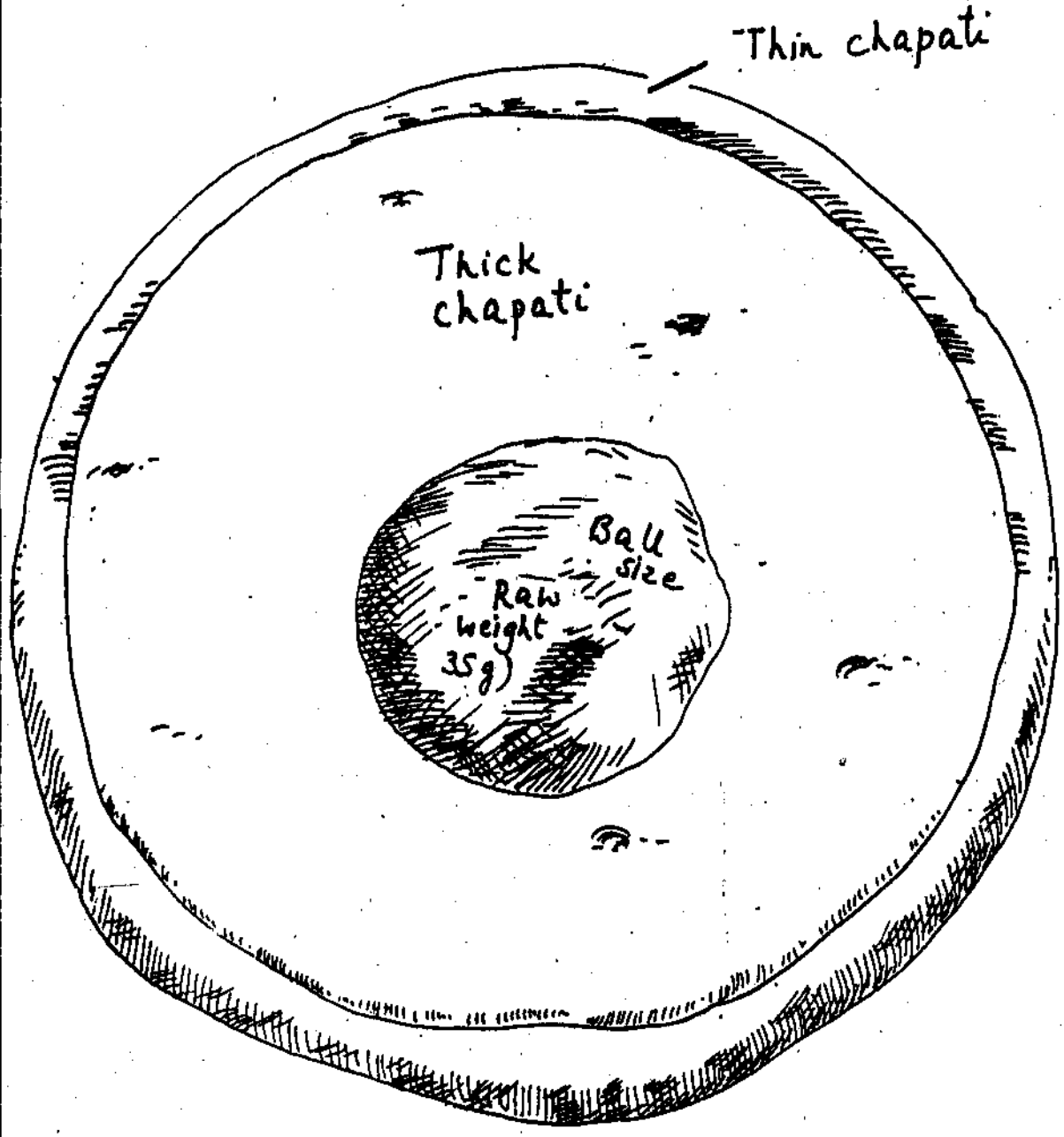
PART C

RELATION OF CHAPATI SIZES TO AMOUNT OF FLOUR

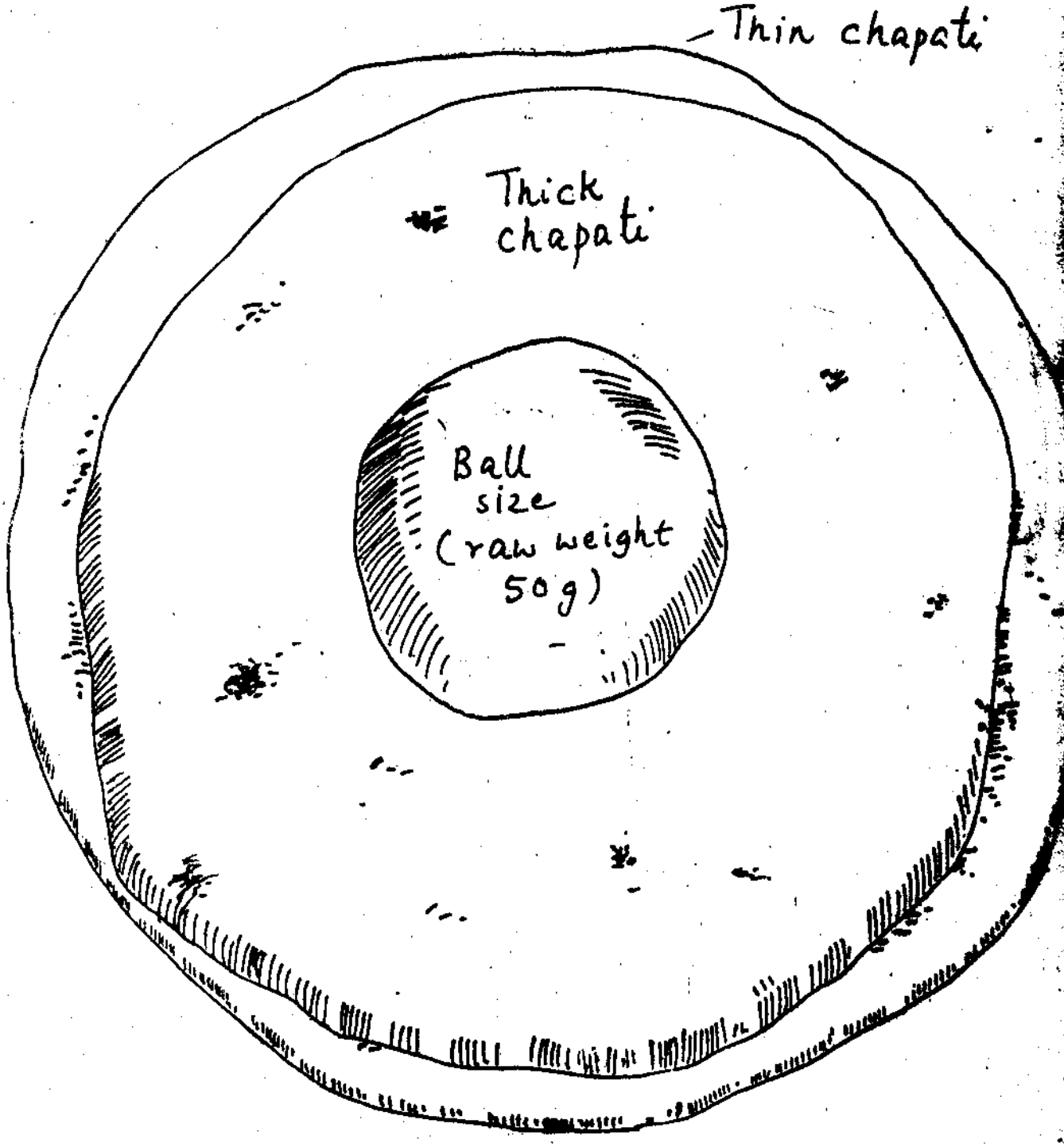
(i) 20 g chapati



(ii) 35 g chapati



(iii) 50 g chapati



SECTION

2

FINDING NUTRITIVE VALUE OF FOODSTUFFS

TO STUDY THIS SECTION

The focus of this section is on learning the salient features and the use of composition tables for the purpose of finding the nutritive value of The section is divided into three subsections each discussing some food composition tables.

food composition tables involves simple mathematical calculations. tion steps related to these calculations are explained by means of Do spend sufficient time on each step.

ading this section, read through Blocks 1, 2 and 3 and find out places food composition tables are made use of any reference is made to You can make use of them. This will enable you to become familiar with ways in which food composition tables are used in the study of

SKILL TO LEARN FROM THIS SECTION

How to use the food composition tables for determining the nutritive value of foodstuffs.

Structure

2.0 INTRODUCTION

When you open up your practical Manual/a magazine or a recipe book, you get tempted to try out the recipes given there. You can easily measure the ingredients of a given recipe using your practical kit and prepare the dish accordingly. Supposing someone at this stage asks you — Is this dish prepared by you nutritious? How much energy and protein does it provide? Is it rich in iron also? What will be your answer?

For answering these questions you should have the information regarding the nutritive value of different foods i.e., the amount of energy, protein and other nutrients contained in different foodstuffs.

You can get this information from the 'Food Composition Tables'. The Food Composition Tables for Indian foods give the nutrient content or composition of almost all common Indian foodstuffs available in different parts of India (See Annexure 2).

How are these tables made? Let us find out. The pioneer institution which has worked in this field in India is the National Institute of Nutrition, Hyderabad (a unit of Indian Council of Medical Research). A group of scientists from this institute analyzed different foodstuffs in their laboratory. They used scientific procedures and techniques to determine the energy, protein, fat, carbohydrate, vitamin and mineral content of each foodstuff. In this way, the scientists determined the nutrient content of almost all common Indian foodstuffs. All the information obtained from the

laboratory tests was then compiled in the form of food composition tables. The Indian Council of Medical Research published these tables in a book titled "Nutritive Value of Indian Foods". The book was prepared by C. Gopalan, B.V. Ramasastri and S. C. Balasubramanian and was first published in 1975. It has been revised by B. S. Narasinga Rao, Y. G. Deosthale and K.C. Pant in 1989. The new revised and updated edition (1989) is now available.

A part of the food composition tables from the book is given in Annexure 2. However, the style of presentation in this section is different from that given in the book. This modification is made to make things simpler for you.

If you want to use the book "Nutritive Value of Indian Foods" as a crosscheck for the information provided in Annexure 2 or for further reference, you can get it from the library at your Study Centre or buy a copy from Indian Council of Medical Research, Ansari Road, New Delhi. The book costs Rs. 18.

The present section deals with the study of salient features of the food composition tables and how to use them for the purpose of finding the nutritive value of foodstuffs. You will also find the discussion on certain limitations of these tables useful.

Objectives

After going through this section, you will be able to:

- identify the salient features of food composition tables
- make use of food composition tables for
  - finding out nutritive value of different foodstuffs
  - comparing nutritive value of foodstuffs and
  - calculating and comparing nutritive value of dishes/snacks.

2.1 WHAT ARE FOOD COMPOSITION TABLES?

You can find your way through the food composition tables by carefully looking at them. Observe the food composition tables given in Annexure 2 and look for some of its salient features.

- The first thing which you will notice is that the tables provide information regarding the energy, protein, fat, carbohydrate, fibre, mineral (calcium, phosphorus, iron) and vitamin (vitamin A, vitamin C, thiamine, riboflavin, niacin, and folic acid) content of commonly used foodstuffs in Indian households.
- Another important point which you can note by carefully looking at the tables is the classification of foodstuffs into food groups. You are familiar with these food groups. These are energy-giving foods, body-building foods and protective/regulatory foods. The various categories of foodstuffs included in each food group are listed below:

Energy-giving foods
Cereals
Roots and tubers
Sugars
Fats and oils

Body-building foods
Milk and milk products
Pulses
Flesh foods

Protective/regulatory foods
Leafy vegetables
Other vegetables
Fruits

Miscellaneous
Nuts and oilseeds
Condiments and spices

- You should also become familiar with the various columns of the food composition tables. Here is a small extract of the table (from Annexure 2) indicating the columns). As you can see, it has 17 columns.

Column 1 indicates serial number and column 2 gives name of foodstuff under each food group.

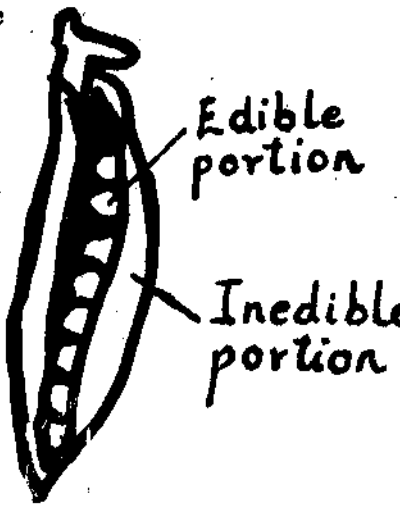
Columns 3 – 17 tell you the amount of various nutrients in 100 g edible portion of raw foodstuffs.

S. No.	Name of the Foodstuff	Moisture g	Protein g	Fat g	Fibre g	Carbo-hydrate g	Energy Kcal
1	2	3	4	5	6	7	8

Calcium mg	Phosphorus mg	Iron mg	Vitamin A Carotene/ retinol µg	Thiamine mg	Riboflavin mg
9	10	11	12	13	14

Niacin mg	Folic acid µg	Vitamin C mg
15	16	17

- What is the meaning of the term edible portion mentioned in the table ? When we buy foodstuffs like vegetables, fruits or nuts from the market, we usually do not consume them as such. We throw away the skin or seeds/stalks and consume only the rest. Similarly, when we buy peas from the market, we actually consume seeds/peas and throw away the pods/shells. We throw away thick stalks from spinach and consume only the leaves. While in the case of other foodstuffs like milk, sugar, atta, maida and suji, we consume all of what we buy. The portions of the foodstuffs which are really consumed/eaten are known as edible portion. Inedible portions are not consumed or eaten and are thrown away.



It means that foodstuffs like milk, atta, maida, suji, rice, pulses, sugar, jaggery, etc. are 100 per cent edible. While others like vegetables, fruits, nuts and oilseeds are not 100 per cent edible.

Remember that the nutrient content of foodstuffs given in the food composition tables is based only on the 100 g edible portion of the raw foodstuffs.

After learning about the salient features of food composition tables, let us focus our attention on various ways in which you can make use of food composition tables.

2.2 FINDING THE NUTRITIVE VALUE OF FOODSTUFFS USING FOOD COMPOSITION TABLES

You can make use of food composition tables in any one of the following ways.

A) Comparison of the nutrient content of 100 g edible portion of raw foodstuffs

B) Calculation of the nutrient content of edible portions of foodstuffs for amounts other than 100 g.

C) Calculation of the nutrient content of a meal/dish.

Let us understand each of the above mentioned uses of the food composition tables

A) COMPARISON OF THE NUTRIENT CONTENT OF 100 g EDIBLE PORTION OF RAW FOODSTUFFS

This aspect is explained here by means of the following example :

Compare the energy, and protein and carotene values of 100 g edible portion of wheat and spinach.

For answering the question open the food composition tables given in Annexure 2 and look for the following :

- IDENTIFY THE FOOD GROUP TO WHICH THEY BELONG
  Wheat is an energy-giving food and placed in the category of cereals. Spinach protective/regulatory food placed in the category of leafy vegetables.
- FIND OUT THE RELEVANT PAGE NO. AND SERIAL NO.
  Values for wheat are on page 43 Serial no. 15. Values for spinach are on page Serial No. 116.
- REFER TO THE APPROPRIATE COLUMNS
  Column 8 (energy), column 4 (Protein) and column 12 (carotene)

ANSWER : 100 g edible portion of wheat has 364 Kcal, 4.8 g protein and 29 µg carotene while 100 g edible portion of spinach has 26 Kcal, 2 g protein and 5580 carotene.

You have to follow similar steps for determining the nutrient content of 100 g ed portion of any other foodstuff.

ACTIVITY 1

Find out the protein, thiamine, calcium, iron and vitamin C content of 100 g edi portion of rice, wheat, jaggery, egg, spinach, groundnut and butter (using the foo composition tables given in Annexure 2). Note down your results in the given ch

Foodstuff	per 100 g edible portion of foodstuffs				
	Protein (g)	Thiamine (mg)	Calcium (mg)	Iron (mg)	Vitam (m
Rice					
Wheat					
Jaggery					
Egg					
Spinach					
Groundnut					
Butter					

Answer the following on the basis of results obtained

a) Which foodstuff among these has maximum protein ?

.....

b) Which foodstuffs among these are rich in almost all nutrients ?

.....

.....

c) Which foodstuffs among these are rich in energy but poor in other nutrient

.....

.....

B) CALCULATION OF NUTRIENT CONTENT OF FOODSTUFFS F AMOUNTS OTHER THAN 100 g

You know that the food composition tables give nutrient content of only the

100 g edible portion of foodstuffs. If you want to calculate energy and protein content of 75 g spinach and 150 g wheat, how will you do it? Here you will have to apply simple mathematical calculations. Let us see how.

Wheat	Spinach
a) 100 g wheat has = 346 Kcal 150 g wheat has = $\frac{346 \times 150}{100}$ = 529 Kcal	a) 100 g spinach has = 26 Kcal 75 g spinach has = $\frac{26 \times 75}{100}$ = 19.50 Kcal
b) 100 g wheat = 4.8 g protein 150 g wheat = $\frac{4.8 \times 150}{100}$ = 7.2 g protein	b) 100 g spinach has = 2 g protein 75 g spinach has = $\frac{2 \times 75}{100}$ = 1.5 g protein
Ans. 150 g wheat has 529 Kcal and 7.2 g protein	75 g spinach has 19.50 Kcal and 1.5 g protein

Similarly, you can use the information given in the table for calculating the nutrient content of any foodstuff in any amount. While doing these calculations, you should also know how to express the values for various nutrients and how to record the results. Let us pay attention to these aspects also.

i) *How to express the values for various nutrients:* By carefully analyzing food composition tables (Annexure 2), you will find that values for some nutrients are expressed in round figures and others till the first decimal place or second decimal place (as shown in the following Chart).

CHART 1

Nutrient	Way to express values	Example
Energy (Kcal)	only in round figures	346 348
Protein (g)	till first decimal place	2.4 20.5
Minerals		
Calcium (mg)	only in round figures	50 45
Iron (mg)	till first decimal place	12.1 10.2
Vitamins		
Vitamin A – beta carotene (μg)	only in round figures	4228 5425
– Retinol (μg)	only in round figures	900 400
Vitamins of the B complex group (mg)	till second decimal place (except folic acid)	0.26 0.23
Vitamin C (mg)	only in round figures	26 13

Do remember that you have to express your results for each nutrient in the same form and same unit as is given in food composition tables or shown in this chart.

While calculating the nutritive value of foodstuffs, you would notice that you may not get results/numerical values in a form expressed in food composition tables or Chart 1. For example, energy content of 75 g spinach came to 19.5 Kcal. However, as you know energy values are expressed in round figures (see Chart 1). You will write that energy content of 75 g spinach is 20 Kcal instead of 19.5 Kcal. Similarly you need rounding off to express the values for other nutrients also, if needed. If iron value

comes to 12.21 mg, you will make it 12.2 mg (till first decimal place). Go through Box 2.1, if you want to know how to round off the numerical values.

Box 2.1 Mathematical Jugglery — Rounding Off the Figures

You must have observed that while doing calculations you often get values/results till second, third or fourth decimal place. You have to round off these values either in round figures/till first decimal place or second decimal place in order to present them in a proper form. Rounding off involves simple mathematical jugglery. You should know how to go about it.

For rounding off, always look at the last digit of the numerical value.

- If it is less than 5, remove the last digit from the numerical value remaining figure remain as it is.
- If the last digit is 5 or more than 5 remove the last digit and increase the second last digit.

Let us try to understand this by the following examples:

A) Rounding off till the second decimal place.

1.025	1.026	1.021
↓	↓	↓
1.03	1.03	1.02

B) Rounding off till the first decimal place.

11.25	11.29	11.21
↓	↓	↓
11.3	11.3	11.2

C) Rounding off to whole (round) figures.

19.2	19.5	19.8
↓	↓	↓
19	20	20

ii) *How to record your results:* In practice all related calculations can be done on a rough page or in the rough column on the same page and results can be presented in tabular form as shown here:

Foodstuff	Amount (g)	Energy (Kcal)	Protein (g)	Other nutrients	Rough column
Wheat	150	529	7.2		$\frac{346 \times 150}{100}$ = 529 Kcal $\frac{4.8 \times 150}{100}$ = 7.2 g protein
Spinach	75	20	1.5		$\frac{26 \times 75}{100}$ = 19.5 Kcal $\frac{2 \times 75}{100}$ = 1.5 g protein

ACTIVITY 2

Calculate the energy, protein, carotene and iron content of the specific amounts of the edible portion of the following foodstuffs:

Rice (g) — 30
Jaggery (g) — 25
Egg (g) — 50
Groundnut (g) — 20
Butter (g) — 80

Foodstuff	Amount (g)	Energy (Kcal)	Protein (g)	Carotene (µg)	Iron (mg)	Rough Column
Rice	30					
Jaggery	25					
Egg	50					
Groundnut	20					
Butter	80					

C) CALCULATION OF THE NUTRIENT CONTENT OF A SNACK OR A DISH

So far you have learnt calculation of nutrient content of foodstuffs. However, the meals you consume do not consist of individual foodstuffs like rice, egg, jaggery, wheat or spinach. Instead, these foodstuffs are a part of various dishes/snacks included in a meal. If you want to calculate the nutritive value of a meal/dish, you will be required to note down each ingredient of a dish/snack and then calculate the nutritive value. Given below is the proforma which you can use for recording your results.

Name of the dish/snack ————————

Ingredients	Amount	Nutrient content		
	(g)	Energy (Kcal)	Protein (g)	Others
1.				
2.				
3.				

ACTIVITY 3

Alka is pregnant. She has been asked by her doctor to eat energy/protein rich snacks (providing at least 200 Kcal energy and 8–10 g protein per serving) in between the main meals. Given below are names (and ingredients) of some snacks gathered by her from the various books/magazines. Using the food composition table calculate the energy and protein content of these snacks and indicate which of them is suitable/not suitable for her.

1) Besan-spinach cheela (besan 40 g, spinach 50 g, onion 30 g, oil 10 g)
2) Bread roll (bread 2 large pieces (60 g), potato 60 g, onion 20 g, oil 10 g).
3) Bread pakora (bread 30 g, besan 20 g, potato 50 g, oil 10 g)

Use the following proforma for recording your results

Name of the dish — Besan spinach cheela

Ingredients	Amount (g)	Energy (Kcal)	Protein (g)
Besan	40		
Spinach	50		
Onion	30		
Oil	10		
Total			

Total energy content ———— Total protein content ————

The dish is suitable/not suitable for Alka (put a ✓ mark against the right choice)

2) Name of the dish — Bread roll

Ingredients	Amount (g)	Energy (Kcal)	Protein (g)
Bread	60		
Potato	60		
Onion	20		
Oil	10		
Total			

Total energy content _____ g. Total protein content _____ g.

The dish is suitable/not suitable for Alka (put a ✓ mark against the right choice).

3) Name of the dish — Bread pakora

Ingredients	Amount (g)	Energy (Kcal)	Protein (g)
Bread	30		
Besan	20		
Potato	50		
Oil	10		
Total			

Total energy content _____ g. Total protein content _____ g.

The dish is suitable/not suitable for Alka (put a ✓ mark against the right choice)

Answer .....

.....

2.3 THINGS WHICH FOOD COMPOSITION TABLES CAN'T TELL

We hope by now you can use food composition tables for finding the nutritive value of any foodstuff mentioned in Annexure 2. However, while making use of the food composition tables you should be aware of the fact that food composition tables have certain limitations also. They cannot tell you all you want to know for meal planning.

Let us see what these limitations are ?

1) You may be surprised to know that the nutrient content of the rice which you bought last year is not exactly similar to the nutrient content of the rice bought this year or to the nutrient content of the samples of rice whose values are given in food composition tables.

There are various factors responsible for these differences — like the variety of plant from which it is obtained, the region where it is grown, type of soil, the method of cultivation used and season in which it is best available.

It means if, you analyse different samples of the same food stuff in a laboratory, you may not get the similar values of protein or vitamin A for all the samples. Although the variation will be negligible in most cases. On the basis of this, you can say that the food composition tables give only the approximate nutrient content of foodstuffs rather than the exact values. As the difference between the exact values and values

given in the tables is not very significant; you can use these tables as such without any modification.

2) When you determine the nutrient content of a dish/or a snack, you calculate only the nutrient content of raw foodstuffs. This is because the food composition tables give only the nutrient content of raw foodstuffs. They do not take into account the losses of various nutrients in cooking and processing. If you find out that raw ingredients of besan–spinach cheela have 12 mg vitamin C, you may not get the same amount after cooking. The losses of the nutrients will depend on the type of method used for cooking (you will learn more about the losses of nutrients in cooking in Section 3).

You should take precautions to prevent the loss of nutrients in pre-preparation as well as cooking. Planning diets/meals on the basis of recommended dietary intakes can also be helpful. You have learnt that recommended dietary intakes have enough margin of safety for nutrient losses. How to make use of food composition tables and RDIs in planning balanced diets is discussed in Sections 5 and 6 of this manual.

3) Remember that the presence of a nutrient in a particular foodstuff does not mean that the body will get it in the same amounts after ingestion. This is because some of the nutrients like calcium, iron, beta carotene, protein, etc. are not completely absorbed in the body. You have learnt about the factors affecting the absorption of these nutrients in Units 4 and 5 of Block 2. The recommended dietary intakes also make allowances for the bioavailability of the particular nutrient in the body after absorption of nutrients. By planning diets/meals/snacks according to recommended dietary intakes, you can take care of this point also.

2.4 SUMMING UP

In this section, you have acquainted yourself with the various aspects of food composition tables. On the basis of the information provided in the section, you can make use of the tables for finding the nutrient value of foodstuffs. A part of food composition tables from the book titled 'Nutritive Value of Indian foods' (1989) is given in Annexure 2. Let us revise all what you have read about the tables.

The tables provide information regarding the energy, protein, vitamin and mineral content of commonly eaten Indian foodstuffs. The values for various nutrients are given only for the 100 g edible portion of raw foodstuffs. The foodstuffs have been classified into three groups : energy-giving foods (cereal, roots and tubers, sugar, fats and oils) ; body-building foods (milk and milk products, pulses, flesh foods, fish and sea foods) ; protective/regulatory foods (leafy vegetables, other vegetables, fruits). In addition, some of the foodstuffs like nuts and oilseeds and condiments/spices are placed in the category of miscellaneous foodstuffs.

All what you have read about the tables can be used for finding the nutritive value of 100 g edible portion of raw foodstuffs. You can also use the tables for finding the nutritive value of foodstuffs in amounts other than 100 g. You have to do simple mathematical calculations, as explained in the section. On this basis, you can also use the food composition tables for finding the nutrient content of a dish/snack or a meal (if you know all the ingredients and their amounts) needed for the preparations.

The section also talks about certain aspects of food composition tables which can be called its limitations. The limitations can be taken care of, if you plan diets/meals/ snacks/according to recommended dietary intakes and select the right method of cooking.

ANNEXURE 2
THE FOOD COMPOSITION TABLES
All Values are per 100 g edible portion of raw foodstuffs

S. No.	Name of the foodstuff	Moisture	Protein	Fat	Fibre	Carbohydrate	Energy	Calcium	Phosphorus	Iron	Vitamin A carotene	Vitamin A Retinol	Thiamine	Riboflavin	Niacin	Folic Acid	Vitamin C
		g	g	g	g	g	Kcal	mg	mg	mg	µg	µg	mg	mg	mg	µg	mg
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
ENERGY-GIVING FOODS																	
Cereals																	
1.	Bajra	12.4	11.6	5	1.2	67.5	361	42	296	8.0	132	0	0.33	0.25	2.3	45.5	0
2.	Barley	12.5	11.5	1.3	3.9	69.6	336	26	215	1.67	10	0	0.47	0.20	5.4	—	0
3.	Bread (wheat White)	39	7.8	0.7	0.2	51.9	245	11	—	1.1	--	—	0.07	—	0.7	—	—
4.	Bread (wheat Brown)	39	8.8	1.4	1.2	49.0	244	18	--	2.2	—	—	0.21	—	2.5	—	—
5.	Jowar	11.9	10.4	1.9	1.6	72.6	349	25	222	4.1	47	0	0.37	0.13	3.1	20	0
6.	Maize, dry	14.9	11.1	3.6	2.7	66.2	342	10	348	2.3	90	0	0.42	0.10	1.8	20.0	0
7.	Maize, tender	67.1	4.7	0.9	1.9	24.6	125	9	121	1.1	32	0	0.11	0.17	0.6	—	6
8.	Ragi	13.1	7.3	1.3	3.6	72	328	344	283	3.9	42	0	0.42	0.19	1.1	18.3	0
9.	Rice, Parboiled hand pounded	12.6	8.5	0.6	—	77.4	349	10	280	2.8	9	0	0.27	0.12	4.0	—	0
10.	Rice, parboiled milled	13.3	6.4	0.4	0.2	79.0	346	9	143	1.0	—	0	0.21	0.05	3.8	11.0	0
11.	Rice, raw hand pounded	13.3	7.5	1.0	0.6	76.7	346	10	190	3.2	2	0	0.21	0.16	3.9	—	0
12.	Rice, raw milled	13.7	6.8	0.5	0.2	78.2	345	10	160	0.7	0	0	0.06	0.06	1.9	8.0	0
13.	Rice, flakes	12.2	6.6	1.2	0.7	77.3	346	20	238	20.0	0	0	0.21	0.05	4.0	—	0
14.	Rice, puffed	14.7	7.5	0.1	0.3	73.6	325	23	150	6.6	0	0	0.21	0.01	4.1	—	0
15.	Wheat, whole	12.8	11.8	1.5	1.2	71.2	346	41	306	5.3	64	0	0.45	0.17	5.5	36.6	0
16.	Wheat flour, whole	12.2	12.1	1.7	1.9	69.4	341	48	355	4.9	29	0	0.49	0.17	4.3	35.8	0
17.	Wheat flour refined	13.3	11.0	0.9	0.3	73.9	348	23	121	2.7	25	0	0.12	0.07	2.4	—	0
18.	Wheat, semolina	--	10.4	0.8	0.2	74.8	348	16	102	1.6	—	—	0.12	0.03	1.6	—	0
19.	Wheat, vermicelli	11.7	8.7	0.4	0.2	78.3	352	22	92	2.0	0	0	0.19	0.05	1.8	—	0
Roots and Tubers																	
20.	Potato	74.7	1.6	0.1	0.4	22.6	97	10	40	0.5	24	0	0.1	0.01	1.2	7.0	17
21.	Sweet potato	68.5	1.2	0.3	0.8	28.2	120	46	50	0.2	6	0	0.08	0.04	0.7	—	24
22.	Tapioca	59.4	0.7	0.2	0.6	38.1	157	50	40	0.9	—	—	0.05	0.1	0.3	—	25
23.	Yam, elephant	78.7	1.2	0.1	0.8	18.4	79	50	34	0.6	260	0	0.06	0.07	0.7	—	0
24.	Yam, ordinary	69.9	1.4	0.1	1.0	26.0	111	35	20	1.2	78	0	0.07	—	0.7	17.5	—
25.	Sago	12.2	0.2	0.2	—	87.1	351	10	10	1.3	—	—	—	—	—	—	—
Sugars																	
26.	Sugar	0.4	0.1	0	—	99.4	398	12	1	0.2	—	—	—	—	—	—	—
27.	Honey	20.6	0.3	0	—	79.5	319	5	16	0.7	—	--	—	—	—	—	—
28.	Jaggery, cane	3.9	0.4	0.1	—	95	383	80	40	2.6	—	—	—	—	—	—	—
29.	Jaggery, coconut Palm	10.3	1.0	0.2	—	83.5	340	1638	62	—	—	—	—	—	—		
30.	Jaggery, date Palm	9.6	1.5	0.3	—	86.1	353	363	62	—	—	—	—	—	—	—	—
31.	Jaggery, fan Palm	8.6	1.0	0.1	—	98.5	359	225	44	—	—	—	—	—	—	—	—
32.	Jaggery, sago Palm	9.2	2.3	0.1	--	84.7	349	1252	372	—	—	—	—	—	—	—	—
Fats and Edible Oils																	
33.	Butter	19	—	81.0	—	—	729	—	—	—	—	960	—	—	—	—	—
34.	Ghee (cow)	--	—	100.0	—	—	900	—	—	—	—	600	—	—	—	—	—
35.	Ghee (buffalo)	—	—	100.0	—	—	900	—	—	—	—	270	—	—	—	—	—
36.	Cooking oil (groundnut, gingelly, palmolein, mustard, coconut etc.)	—	—	100.0	—	—	900	—	—	--	0	0	—	—	—	—	—
37.	Hydrogenated oil	--	—	100.0	—	—	900	—	—	—	—	750	—	—	—	—	—

S. No.	Name of the foodstuff	Moisture	Protein	Fat	Fibre	Carbohydrate	Energy	Calcium	Phosphorus	Iron	Vitamin A carotene	Vitamin A Retinol	Thiamine	Riboflavin	Niacin	Folic Acid	Vitamin C
		g	g	g	g	g	Kcal	mg	mg	mg	µg	µg	mg	mg	mg	µg	mg
	BODY-BUILDING FOODS																
	Milk and milk products																
38.	Milk, buffalo's	81.0	4.3	6.5	—	5.0	117	210	130	0.2	0	48	0.04	0.10	0.1	5.6	1
39.	Milk, cow's	87.5	3.2	4.1	—	4.4	67	120	90	0.2	6	52	0.05	0.19	0.1	8.5	2
40.	Milk, goat's	86.8	3.3	4.5	—	4.6	72	170	120	0.3	0	55	0.05	0.04	0.3	1.3	1
41.	Milk, human	88.0	1.1	3.4	—	7.4	65	28	11	—	0	41	0.21	0.02	—	—	3
42.	Curds, cow's milk	89.1	3.1	4.0	—	3.0	60	149	93	0.2	0	31	0.05	0.16	0.1	12.5	1
43.	Butter milk	97.5	0.8	1.1	—	0.5	15	30	30	0.1	—	—	—	—	—	—	—
44.	Skimmed milk	92.1	2.5	0.1	—	4.6	29	120	90	0.2	—	—	—	—	—	0.1	1
45.	Channa, cow's milk	57.1	18.3	20.8	—	1.2	265	208	138	—	0	110	0.07	0.02	—	—	3
46.	Channa, buffalo's milk	54.1	13.4	23	—	7.9	292	480	277	—	—	—	—	—	—	—	—
47.	Cheese	40.3	24.1	25.1	—	6.3	348	790	520	2.1	0	82	—	—	—	—	—
48.	Khoa, whole buffalo milk	30.6	14.6	31.2	20.5	421	650	420	5.8	—	—	—	—	—	—	—	—
49.	Khoa, cow's milk	25.2	20.0	25.9	—	24.9	413	956	613	—	0	149	0.23	0.41	0.4	—	6
50.	Khoa, skimmed buffalo milk	46.1	22.3	1.6	—	25.7	206	990	650	2.7	—	—	—	—	—	—	—
	Pulses																
51.	Bengal gram, whole	9.8	17.1	5.3	3.9	60.9	360	202	312	4.6	189	0	0.3	0.15	2.9	186	3
52.	Bengal gram, dal	9.9	20.8	5.6	1.2	59.8	372	56	331	5.3	129	0	0.48	0.18	2.4	147.5	1
53.	Bengal gram, roasted	10.7	22.5	5.2	1.0	58.1	369	58	340	9.5	113	0	0.2	—	1.3	139	0
54.	Black gram, dal	10.9	24.0	1.4	0.9	59.6	347	154	385	3.8	38	0	0.42	0.2	2	132	0
55.	Cow pea	13.4	24.1	1.0	3.8	54.5	323	77	414	8.6	12	0	0.51	0.2	1.3	133	0
56.	Green gram, whole	10.4	24.0	1.3	4.1	56.7	334	124	326	4.4	94	0	0.47	0.27	2.1	—	0
57.	Green gram, dal	10.1	24.5	1.2	0.8	59.9	348	75	405	3.9	49	0	0.47	0.21	2.4	140	0
58.	Horse gram, whole	11.8	22.0	0.5	5.3	57.2	321	287	311	6.8	71	0	0.42	0.20	1.5	—	1
59.	Lentil	12.4	25.1	0.7	0.7	59.0	343	69	293	7.6	270	0	0.45	0.20	2.6	36	0
60.	Moth beans	10.8	23.6	1.1	4.5	56.5	330	202	230	9.5	9	0	0.45	1.5	—	2	
61.	Rajmah	12.0	22.9	1.3	4.8	60.6	346	260	410	5.1	—	—	—	—	—	—	—
62.	Red gram, dal	13.4	22.3	1.7	1.5	57.6	335	73	304	2.7	132	0	0.45	0.19	2.9	103	0
63.	Soyabean	8.1	43.2	19.5	3.7	20.9	432	240	690	10.4	426	0	0.73	0.39	3.2	100	—
	Meat and Poultry																
64.	Beef (muscle)	74.3	22.6	2.6	—	—	114	10	190	0.8	0	18	0.15	0.04	6.4	—	2
65.	Buffalo meat	78.7	19.4	0.9	—	—	86	3	189	—	—	—	—	—	—	7.8	—
66.	Egg, duck	71.0	13.5	13.7	—	0.8	181	70	260	2.5	540	360	0.12	0.26	0.2	80	—
67.	Egg, hen	73.7	13.3	13.3	—	—	173	60	220	2.1	600	360	0.1	0.4	0.1	78.3	0
68.	Fowl (chicken)	72.2	25.9	0.6	—	—	109	25	245	—	—	—	—	0.14	—	6.8	—
69.	Goat meat (lean)	74.2	21.4	3.6	—	—	118	12	193	—	—	—	—	—	—	4.5	—
70.	Liver (goat)	76.3	20.0	3.0	—	—	107	17	279	—	—	—	—	—	—	176.2	—
71.	Liver (sheep)	70.4	19.3	7.5	—	1.3	150	10	380	6.3	0	6690	0.36	1.70	17.6	188.0	20
72.	Mutton (muscle)	71.5	18.5	13.3	—	—	194	150	150	2.5	0	9	0.18	1.14	6.8	5.8	—
73.	Pork (muscle)	77.4	18.7	4.4	—	—	114	30	200	2.2	0	0	0.54	0.09	2.8	—	2
	Fish and other sea foods																
74.	Anchovy	69.3	19.3	9.6	—	0.2	164	143	174	1.5	—	—	—	—	—	—	
75.	Bhekti, fresh	79.9	14.9	0.8	—	3.0	79	480	350	3.1	—	—	—	—	0.7	—	10
76.	Bhekti, dried	20.1	60.2	2.0	—	1.8	266	939	347	15.0	—	—	—	—	—	—	
77.	Bombay duck, dried	16.7	61.7	4.0	—	2.5	293	1389	240	19.1	—	—	—	—	—	—	—
78.	Cat fish	77.1	21.4	—	—	—	86	10	230	—	—	—	—	—	2.5	—	—

S. No.	Name of the foodstuff	Moisture	Protein	Fat	Fibre	Carbohydrate	Energy	Calcium	Phosphorus	Iron	Vitamin A carotene	Vitamin A Retinol	Thiamine	Riboflavin	Niacin	Folic Acid	Vitamin C
		g	g	g	g	g	Kcal	mg	mg	mg	µg	µg	mg	mg	mg	µg	mg
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
79.	Crab (muscle)	83.5	8.9	1.1	—	3.3	59	1370	150	21.2	780	0	—	—	3.1	—	—
80.	Crab, small	65.3	11.2	9.8	—	9.1	169	1606	253	—	—	—	—	—	—	—	—
81.	Herring, Indian	72.8	23.3	23.2	—	2.2	119	429	305	9.3	—	—	—	—	—	—	—
82.	Herring, Ox-eyed	73.7	20.7	2.2	—	0.8	106	429	131	6.3	—	—	—	—	—	—	—
83.	Hilsa	53.7	21.8	19.4	—	2.9	273	180	280	2.1	—	—	—	—	2.8	—	24
84.	Indian Whiting	77.1	19.2	0.6	—	1.6	89	71	262	2.2	—	—	—	—	—	—	—
85.	Katla	73.7	19.5	2.4	—	2.9	111	530	235	0.9	—	—	—	—	0.8	—	—
86.	Lobster	77.3	20.5	0.9	—	0	90	16	279	—	—	—	—	—	—	—	—
87.	Mackerel	77.3	18.9	1.7	—	0.5	93	429	305	4.5	—	—	—	—	—	—	—
88.	Mullet	69.9	19.1	7.8	—	2.1	155	357	175	4.4	—	—	—	—	2.6	—	—
89.	Mussel, fresh water	79.5	14.5	1.6	—	2.1	81	592	406	—	—	—	—	—	—	—	—
90.	Oil Sardine	76.5	19.6	2.0	—	0.1	97	357	349	6.1	—	—	—	—	—	—	—
91.	Pomfret, black	74.5	20.3	2.6	—	1.5	111	286	306	2.3	—	—	—	—	—	—	—
92.	Pomfret, white	78.4	17.0	1.3	—	1.8	87	200	290	8.9	—	—	—	0.15	2.6	—	—
93.	Prawn	77.4	19.1	1.0	—	0.8	89	323	278	5.3	0	0.01	0.1	4.8	—	—	—
94.	Rohu	76.7	16.6	1.4	—	4.4	97	650	175	1.0	—	—	0.05	0.07	0.7	—	22
95.	Sardine	78.1	21.0	1.9	—	—	101	90	360	2.5	—	—	—	—	2.6	—	—
96.	Shrimp, small dried	6.0	68.1	8.5	—	—	349	4384	1160	—	—	—	—	—	—	[illegible]	[illegible]
97.	Singhala	61.0	20.9	3.1	—	13.9	167	98	152	1.8	—	—	—	—	—	[illegible]	[illegible]
98.	Surmai, fresh	63.0	19.9	1.4	—	—	92	92	161	2	—	—	—	—	—	—	—
99.	Surmai, dried	43.3	38.6	6.2	—	—	210	148	172	4.4	—	—	—	—	—	—	—
	PROTECTIVE/REGULATORY FOODS																
	Leafy Vegetables																
100.	Amaranth, tender	85.7	4.0	0.5	1.0	6.1	45	397	83	3.5	3520	0	0.03	0.3	1.2	149	90
101.	Bathua leaves	89.6	3.7	0.4	0.8	2.9	30	150	80	4.2	1740	0	0.01	0.14	0.6	—	88
102.	Cabbage	91.9	1.8	0.1	1.0	4.6	27	39	44	0.8	120	0	0.06	0.09	0.04	23	434
103.	Celery leaves	88.0	6.3	0.6	1.4	1.6	37	230	140	6.3	3990	0	0	0.11	1.2	—	62
104.	Colocasia leaves (black variety)	78.8	6.8	2.0	1.8	8.1	77	460	125	1.0	12000	0	0.06	0.48	1.9	—	69
105.	Colocasia leaves (green variety)	82.7	3.9	1.5	2.9	6.8	56	227	82	10	10278	0	0.22	0.26	1.1	—	13
106.	Coriander leaves	86.3	3.3	0.6	1.2	6.3	44	184	71	1.4	6918	0	0.05	0.06	0.8	—	135
107.	Curry Leaves	63.8	6.1	1.0	6.4	18.7	108	830	57	0.9	7560	0	0.08	0.21	2.3	93.9	4
108.	Drumstick leaves	75.9	6.7	1.7	0.9	12.5	92	440	70	0.9	6780	0	0.06	0.05	0.8	—	220
109.	Fenugreek leaves	86.1	4.4	0.9	1.1	6	49	395	51	1.9	2340	0	0.04	0.31	0.8	—	52
110.	Knol Khol greens	86.7	3.5	0.4	1.8	6.4	43	740	50	13.3	4146	0	0.25	—	3.0	—	157
111.	Lettuce	93.4	2.1	0.3	0.5	2.5	21	50	28	2.4	990	0	0.09	0.13	0.5	—	10
112.	Mint	84.9	4.8	0.6	2.0	5.8	48	200	62	15.6	1620	0	0.05	0.26	1.0	114	27
113.	Mustard leaves	89.8	4.0	0.6	0.8	3.2	34	155	26	16.3	2622	0	0.03	—	—	—	33
114.	Parsley	74.6	5.9	1.0	1.8	13.5	87	390	175	17.9	1920	0	0.04	0.18	0.5	—	284
115.	Radish leaves	90.8	3.8	0.4	1.0	2.4	28	265	59	0.1	5295	0	0.18	0.47	0.8	—	81
116.	Spinach	92.1	2.0	0.7	0.6	2.9	26	73	21	1.1	5580	0	0.03	0.26	0.5	123	28
	Other vegetables																
117.	Ash gourd	96.5	0.4	0.1	0.8	1.9	10	30	20	0.8	0	0	0.06	0.01	0.4	—	1
118.	Bitter gourd	92.4	1.6	0.2	0.8	4.2	25	20	70	0.6	126	0	0.07	0.09	0.5	—	88
119.	Bottle gourd	96.1	0.2	0.1	0.6	2.5	12	20	10	0.5	0	0	0.03	0.01	0.2	—	0
120.	Brinjal	92.7	1.4	0.3	1.3	4	24	18	47	0.4	74	0	0.04	0.11	0.9	34	12

S. No.	Name of the foodstuff	Moisture	Protein	Fat	Fibre	Carbohydrate	Energy	Calcium	Phosphorus	Iron	Vitamin A carotene	Vitamin A Retinol	Thiamine	Riboflavin	Niacin	Folic Acid	Vitamin C
		g	g	g	g	g	Kcal	mg	mg	mg	µg	µg	mg	mg	mg	µg	mg
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
121.	Broad beans	85.4	4.5	0.1	2.0	7.2	48	50	64	1.4	9	0	0.08	—	0.8	—	12
122.	Cauliflower	90.8	2.6	0.4	1.2	4.0	30	33	57	1.2	30	0	0.04	0.10	1.0	—	56
123.	Cluster beans	81.0	3.2	0.4	3.2	10.8	16	130	57	1.1	198	0	0.09	0.03	0.6	144	49
124.	Cowpea pods	85.3	3.5	0.2	2.0	8.1	48	72	59	2.5	564	0	0.07	0.09	0.9	—	14
125.	Cucumber	96.3	0.4	0.1	0.4	2.5	13	10	25	0.6	0	0	0.03	0	0.2	14.7	7
126.	Double beans	73.8	8.3	0.3	4.3	12.3	85	40	140	2.3	—	—	—	—	—	—	22
127.	Drumstick	86.9	2.5	0.1	4.8	3.7	26	30	110	0.2	110	0	0.05	0.7	0.2	—	120
128.	Drumstick flowers	85.9	3.6	0.8	1.3	7.1	50	51	90	—	—	—	—	—	—	—	—
129.	Field beans, tender	86.1	3.8	0.7	1.8	6.7	48	210	68	0.8	187		0.10	0.06	0.7	—	9
130.	French beans	91.4	1.7	0.1	1.8	4.5	26	50	28	0.6	132	0	0.08	0.06	0.3	45.5	24
131.	Capsicum	92.4	1.3	0.3	1.0	4.3	24	10	30	0.6	427	0	0.55	0.05	0.1	—	137
132.	Jack tender	84.0	2.6	0.3	2.8	9.4	51	30	40	1.7	0	0	0.05	0.04	0.2	—	14
133.	Knol khol	92.7	1.1	0.2	1.5	3.8	21	20	35	1.5	21	0	0.05	0.09	0.5	—	85
134.	Ladies finger	89.6	1.9	0.2	1.2	6.4	35	66	56	0.4	52	0	0.07	0.1	0.6	105.1	13
135.	Lotus stem, dry	9.5	4.1	1.3	25.0	51.4	234	405	128	60.6	0	0	0.82	1.21	1.9	—	3
136.	Mango, green	87.5	0.7	0.1	1.2	10.1	44	10	19	0.3	90	0	0.04	0.01	0.2	—	3
137.	Onion stalk	87.6	0.9	0.2	1.6	8.9	41	50	50	7.4	595	0	0	0.03	0.3	—	17
138.	Parwar	92.0	2.0	0.3	3.0	2.2	20	30	40	1.7	153	0	0.05	0.06	0.5	—	29
139.	Plantain (green)	83.2	1.4	0.2	0.7	14.0	64	10	29	6.3	30	0	0.05	0.02	0.3	16.4	24
140.	Plantain (flower)	89.9	1.7	0.7	1.3	5.1	34	32	42	1.6	27	0	0.05	0.02	0.4	—	16
141.	Pumpkin	92.6	1.4	0.1	0.7	4.6	25	10	30	0.4	50	0	0.06	0.04	0.5	13.0	2
142.	Ridge gourd	95.2	0.5	0.1	0.5	3.4	17	18	26	0.4	33	0	—	0.1	0.2	—	5
143.	Snake gourd	94.6	0.5	0.3	0.8	3.3	18	26	20	1.5	96	0	0.04	0.06	0.3	15.5	9
144.	Tinda, tender	93.5	1.4	0.2	1.0	3.4	21	25	24	0.9	13	0	0.04	0.08	0.8	—	18
145.	Vegetable marrow	94.8	0.5	0.1	0.8	3.5	17	10	30	0.6	—	—	0.02	0	0.4	—	18
146.	Tomato	94.0	0.9	0.2	0.8	3.6	20	48	20	0.6	351	0	0.12	0.06	0.4	30	27
	Fruits																
147.	Amla	81.8	0.5	0.1	3.4	13.7	58	50	20	1.2	9	0	0.03	0.01	0.2	—	600
148.	Apple	84.6	0.2	0.5	1.0	13.4	59	10	14	0.7	0.9	0	—	—	0	—	1
149.	Apricot, fresh	85.3	1	0.3	1.1	11.6	53	20	25	2.2	2160	0	0.04	0.13	0.6	—	6
150.	Apricot, dry	19.4	1.6	0.7	2.1	73.4	306	110	70	4.6	58	0	0.22	—	2.3	—	2
151.	Bael fruit	61.5	1.8	0.3	2.9	31.8	137	85	50	0.6	55	0	0.13	0.03	1.1	—	8
152.	Banana, ripe	70.1	1.2	0.3	0.4	27.2	116	17	36	0.4	78	0	0.05	0.08	0.5	—	7
153.	Cape gooseberry	82.9	1.8	0.2	3.2	11.1	53	10	67	2	1428	0	0.05	0.02	0.3	—	49
154.	Cherries (red)	83.4	1.1	0.5	0.4	13.8	64	24	25	0.6	0	0	0.08	0.08	0.3	—	7
155.	Currants (black)	18.4	2.7	0.5	1.0	75.2	316	130	110	8.5	21	0	0.03	0.14	0.4	—	1
156.	Dates (dried)	15.3	2.5	0.4	3.9	75.8	317	120	50	7.3	26	0	0.01	0.02	0.9	—	3
157.	Dates (fresh)	59.2	1.2	0.4	3.7	33.8	144	22	38	1.0	—	—	—	—	—	—	—
158.	Grapes (blue variety)	82.2	0.6	0.4	2.8	13.1	58	20	23	0.5	3	0	0.04	0.03	0.2	—	1
159.	Grapes (pale variety)	79.2	0.5	0.3	2.9	16.5	71	20	30	0.5	0	0	—	—	0	—	1
160.	Grape fruit (triumph)	92	0.7	0.1	—	7	32	20	20	0.2	—	0	0.12	0.02	0.3	—	31
161.	Guava (country)	81.7	0.9	0.3	5.2	11.2	51	10	28	0.3	0	0	0.03	0.03	0.4	—	212
162.	Guava (hill)	85.3	0.1	0.2	4.8	9	38	50	20	1.2	0	0	0.02	0.02	0.3	—	15
163.	Jackfruit:	76.2	1.9	0.1	1.1	19.8	88	20	41	0.6	175	0	0.03	0.13	0.4	—	7
164.	Lemon	85.0	1.0	0.9	1.7	11.1	57	70	10	0.3	0	0	0.02	0.01	0.1	—	39
165.	Lemon (sweet)	90.5	0.7	0.3	0.7	.3	35	30	20	0.7	—	—	—	0.04	0	—	45

S. No.	Name of the foodstuff	Moisture	Protein	Fat	Fibre	Carbohydrate	Energy	Calcium	Phosphorus	Iron	Vitamin A carotene	Vitamin A Retinol	Thiamine	Riboflavin	Niacin	Folic Acid	Vitamin C
		g	g	g	g	g	Kcal	mg	mg	mg	µg	µg	mg	mg	mg	µg	mg
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
165.	Lichi	84.1	1.1	0.2	0.5	13.6	61	10	35	0.7	0	0	0.02	0.06	0.4	—	31
167.	Lime	84.6	1.5	1.0	1.3	10.9	59	90	20	0.3	15	0	0.02	0.03	0.1	—	63
168.	Lime (sweet, malta)	90.3	8.7	0.2	0.6	7.8	36	30	20	1.0	0	0	—	—	0	—	54
169.	Lime (sweet, Musambi)	88.4	0.8	0.3	0.5	9.3	43	40	30	0.7	0	0	—	—	0	—	50
170.	Loquat	88.2	0.60	0.3	0.8	9.6	43	30	20	1.3	559	0	—	—	0	—	0
171	Mango (ripe)	81.0	0.6	0.4	0.7	15.9	74	14	16	1.3	2743	0	0.08	0.09	0.9	—	16
172.	Melon musk	95.2	0.3	0.2	0.4	3.5	17	32	14	1.4	169	0	0.11	0.08	0.3	—	36
173.	Melon water	95.8	0.2	0.2	0.22	3.3	16	11	12	7.9	0	0	0.02	0.04	0.1	—	1
174.	Mulberry	86.5	1.1	0.4	1.1	10.3	49	70	30	2.3	57	0	0.04	0.13	0.5	—	13
175.	Orange	87.6	0.7	0.2	0.3	10.9	48	26	20	0.3	1104	0	—	—	—	—	30
176.	Orange Juice	97.7	0.2	0.1	—	1.9	9	5	9	0.7	15	0	0.06	0.02	0.4	—	64
177.	Papaya	90.8	0.6	0.1	0.8	7.2	32	17	13	0.5	666	0	0.04	0.25	0.2	—	57
178.	Peaches	86.0	1.2	0.3	1.2	10.5	50	15	41	2.4	0	0	0.02	0.03	0.5	—	6
179.	Pears	86.0	0.6	0.2	1.0	11.9	52	8	15	0.5	28	0	0.06	0.03	0.2	—	0
180.	Phalsa	80.8	1.3	0.9	1.2	14.7	72	129	39	3.1	419	0	—	—	0.3	—	22
181.	Pineapple	87.8	0.4	0.1	0.5	10.8	46	20	9	2.4	18	0	0.2	0.12	0.1	—	39
182.	Plum	86.9	0.7	0.5	0.4	11.1	52	10	12	0.6	166	—	0.04	0.1	0.3	—	5
183.	Pomegranate	78.0	1.6	0.1	5.1	14.5	65	10	70	1.8	0	0	0.06	0.1	0.3	—	16
184.	Raisins	20.2	1.8	0.3	1.1	74.6	308	87	80	7.7	2.4	0	0.07	0.19	0.7	—	1
185.	Raspberry	84.8	1.0	0.6	1.0	11.7	56	40	110	2.3	1248	0	—	—	0.8	—	30
186.	Sapota	73.7	0.7	1.1	2.6	21.4	98	28	27	1.3	97	0	0.02	0.03	0.2	—	6
187.	Strawberry	87.8	0.7	0.2	1.1	9.8	44	30	30	1.8	18	0	0.03	0.02	0.2	—	52
	MISCELLANEOUS																
	Nuts and Oilseeds																
188.	Almond	5.2	20.8	58.9	1.7	10.5	655	230	490	5.1	0	0	0.24	0.57	4.4	—	0
189.	Cashewnut	5.9	21.2	46.9	1.3	22.3	596	50	450	5.8	60	0	0.63	0.19	1.2	—	0
190.	Chilgoza	4.0	13.9	49.3	1.0	29.0	615	91	494	3.6	—	—	0.32	0.3	3.6	—	0
191.	Coconut dry	4.3	6.8	62.3	6.6	18.4	662	400	210	7.8	0	0	0.08	0.01	3.0	16.5	1
192.	Coconut fresh	36.3	4.5	41.6	3.6	13.0	444	10	240	1.7	0	0	0.05	0.10	0.8	12.8	1
193.	Cocoput tender	90.8	0.9	1.4	—	6.3	41	10	30	0.9	—	—	—	—	—	—	—
194.	Coconut milk	42.8	3.4	41.0	0	11.9	430	15	140	1.6	0	0	0.08	0.04	0.6	—	3
195.	Coconut water	93.8	1.4	0.1	0	4.4	24	24	10	0.1	0	0	0.01	0	0.1	—	3
196.	Gingelly seeds	5.3	18.3	43.3	2.9	25.0	563	1450	570	9.3	60	0	1.01	0.34	4.4	100	0
197.	Groundnut	3.0	25.3	40.1	3.1	26.1	567	90	350	2.5	37	0	0.90	0.13	19.9	30	0
198.	Groundnut roasted	1.7	26.2	39.8	3.1	26.7	570	77	370	3.1	0	0	0.39	0.13	22.1	—	0
199.	Mustard seeds	8.5	20.0	39.7	1.8	23.8	541	490	700	7.9	162	0	0.65	0.26	4.0	—	0
200.	Pistachio nut	5.6	19.8	53.5	2.1	16.2	626	140	430	7.7	144	0	0.67	0.28	3.3	—	—
201.	Walnut	4.5	15.6	64.5	2.6	11.0	687	100	380	2.6	6	0	0.45	0.40	1.9	—	0
202.	Watermelon seeds	4.3	34.1	52.6	0.8	4.5	628	100	937	7.4	—	—	—	—	—	—	—
	Condiments and spices																
203.	Asafoetida	16.0	4.10	1.1	4.1	67.8	297	690	50	39.4	4	0	0	0.04	0.3	—	0
204.	Cardamom	20.0	10.2	2.2	20.1	42.1	229	130	160	4.6	0	0	0.22	0.17	0.8	—	0
205.	Chillies, dry	10.0	15.9	6.2	30.2	31.6	246	160	370	2.3	345	0	0.93	0.43	9.5	—	90
206.	Chillies, green	85.7	2.9	0.6	6.8	3.0	29	30	80	4.4	175	0	0.19	0.39	0.9	29	119
207.	Cloves, dry	25.2	5.2	8.9	9.5	46.0	286	740	100	11.7	253	0	0.08	0.13	0	—	0
208.	Coriander	11.2	14.1	16.1	32.6	21.6	288	630	393	7.1	942	0	0.22	0.35	1.1	32	0
209.	Cumin seeds	11.9	18.7	15.0	12.0	36.6	356	1080	511	11.7	522	0	0.55	0.36	2.6	—	7

210. Fenugreek	13.7	26.2	5.8	7.2	44.1	333	160	370	6.5	96	0	0.34	0.29	1.1	84
211. Garlic, dry	62.0	6.3	0.1	0.8	29.8	145	30	310	1.2	0	0	0.06	0.23	0.4	—
212. Ginger, fresh	80.9	2.3	0.9	2.4	12.3	67	20	60	3.5	40	0	0.06*	0.03	0.6	—
213. Mango powder	6.8	2.8	7.8	13.7	64.0	337	180	16	45.2	—	—	—	—	—	—
214. Nutmeg fruit	14.3	7.5	36.4	11.6	28.5	472	120	240	2.0	0	0	0.33	0.01	1.4	—
215. Omum	7.4	17.1	21.8	21.2	24.6	363	1525	443	12.5	71	0	0.21	0.28	2.1	—
216. Pepper, dry (black)	18.2	11.5	6.8	14.9	49.2	304	460	198	12.4	1080	0	0.09	0.14	1.4	—
217. Tamarind pulp	20.9	3.1	0.1	5.6	67.4	283	170	110	17	60	0	—	0.07	0.7	—
218. Turmeric	13.1	6.3	5.1	2.6	69.4	349	150	282	67.8	30	0	0.03	0	2.3	18.0

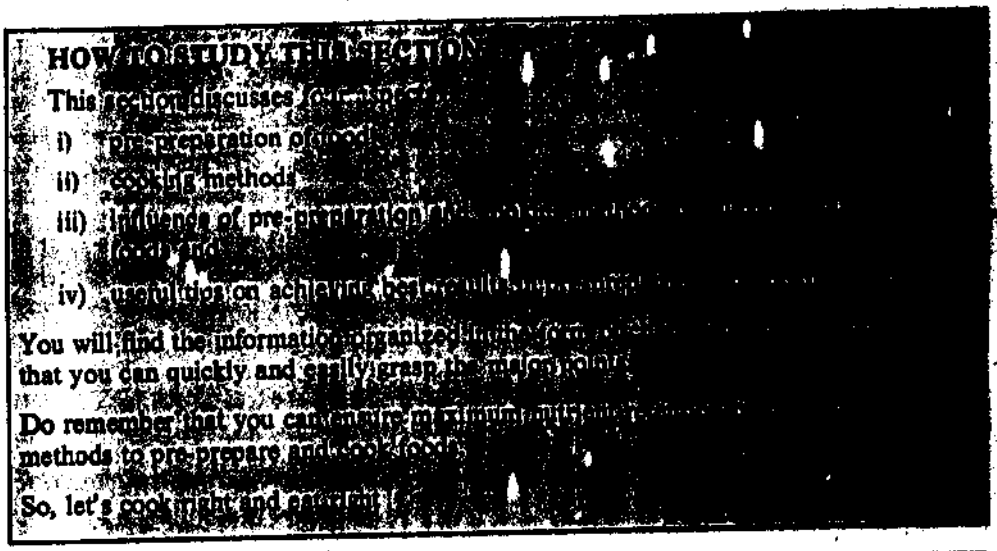
Source : Nutritive value of Indian Foods by C. Gopalan, B.V. Rama Sastri, S.C. Balasubramanian, revised and updated by B.S. Narasinga Rao, Y.G. Deosthale and K.C. Pant, NIN, 1989.

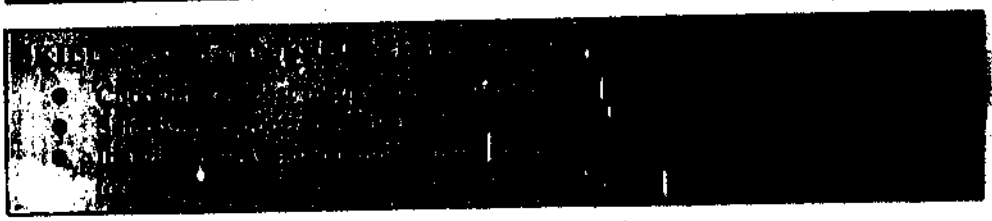
Note : Indication (–) here means -- Values not found
Indication (0) here means – does not contain any.

SECTION

3

METHODS OF COOKING





Structure

3.0 INTRODUCTION

Savita is preparing idlis. She first soaks rice and urad dal (black gram) separately overnight. The next morning she grinds them separately, mixes the ground rice and dal and keeps it aside to ferment. And last of all she pours the fermented batter into idli moulds and steams it. The most spongy and soft idlis are ready!

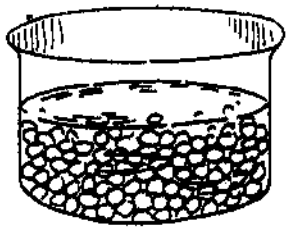
Can you list the processes involved from start to finish? Yes, of course. They are :

- Soaking
- Grinding
- Mixing
- Fermenting
- Steaming

Now which are pre-preparation methods and which cooking methods? Soaking, grinding, mixing and fermenting are done prior to cooking. They are hence examples of pre-preparation methods. Steaming is, of course, a cooking method.

Let us talk about these and other pre-preparation and cooking methods in the following subsections.

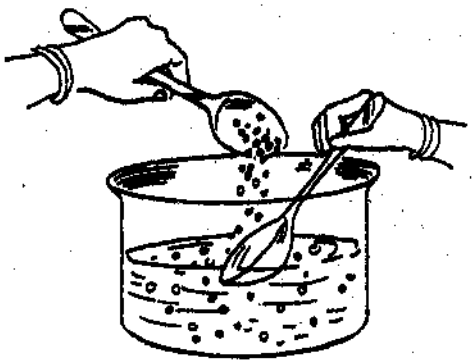
CUTTING



SOAKING

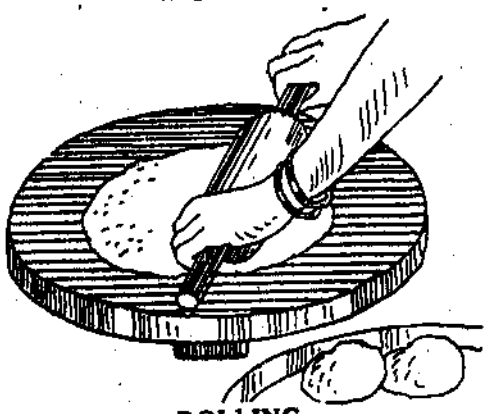
GRINDING

POUNDING

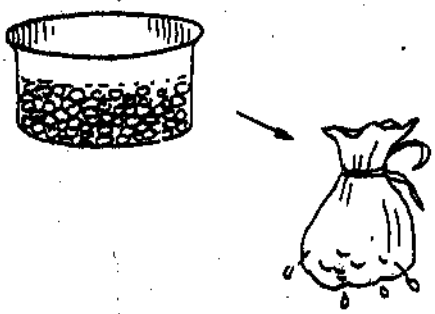


MIXING

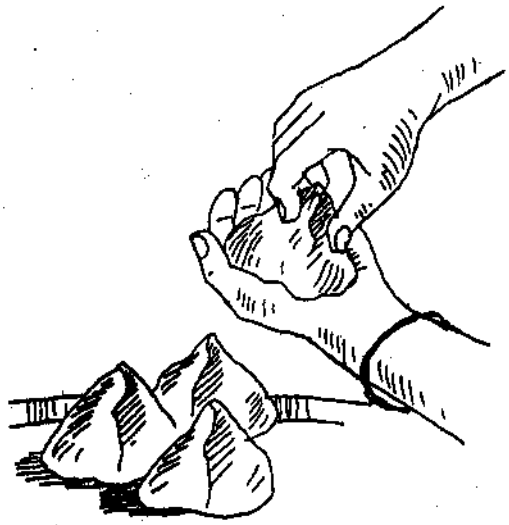
PEELING



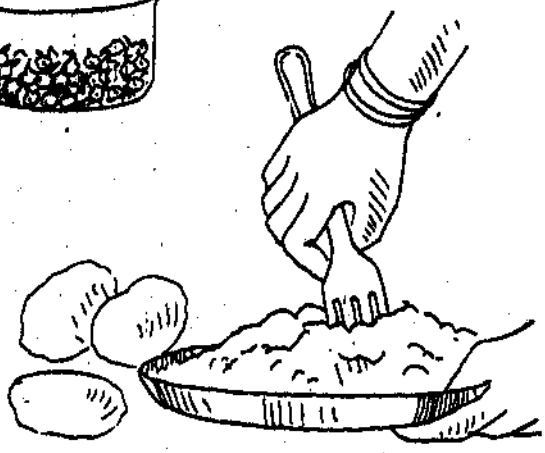
ROLLING



SPROUTING



MOULDING

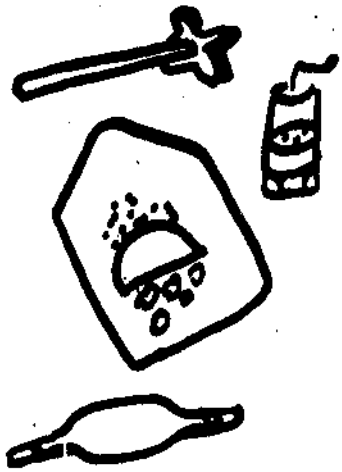


MASHING

3.1 CHECKING OUT THE PRE-PREPARATION METHODS

India is a land of rich diversity. Cooking is just one expression of this diversity. We prepare a host of delicious dishes each typical of a particular region and its people. But if we think for a moment about the processes we carry out before cooking we can prepare a list like this:

i) Peeling
ii) Cutting (including slicing, chopping, dicing)
iii) Grating
iv) Pounding
v) Grinding
vi) Soaking
vii) Sprouting
viii) Fermenting
ix) Mixing (including kneading)
x) Mashing
xi) Rolling
xii) Moulding



If you think a little you might be able to add some more. Further, you might have noticed that each region has its own typical equipment for these procedures. It is amazing, isn't it? From the rolling stones and rolling pins typical of the north to the paddle-like mixers in the South. From grinding stones to the mortar and pestle used for pounding! We also have the typical moulds which give us so many interesting designs for fried savoury snacks such as chakli, murukku and steamed preparations such as idiappam.

One question that you might like to ask could be—how do these methods influence cooking? Very often particular pre-preparation methods are necessary for making a particular dish. We cannot make poories without kneading the dough and rolling it out before frying. Similarly, we cannot make chutneys without grinding and mixing. In fact these pre-preparation procedures make it easier to use a particular cooking method.

Another major influence is the role of pre-preparation in making cooking faster. What would happen if we do not cut and chop foods before cooking? The finer we cut, the faster the cooking. Ground foods cook very rapidly indeed. But there are disadvantages too as the following chart will show you.

Pre-preparation method	Extent of nutrient losses
Peeling	Thin peels, less loss
Cutting	Thinner and smaller pieces, more loss
Grating	Finer pieces, more loss
Grinding	Finer particles, more loss
Soaking	Longer time and more water, more loss

You already know that certain vitamins are very susceptible to destruction when exposed to air such as vitamin C. So procedures like *peeling, cutting, grating and grinding all influence vitamin C content in particular because the foodstuff is exposed to air.* Other nutrients are generally not influenced. In peeling, of course, a part of the food is discarded. The nutrients present in the discarded portion would, therefore, also be lost.

Soaking is a procedure that can greatly influence nutrient content. *The longer we soak a food item the more the water-soluble vitamins and minerals leach (move) out of the food and enter the soaking water.* So we should soak only as long as

necessary. Nutrient losses due to soaking can be minimized if we use the same water for subsequent cooking. For example if we soak rice and then cook it in the same water nutrients would be conserved rather than wasted. Now, that's easy to do, isn't it?

Processes like pounding and mixing do not lower nutrient content to any significant extent.

As you learnt earlier in Block 2 there are pre-preparation procedures that add nutrients to food. These procedures are sprouting and fermenting.

Pre-preparation process	Nutrient added
Sprouting	Vitamin C, B vitamins
Fermentation	B vitamins

You are probably familiar with several sprouted foods such as sprouted pulses and cereal grains and fermented foods such as the mixtures used for making bread, bhatura, idli, dosa, dhokla. In fact curd is also a fermented food.

ACTIVITY 1

a) Which pre-preparation procedures do you use at home?

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.....

b) On the basis of what you have learnt would you try to change some of the practices you adopt?

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c) Do you include sprouted or fermented foods in your diet? Describe one sprouted and one fermented dish commonly consumed in your region.

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3.2 WHAT'S COOKING?

Food and cooking are central themes in any culture. We know that food is often an expression of our identity. But have you ever wondered or asked yourself the question — why do we cook? You might come up with answers like:

- To make food more palatable and tasty
- To help chewing
- To make food look attractive and improve the appetite
- To introduce variety.

These are in fact the reasons we think of on the basis of our experience and common sense. In addition to these there are certain specific advantages of cooking food:

i) Cooking makes food easy to digest
ii) Cooking destroys harmful micro-organisms like bacteria in food which can cause disease.

Cooking methods generally use heat to bring about the desired results. So heat is a common feature as you see in the following chart which describes the main types of cooking methods.

	Moist Heat	Dry Heat	Dry Heat (Heated Fat or Oil as Medium)
Description	Methods using hot water or steam to cook a food	Methods using hot air or direct contact of food with a hot surface	Methods using hot fat or oil to cook foods
Examples	Boiling Simmering Blanching Steaming Pressure Cooking Poaching Stewing	Roasting Grilling and Toasting Baking	Sauteing Frying

You may be familiar with most of these cooking methods. But you may find a few terms unfamiliar. Read through the following ready reference if you have any doubts.

1) Boil : To cook in a liquid at the boiling point. The boiling point is the temperature at which the liquid is hot enough to bubble and steam.

2) Simmer : To cook in a liquid at temperatures below the boiling point. Usually liquid is brought to a boil and the flame reduced.

3) Blanch : To partially cook by dipping in boiling water for a few seconds to two minutes. We remove the skin of tomatoes and almonds by blanching.

4) Steam : To cook food inside a metal basket or another holder containing holes over boiling water. We steam idlis, dhokla and idiappam.

5) Pressure Cook : To cook foods by steaming (heating) under high pressure. Increasing pressure increases the temperature at which water boils. This means water will boil at a higher temperature in a pressure cooker.

6) Poach : To cook in hot liquid usually below boiling point taking care to retain shape. We poach eggs in hot water. We can also poach fish, fruits.

7) Stew : To cook in a small amount of liquid in a covered container.

8) Roast : To cook food by placing it in direct contact with the heat source. Fat or oil is smeared on the food at intervals while it is roasted to help even cooking. The heat source may be live coals, an oven or tandoor. Sometimes food items are roasted in a metal karhai e.g. suji, chana dal.

9) Grill : To cook food by placing on a metal grill over the source of heat. When bread is browned over a grill or on live coals the method is called toasting.

10) Bake : To cook using equipment such as an oven or tandoor in which hot air circulates. We bake biscuits, bread, cookies and cakes.

11) Saute : To cook by tossing food in a small amount of fat. Sauteing is often followed by some other method of cooking. We saute onions, tomatoes and other vegetables.

12) **Fry** : To cook in hot fat. When foods are partially immersed in hot fat, the method is called shallow frying. When foods are completely immersed, the method is called deep frying.

Read this list a couple of times to familiarize yourself with the cooking methods. Next we must try to understand the advantages and disadvantages of various cooking methods.

PLUS POINTS OF COOKING METHODS

- Grilling, frying, pressure cooking help rapid cooking.
- Frying and steaming introduce different textures. So do roasting, grilling and baking.
- Stewing gives a delicate flavour.
- Pressure cooking and steaming conserve nutrients.
- Steaming makes food light and more digestible.

MINUS POINTS OF COOKING METHODS

- Frying and roasting need continuous and careful attention to prevent burning.
- Frying and roasting add a lot of fat and therefore calories.
- Boiling takes time ; so does stewing.
- Frying cuts down on vitamins which are destroyed by heat e.g. vitamin C, vitamin A. So do roasting, grilling and baking.
- Moist heat methods involve loss of water-soluble vitamins particularly if excess water is used and the extra drained off.

It would be of great benefit to us if we could use this information to select the right types of cooking methods for different kinds of food items. The following check list can help.

Description of food items	Example	Suitable cooking methods
I. Tough, difficult-to-cook foods (i.e. foods that take a long time to cook)	Tough meats, including chicken, tougher fibrous vegetables, potatoes, rice	Pressure cooking Boiling, Simmering and Stewing
II. Tender foods	Tender meat or fish, some vegetables	Frying Grilling Baking
III. Other foods	Vegetables, potatoes Bread	Frying (cutlets) Grilling Baking Toasting Grilling

ACTIVITY 2

Here are three dishes one each from Kashmir, Gujarat and Andhra Pradesh (Hyderabad). Underline all terms used in the recipe to indicate pre-preparation or cooking methods. Use a dotted line for pre-preparation methods (. . . . .) and a solid line (_____) for cooking methods as indicated.

DUM GOSHT (Kashmir)

Ingredients : Mutton (meat), poppy seeds, ginger, garlic, almonds, peppercorns (whole pepper), cardamom, cinnamon, cumin seeds, turmeric powder, green papaya, coriander leaves, salt, ghee.

Method : Chop mutton into pieces. Roast poppy seeds and almonds and grind to a paste. Grind ginger and garlic to a paste. Grind cardamom, pepper, papaya and coriander leaves with salt to taste. Wash meat and beat on a grinding stone. Mix ground masala with poppy seed paste, cinnamon sticks, cumin seeds and keep meat pieces covered with this mixture for an hour. Heat ghee in a frying pan, add meat pieces and fry for a few minutes. Add water, simmer gently till cooked.

OSAMAN (Gujarat)

Ingredients: Tur (arhar) dal, jaggery, tamarind, chilli powder, cloves, cinnamon, ginger, green chillies, curry leaves, coriander leaves, mustard seeds, cumin seeds, salt, oil.

Method: Pressure cook the dal with water and turmeric powder. Drain off the water from the dal into another vessel. Add salt, jaggery to taste and tamarind juice to the water drained off from the dal. Allow to simmer on a low fire for a few minutes. Add green chillies and chopped ginger. Heat a little oil, add cloves, cinnamon and curry leaves. Fry well and temper curry with this. Add chopped coriander leaves and serve hot.

SHIKAMPURI KABAB (Hyderabad, Andhra Pradesh)

Ingredients: Minced meat, bengal gram dal, cumin seeds, garam masala powder, chilli powder, ginger, egg, a lime, salt, ghee.

Method: Cook the minced meat with spices by simmering. Beat egg. Add half the quantity of beaten egg and lime juice to minced meat and grind to a fine paste. Chop the rest of the ingredients for the filling, mix together with cooked dal and keep aside. Divide the meat mixture into even sized portions. Shape each portion into a flat kabab. Place a little of the filling in the centre of each kabab and seal well on all sides. Heat a tawa and fry well on both sides, using ghee, until golden brown in colour. Serve hot with mint chutney, slices of fresh lime and onion.

3.3 NUTRIENTS: STILL THERE OR ALL GONE?

Cooking influences the nutrients in foods. The method of cooking and the degree of cooking can decide whether nutrients are conserved or destroyed.

Let us take a quick look at what cooking does to proteins, carbohydrates, fats, vitamins and minerals.

Protein → Heat → Coagulated protein

Influence of cooking on proteins

Proteins harden and solidify or *coagulate* on cooking. Have you noticed the changes when frying an egg? The liquid sets on heating and becomes solid. This is the process of coagulation. However, milk protein is an exception. Unlike other proteins it does not coagulate. It is important to cook proteins to the right extent because *proteins shrink and harden on overcooking.* This also renders them indigestible.

Lysine + Sugar → Indigestible complex

Excessive heating of foodstuffs also affects the nutritive value of proteins. Sugars like glucose and lactose form complexes with amino acids like lysine. These complexes cannot be broken down by the protein-digesting enzymes. The result, of course, is that these amino acids are no longer available to the body.

Some pulses like soyabean and bengal gram contain certain substances which hinder the digestion of the proteins of these foods by the enzyme trypsin present in our intestines. During cooking these *trypsin inhibitors* are destroyed. This is why it becomes important not to consume these foods raw. In fact, the digestibility of protein in several foods improves as a result of moderate heating as in day-to-day cooking.

Influence of cooking on carbohydrates

STARCH → Dextrinization (on dry heating)

On cooking, the starch granules in foods swell as they absorb water. This process is called gelatinization and is in fact the reason for the thickening of soups, curries, stews to which maida (refined flour) paste is added. *Gelatinization* takes place in all starch-containing foods such as potatoes on heating in the presence of moisture. Dry heat causes the starches to break down into smaller molecules called *dextrins.* This happens, for example, in the toasting of bread or making of chapatis or rotis. Dextrins have a mildly sweet flavour.

STARCH → Gelatinization (on moist heating)

Sugar behaves quite differently. As you heat table sugar it forms a syrup with water. On further cooking the syrup thickens and changes colour. This is due to a process called *caramelization.* The brown, thick liquid formed is called caramel and is used in a number of preparations such as custard, cakes. Ordinary cooking causes little loss of carbohydrates.

Influence of cooking on fats

As in the case of carbohydrates our usual cooking practices do not influence fats to any great extent. They are easily available to the body.

What change do you notice when you heat a fat or oil? The temperature rises uptil a point when the fat or oil appears to 'smoke'. This temperature is, in fact, called the smoking point and varies from one fat/oil to another. You should not heat the fat much more than this before putting in the foodstuffs to be fried. Otherwise the fat can catch fire!

However, fats used repeatedly for frying get broken down to form certain harmful substances. The practice of repeated re-heating of fats should therefore be avoided.

Influence of cooking on vitamins and minerals

The water-soluble vitamins and minerals dissolve in the liquid used for soaking and cooking. This is called leaching. If the soaking or cooking water is thrown away there will be considerable losses of vitamin C, B vitamins, sodium, potassium and chloride.

It is therefore important to use the minimum of water or to utilize the liquid used for cooking in soups or curries. Steaming and pressure cooking limit cooking losses due to leaching. Boiling roots and tubers with their skins is the best. This seals in the nutrients.

Vitamin C's enemies
- Heat
- Air (oxygen)

Cutting and peeling influence the extent of losses as you learnt earlier in the subsection on pre-preparation methods. Do you recall the main points? Remember to peel thinly and to cut vegetables in moderate sizes or larger pieces to prevent excessive losses.

We must also mention cooking practices in preparing rice. It is common to wash rice three or four times with large amounts of water. This can sharply decrease the content of B vitamins. Rice of poor quality, of course, requires more washing. Vitamins, particularly thiamine and niacin, can be lost to the extent of 40 per cent. Throwing away the excess cooking water also means throwing away nutrients as you would have realized by now.

Two vitamins — Vitamin C and thiamine – fear the heat with good reason! Both are destroyed on heating. Vitamin C has another enemy — air and the oxygen it contains. The vitamin is easily oxidized on exposure to air and in this oxidized form is of no use to the body. This means we should not peel vegetables or fruits much before use. We should cut them into larger sized pieces.

Thiamine's enemies
- Heat
- Soda

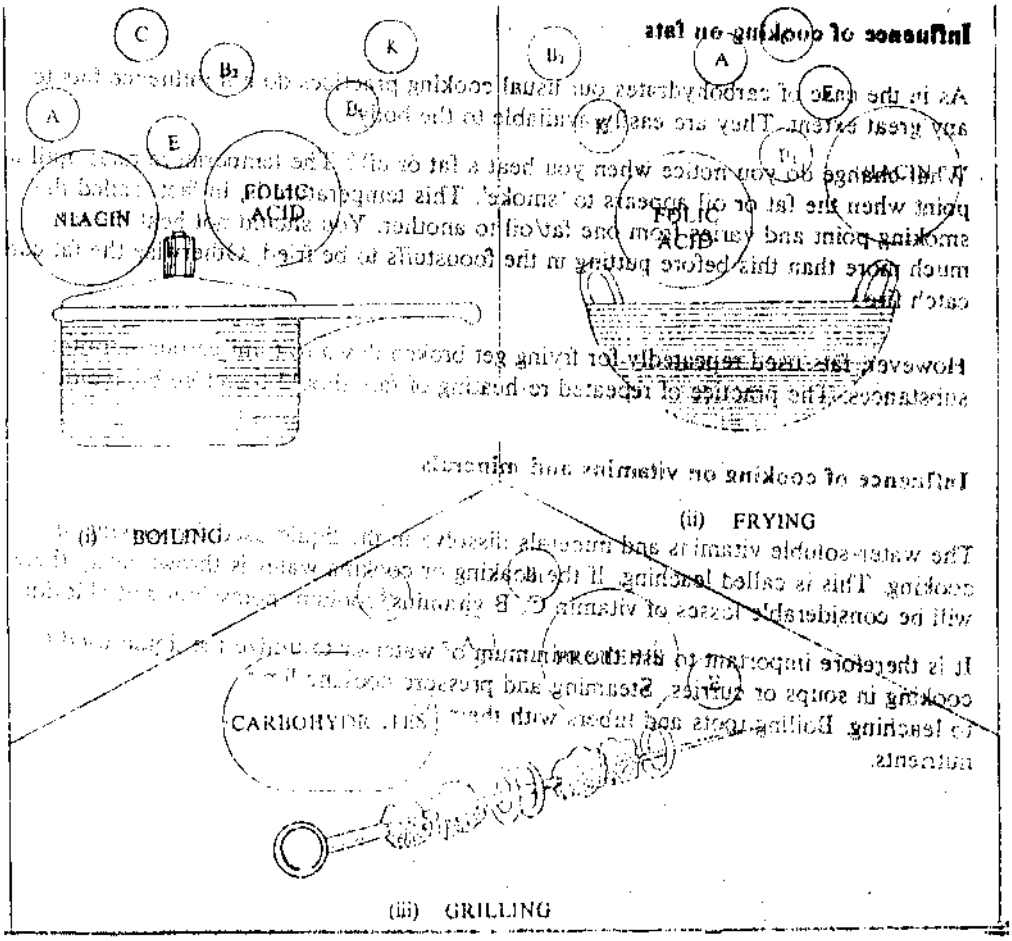
Many of us add sodium bicarbonate (soda bicarb) when cooking pulses. Do you know that soda facilitates cooking but knocks out the thiamine as well? This is absolutely true. Thiamine is easily destroyed in the presence of soda which is alkaline.

On the other hand, an acidic medium (e.g. medium with tamarind, tomatoes) preserves vitamins. Acid is a particular friend of vitamin C.

Fat-soluble vitamins are, however, a class apart. They are not affected to any great extent by cooking in water. But during shallow frying or roasting vitamin A is lost in significant amounts. In deep frying cooking time is short and losses tend to be less.

ACTIVITY 3

The following figures represent different methods of cooking. Shade the circles corresponding to the nutrient or nutrients that you think will be lost to a greater extent for each of the cooking methods. The letters A, C, E, B are of course, referring to the vitamins.



3.4 USEFUL COOKING TIPS

We often ask ourselves questions about the best kind of cooking method and how to get the best results with one particular method. A quick glance at this discussion should help you. Let's begin with boiling.

Boiling

- Pour in just enough water to cover the food. You can replenish the water if too much evaporates.
- Add vegetables to boiling water.
- Cook covered to avoid evaporation and speed up cooking. The lid should be tight fitting!
- Turn down the flame once water boils and allow it to simmer till the food is cooked.

Remember that pressure cooking is far better than boiling. It helps to retain nutrients and is faster too.

Steaming

- Allow water to boil in the double-boiler or steamer before the vessel containing food is placed over it.
- Replenish water in the steamer. Don't allow it to dry out.
- Use a pan with a tight lid.
- Cover the food with greased paper or a greased lid so that the moisture drops that form on it don't drip back onto the food.

Stewing

- Use a tight-fitting lid.
- Use enough water to allow for slow cooking.
- Simmer so as to help slow, steady and prolonged cooking.
- Don't overcook!

Baking

- Keep temperature right in oven or tandoor.
- Heat oven slightly more than required before placing the food in it.

- Don't open the oven too often.
- Put in only enough mixture in baking trays and pans to prevent overflow.

Grilling

- Maintain high temperature throughout.
- Grill only tender foods.
- Cut foods into thinner slices.
- Grease the pan (in case of grilling on a pan or tray) or the foodstuff (in case of cooking directly on a flame).

Roasting

- Coat meat pieces with small amount of fat during roasting.
- Turn from one side to another for even cooking.
- Keep on high heat initially and then lower heat slightly to enable proper cooking.
- Stir continuously while roasting grains (cereals, pulses) or spices to prevent burning and uneven cooking.

Pressure cooking

- Keep the capacity of the pressure cooker in mind. Read instructions carefully to see how much your pressure cooker can hold.
- Wait for the first whistle : then turn down the flame.
- Don't overcook ! Remember pressure cooking is much faster than boiling.

ACTIVITY 4

1) Prepare your [illegible] base [illegible] what you have learnt so far about the following [illegible] cooking method. We have mentioned two [illegible] to give you [illegible]

PEELING

PEEL ONI[illegible]

PEEL THI[illegible]

.....

.....

.....

CUTTING

.....

.....

WASHI[illegible]

.....

.....

BOILI[illegible]

.....

FRYIN[illegible]

.....

.....

3.5 SUMMING UP

Let's list out the practical points that emerged from this section. We have talked about pre-preparation methods as well as cooking methods. We hope this rhyme will get the message across.

Peel thin
Peel only if you must
Each bit matters !

Chop bigger.
Slice thicker.
That's the bit that matters!

Pressure cook.
Boil only if you must.
Cooking time matters!

Fry and roast.
Bake, grill and toast.
Temperature matters!

Here are some specific instructions to keep in mind about three of the pre-preparation methods.

A) **Peeling**
- Peel only if it is a must
- Peel just before cooking
- Peel as thinly as possible
- Wash food well and drain before peeling
- Never wash after peeling.

B) **Cutting, chopping, slicing**
- Cut after washing or straight after peeling
- Cut into medium-sized pieces and not very small ones.
- Don't expose cut foods to air for long.
- Don't leave the food too long after cooking.
- Use stainless steel knives, choppers or slicers to maintain natural colour.
- Cut with a sharp knife to get even edges and good shapes.

C) **Soaking**
- Soak in as little water as necessary, just enough to cover.
- Don't soak too long.
- Don't throw away the liquid.

This section also described the nutrient losses due to cooking methods. Water-soluble vitamins leach out into the cooking water and are hence lost unless this water is used. Some of them such as vitamin C are also sensitive to heat. Thiamine is destroyed by cooking soda. Fat-soluble vitamins are more resistant and are not destroyed except during frying and roasting.

To keep cooking losses to the minimum, it is important not to overcook and not to add substances such as soda. All extra water or fluid left after cooking should be used in soups, curries or other preparations.

You were also introduced to changes in various nutrients due to cooking. Starches gelatinize on moist heating and form dextrins on dry heating. Sugar forms syrups and caramel. Proteins thicken and coagulate as foods containing them are heated such as meat, fish, eggs.

SECTION

4

REGIONAL MEAL PATTERNS

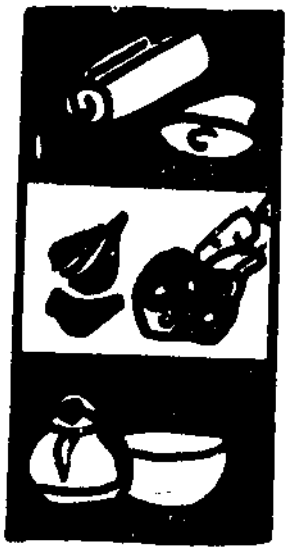
HOW TO STUDY THIS SECTION

This section gives you a bird's eye view of the meal patterns typical of different regions in our country. It gives you additional information but is *optional.*

The structure of this section is not the same as for other sections in this manual. It consists of charts giving the meal patterns of states e.g. Bihar, Maharashtra, Assam, Punjab, Karnataka, Kerala, Andhra Pradesh. Remember that there is considerable variation in meal patterns even within a state. So the dishes we have mentioned may not be typical for every part of a particular state.

We hope you will be able to appreciate some of the finer points in regional cuisine. Some details about the cereals and pulses, crops and oilseeds grown in different parts of the country is depicted in a series of maps in Annexure 4.

Now here's an exciting project for which you can collaborate with us. Use the proforma given at the end of this section. Fill it up and send it back to us. Only you can give us this information about the meal pattern in your region. *We will consider this as part of your practical assignment.* When we bring out a compilation of this material we will also acknowledge your effort. You can potentially see your name in print.



ANDHRA PRADESH

In Andhra Pradesh as in many Southern States there are three main meals traditionally. The first meal is taken in the morning around 10 a.m. The next meal is called tiffin and taken around 2.30 p.m. The night meal is usually served by 7–8 p.m.

The typical meals are :

Morning :

- Rice
- Dry vegetable preparation
- Plain arhar dal/dal with vegetables (tomato/cucumber/lemon/raw mango) or dal with leafy vegetable (amaranth/spinach)
- Pulusu (a mixed vegetable preparation with brinjal, lauki, sweet potato, drumstick in a liquidy base with tamarind)
- Chutney (freshly prepared with brinjal/cucumber/tomato/coconut/tori)

Tiffin : Any one snack and coffee

- Upma
- Dosa
- Pesarattu (dosa with whole green gram only)
- Minapattu (dosa with urad dal only) (Attus are slightly thicker than dosas)
- Pakodis

Dinner

- Rice
- Dry vegetable preparation
- Rasam (dal soup)
- Curds
- Pickle

Some dishes prepared on festive occasions include :

Pulihara : A rice preparation with tamarind and fried cashewnuts, peanuts, chana dal spiced with chillies, mustard seeds, fenugreek seeds, asafoetida and turmeric. This dish is also a favourite on journeys with roast papad, vadiyalu and plain curds.

Bobattu : A shallow fried sweet pancake ; balls made of maida with a sweet chana dal or sweet potato-jaggery centre rolled out into poori – like rounds and shallow fried.

Baghare baingan : This is typical of Hyderabad. Brinjals are slit lengthwise and fried till brown and mixed with masala paste (coriander seeds, chopped onions, red chillies, garlic, coconut scrapings) and jaggery.

Some common tiffin items include :

Menthula dosa : Batter of ground rice, urad dal and fenugreek seeds fermented overnight, shallow fried and served with coconut chutney.

Vullipaya Bhajji : Batter of besan, rice flour, chilli powder, crushed coriander seeds, turmeric powder, asafoetida and chopped onions deep fried and served hot with chutney.

Some accompaniments and items for lunch and dinner include :

Tiyya gummadi : A curry made of red pumpkin, coconut, cashewnuts, jaggery, milk and spices such as mustard seeds, red chillies and curry leaves.

Aratikaya kura : A curry made of plantains, onions, green chillies, coconut, peppercorns, cloves, mustard seeds, turmeric, and sugar.

Kothimira pachadi : Coriander chutney with coriander leaves, urad dal, tamarind, asafoetida, chillies, mustard seeds.

Venkaya pachadi : Chutney made of roasted brinjals, fried onion, turmeric, cumin powder, chilli powder, garlic, green chillies.

Masala tomato perugu pachadi : Tomatoes and curd chutney with onions, coriander leaves, curry leaves, turmeric powder, chilli powder, garam masala, cumin seeds, mustard seeds.

Pappu kura : Amaranth curry with moong dal, urad dal, onions, mustard seeds, cumin seeds, asafoetida, red chillies, green chillies, coconut scrapings.

ASSAM

Alternate Meal Patterns

Heavy breakfast	Breakfast	Breakfast
Lunch	Lunch	Mid-morning
Dinner	Tea	Lunch
	Dinner	Tea
		Dinner

A three to four meal pattern is common in Assam. The difference in the meal patterns of the upper and the lower class people is in the number of items/dishes taken in one meal and in the quality of staple i.e. rice consumed. Mustard oil is the common medium of cooking in all Assamese household.

A day's Menu

Breakfast	:	Sandoh
Lunch	:	Bhat Khar Bhaji (rongalao bhaji or lao bhaji or baingan bhaji or bhendi bhaji etc.) Dail Masar Tenga
Tea	:	Til pitha Tea
Dinner	:	Bhat Dail Bhagi Masar anja Banana

Alternate breakfast dishes

Doi Chira: Preparation made from rice flake, curd and jaggery. Rice flakes are soaked in water for 2-3 minutes and then the water is drained and to the rice flake curd and jaggery/sugar is added and served.

Bora Chaul Sijowa: Preparation prepared from a special kind of rice (bora chaul) found in Assam. The rice is steamed in water and then taken with milk and jaggery.

Akoi: Puffed rice (Akoi) eaten with curd or milk to which sugar is added. Sometimes mangoes, bananas or jack fruit may be added to the preparation.

Poita Bhat: Preparation made from cooked boiled rice. The boiled rice is soaked in water overnight (poita bhat) and eaten with salt, mustard oil, chillies and raw chopped onions all mixed together. (A common breakfast item for rural areas.)

Sandoh: A liquid preparation prepared from powdered roasted rice (sandoh), milk or curd and jaggery.

The above mentioned dishes are called Jal-pan taken specially in rural areas. In urban areas people now-a-days are used to typical western breakfast of bread, butter, egg (fried) with tea or milk. Alternatively puries (luchi) made of maida may also be eaten during breakfast along with some vege able preparation (Luchi-bhaji).

Lunch/Dinner Dishes

Bhat: A boiled rice preparation.

Khar: Khar means soda-bi-carbonate. Traditionally khar is made from a special type of plantain tree called — 'Athiya kal' or 'Bhim-kal'. First, the trunk of the tree is cut into small pieces, then dried in the sun. Finally these pieces are burnt and the ash so obtained is stored in an airtight container. Whenever one needs, a little ash, is taken and soaked in water. The water is then strained and the liquid alkaline preparation so obtained is called the khar.

Note: Dishes containing khar are made with raw papaya, green leafy vegetables, radish, beans, bottle gourd etc. Pulses like sabut urad (mati dail) is also prepared using khar. Fishes mainly small ones or the head of big fishes are also prepared using khar. Except salt no spices are used while preparing these dishes.

Dail: A pulse preparation prepared either using masoor, moong, chana or arhar dal. The dail is served well garnished with onion, fenugreek seeds, bay leaf and saunf.

Masar anja: Curry preparation made from fish onion, mustard oil, fenugreek seeds and certain spices. Normally jika (ridge gourd) or lao (bottle gourd) is put into the fish curry. (Rohu, Sithol, Bahu are the variety of fishes commonly used.)

Masar Tenga: Tenga specially means sour. Tenga is prepared using tomatoes. No masala is added. Only fenugreek seed is used in Tarka (initially in hot oil). Salt, haldi and lime juice or any other sour or citrus juice may be added. Normally vegetables (Dhekia) cut into small pieces are cooked and added to the Masar Tenga. The preparation is then generally called 'Dhekia Tenga' (Rohu, sithol, bahu are the fishes commonly eaten in Assam).

Patot Diya Mach: A steamed preparation made from plantain leaves and fish (Rahu and Pabho are the commonly used fishes). The fish is marinated with salt, turmeric, mustard and green chillies. The marinated fish is then wrapped in the plantain leaf and tied with a thread or the fibre of the leaf. The preparation is then steamed and it is ready to be served.

Bhaji: A dry fried vegetable preparation. Few common bhaji preparations include — Lao bhaji (fried bottle gourd preparation), Rangalao bhaji (pumpkin preparation), Baingan bhaji (brinjal preparation), Bhendi bhaji (ladies finger preparation) etc.

Labra: A mixed vegetable curry preparation. Vegetables commonly used include bottle gourd, pumpkin, ridge gourd, brinjal, ladies finger, cauliflower or any other seasonal vegetable.

Note: Dishes prepared and served during lunch and dinner are generally common. But Khar and Tenga are not normally consumed at night.

FEW SNACKS

Pitha: A pancake like preparation made from a special kind of rice called "Bora Chaul". Rice is soaked for two to three hours in water and then ground. The rice paste formed is very sticky. Using this paste, pancake like preparation is prepared. Oil is generally not required to prepare the pancake. Different kinds of pithas are prepared namely Til Pitha (sesame seed pitha), Narikol Pitha (coconut pitha), Pheni Pitha, Ghila Pitha. Pithas can be both sweet and savoury and are common snacks in Assam.

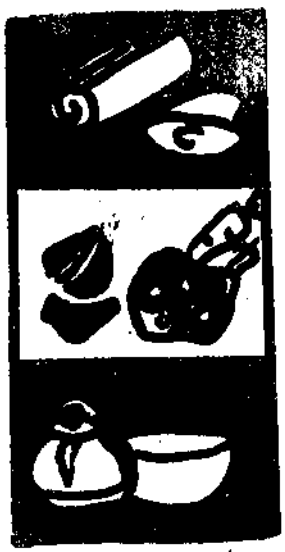
Laru (Laddoo): Preparation made of roasted rice powder (Poka Mithi), roasted til seeds, coconut, puffed rice, khoa etc. All ingredients are mixed together and laddoos prepared.

Luchi-Bhaji: Luchi refers to a puri prepared from refined wheat flour. It is consumed along with potato curry (bhaji).

Mohan Bhog: Preparation made of semolina, fat, sugar and nuts. It is similar to suji halwa commonly consumed in north India.

Nimki: A savoury refined wheat flour preparation resembling Mathries commonly consumed in north India.

Singara: A refined wheat flour and potato preparation, similar to Samosa.



BIHAR

Traditionally there are only two full meals in Bihar.

Morning (around 9 or 10 a.m.)

A proper meal usually consisting of the following dishes is prepared:

— Boiled rice (mainly parboiled rice)

— Dal

- Arhar, chana, masoor, moong and locally grown pulse called 'bokla' are used commonly.
- A single pulse or a mixture of few like arhar, chana, masoor and moong is commonly cooked.

— One Vegetable dish

- Baingan ka Bhartha (brinjal preparation)
- Bachka (thin slices of vegetables coated with besan)
- Takkar (powdered linseed mixed with salt lime juice, water, roasted cumin seed powder)

- **Bhujiya** (Potato and onion (in equal quantities) shallow fried over low heat).

— Pappad
— Pickle/chatni

Mid Afternoon meal or tea (4 or 5 p.m.)
Usually snacks/sweet dishes are prepared during this time. Common snacks are Poha (made from puffed rice, groundnuts, vegetables, like potato/peas etc.)
Pakora (vegetables coated with besan and deep fried)
Halwa (roasted suji/atta mixed with water and sugar)

Night (around 9 to 10 a.m.)
Chapati/Parantha/stuffed parantha
One or two vegetable preparations.

Preferences for Non-vegetarian Foods
Eggs are commonly consumed as boiled/fried egg or egg curry. Avoided in summer months.

Fish is used daily/twice or thrice a week depending on income level.

Mutton/chicken are used as special dishes on sundays or holidays.

Recipes of common dishes

Sattu — a special item
Sattu (flour of roasted gram) is used quite commonly in Bihar to prepare many delicacies (eaten as part of main meals or afternoon snacks). One example is Sattu balls. In this specific dish, sattu with salt and roasted cumin seed powder is mixed with enough water to make balls and the balls are eaten with raw onion and green chilli. Sattu is also used as stuffing for Parantha.

Litti is another dish made from sattu. (Sattu is stuffed into balls of wheat flour dough and the balls are roasted on slow fire. Tradition ally cow-dung fire is used for roasting the balls. Litti is eaten with potato bhaji or baingan ka bhartha.)

Dal
Clean and wash dal. Add salt and turmeric powder and enough water to cook the dal. Boil or pressure cook.
Bagahar Preparation
Heat a little mustard oil or ghee. Add cumin seeds, red chilli powder, chopped pieces of garlic, and bay leaves. Mix in cooked dal.

Baingan Ka Bartha (*Bihari*) : Take a round brinjal, make three to four slits. Put garlic pieces into slits. Roast brinjal on direct fire. Mash roasted brinjal. Add chopped onion, green chilli, salt and raw mustard oil.

Bhindi sabji (*Bihari*) : Wash and dry ladies finger. Slit length wise. Heat mustard oil and add a few fenugreek seeds. Add ladies finger and fry for sometime. Add ground masala (mustard seeds, garlic, red chilli, turmeric and salt), continue frying for 5-7 minutes. Add 1/2 to 1 cup water. Cover and simmer for sometime.

GUJARAT

The traditional meal pattern of this state can be summarized thus :

Morning :
- Tea
- Thepla

Lunch :
- Chapatis
- Rice
- Dal
- Vegetable Preparation
- Papad
- Buttermilk

Afternoon :
- Tea
- Sev-Mamra

Dinner :
- Handwo

- Buttermilk/milk
- Pickle

The addition of sugar or jaggery to dal and vegetable preparations is typical of Gujarat. In addition people of this state combine cooking methods in an interesting way. The combination of steaming and shallow or deep frying is an example.
Here is a description of some typical dishes of Gujarat :

Thepla
Chapatis made of wheat flour and shallow fried.

Sev-Mamra
Deep fried preparation of noodle-like dough made from chana flour mixed with shallow fried, puffed rice and sugar. Lemon, green chillies, curry leaves, mustard seeds, asafoetida are added for flavour.

Handwo
Wheat flour, tur dal, chana dal, bottlegourd are mixed into a dough and the dough is soaked in buttermilk with a pinch of soda. This is steamed and then shallow fried with spices and sesame (til) seeds. The preparation is again steamed before serving.

Rotlo
Small chapatis made of bajra dough roasted on a tawa and then roasted on a low flame till cooked.

Khari Poori
Deep fried rounds made of whole wheat flour.

Battata Paowa
Shallow fried potatoes with rice flakes and asafoetida, green chillies and coriander leaves.

Some common snacks include :

Khatta Dhokla
Batter made of chana dal flour (besan), rice flour, and urad flour with buttermilk, turmeric and a pinch of soda and then subsequently steamed.

Ethada
Rice flour, urad flour soaked in water (to semi-solid paste consistency with a pinch of soda for 7-8 hours) poured in shallow pans and steamed.

Khandvi
A mixture of soaked coarse chana flour in buttermilk is roasted, spread on a smooth surface and rolled. These are then shallow fried with mustard seeds and turmeric, cut into pieces and served garnished with coriander leaves, coconut and green chillies.

Muthia
A stiff dough of wheat flour, moong flour, tur flour, sugar, methi, ajmo is made with butter milk. The dough is then cut into small oblong pieces, steamed and then shallow fried.

Khakhra
A dough of semolina with a little juice of green chillies rolled out thinly like chapatis, roasted on a tawa and then on a direct flame to make them crisp.

Patra
Colocasia leaves spread with a batter of chana flour, wheat flour, sugar and salt, rolled and then steamed. The steamed leaf rolls are cut into pieces and shallow fried with ajmo, red chilli and til seeds.

Bhakar vadhi
Dough of chana flour, (besan) made into a roll with filling of coconut paste, red chilli, sugar, lemon and turmeric. The roll is then cut into pieces and deep fried on a slow flame.

Undhiu
Fried vegetables (french beans, sweet potatoes, potatoes, brinjal) with muthia. The vegetables are filled with groundnut paste and shallow fried.

HIMACHAL PRADESH

The usual meal pattern resembles this :

Early Morning
- Tea

Later in the Morning (around 9 a.m.)	• Milk
Lunch (1 p.m.)	• Rice and/or Chapati (maize or wheat flour) • Dal preparation or seasonal vegetable • Salad made of onion/ginger
Evening Tea (4 p.m.)	• Tea
Dinner (9 p.m.)	• Chapati and/or rice • Dal/Vegetable Preparation OR • Bedi with chach (bedi is a colocasia/arbi/kachalu and maize flour preparation and chach is buttermilk)
Bed time (10 p.m.)	• Milk

Some preparations typical of Himachal Pradesh include :

Bedi
Rounds of maize flour dough are rolled out and filled with a mixture of boiled, mashed kachalu, ginger and spices. Chapatis are made of this with the hands and cooked on a tawa with oil or ghee applied.

Khairu
Buttermilk preparation like lassi (liquid remaining after butter is removed from milk) with fried spices such as turmeric, coriander, cumin (zeera).

Adrak ki subji
Dry preparation of ginger cut into small pieces and fried with spices such as turmeric, coriander powder, garam masala, cumin (zeera), fenugreek (methi) seeds, asafoetida and salt.

Saag ***(himachali)***
Dry preparation of cholai (amaranth) or batthu (bathua) or spinach or mustard. The leaves are boiled along with potato, water is squeezed out and the mixture is fried with spices in mustard oil. Usually eaten with rice, sometimes fried along with boiled rice.

Aloo pyaz ki subji
Lengthwise pieces of onion and potato fried in mustard oil with spices such as turmeric, asafoetida, coriander powder, cumin as well as ginger.

Dal
Urad dal, rongi (a pulse) are boiled with turmeric, ginger, asafoetida (hing). Coriander seeds or powder, cumin and garam masala are fried in oil and this mixture is poured over the dal.

Kwarpattha
Liquidy preparation made from the bitter leafy portion of a shrub. The skin is first removed, the leaves are washed thoroughly and then soaked for 2-3 hours and then washed again. The leaves are then cut into pieces and fried with spices (turmeric, asafoetida, coriander seeds, cumin, garam masala).

Meethe chawal ***(himachali)***
Boiled rice mixed with fried turmeric to which sugar and dried grapes (kismis) and nuts are added.

Batura ***(himachali)***
A typical preparation of Mandi district made by fermenting dough made of atta, rolling into small rounds and then deep frying.

Chutneys
Made by grinding
- Dadu (seeds of a fruit) and coriander leaves
- raw mango with onion

Chholang
Citrus fruit warmed for a short time in a covered bowl over smoking coals (made by sprinkling mustard oil over coals).

Himachal Pradesh has some unique preparations for festive occasions such as :

Nishashta
Halwa-like preparation made by first soaking whole wheat, removing the outer skin

and grinding to form a paste. Paste is then dried to a dry powder or irregular pieces. The powder is soaked in water for 10-15 minutes, shaken nicely with sugar and cooked in oil or ghee till it reaches halwa consistency.

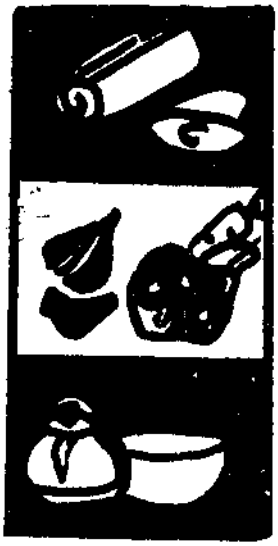
Babroo
Batter is made by mixing wheat flour with sugar or shakkar (jaggery) and water and then fried on a special flat frying pan in the form of small rounds. The batter is poured on the pan with a spoon or squeezed out of a hole made in a cloth bag.

Badana
Small balls made of urad (washed) dal which has been soaked, ground and then fried. The fried balls are served in sugar syrup and eaten with rice.

Prak
Dough made of maida rolled out into small rounds, filled with coconut powder, sugar, khoa, nuts and shaped either round or bean shaped. These are then deep fried.

In the upper hilly regions of Himachal Pradesh people consume dried fruits such as apples and apricots. Nuts such as walnuts, groundnuts are also eaten. So are fresh figs, plums and guavas. Walnuts are dipped in a thick sugar syrup so as to give a white, powdery coating. This is consumed as a snack.

Another speciality is the hot, black tea sipped after pouring in ghee.



KARNATAKA

Most people consume three meals in a day — two main meals and a tiffin in the afternoon. Snacks are consumed in between with coffee. Main meals are based on rice preparations and various accompaniments to go with it. The main meals consist of preparations such as:

- Rice
- Saru (thick dal soup)
- Huli (preparation of dal with vegetables)
- Palya (curry with ingredients such as vegetables or fish)
- Kootu (lentils with vegetables)
- Curds or buttermilk
- Pickles

For tiffin, preparations such as the following are common:

- Akki rotti/Ragi rotti (rotis made with rice or ragi flour mixed with coconut and cooked on a tawa with ghee or butter)
- Avalakki preparation (parched rice, soaked rawa with vegetables and masala)
- Uppitu (Upma-like preparation) also made with vegetables and lemon

On festive and auspicious occasions the following dishes have special meaning:

- Chittranna (a rice preparation in which rice is served mixed with various types of chutneys; the chutneys are made of either raw mango or tamarind with grated coconut and groundnuts)
- Kosambiri (a salad made of ingredients such as cucumber, carrots, moong dal, chana dal, coriander leaves, asafoetida and coconut)
- Mandige (a sweet roti-like preparation stretched out on an inverted matka and cooked)

Common snacks in Karnataka include:

- Kodubade (a preparation made by frying a mixture of rice flour, fenugreek leaves/coriander leaves, fat and coconut till reddish in colour)
- Thenkol chakli (a mixture of rice flour, urad dal flour with fat, asafoetida and zeera made into a paste, passed through a mould and fried)
- Sandige (balls made of washed parched rice and masalas, dried and then fried in smoking hot fat)
- Ragi hurihittu (roasted ragi flour preparation mixed with milk, sugar, coconut and ghee)

Some of the common preparations in Karnataka are listed here with their description:

1) **Bisi Bele Huil Anna**: Rice in spicy sauce made of dal, coconuts, cashewnuts, tamarind.
2) **Bele Potoli**: Bengal gram preparation with coarsely ground dal, green chillies, cumin seeds.

3) **Alugedde Kut**: Fried potatoes with ground masala (dry roasted red chillies, fenugreek, mustard seeds, asafoetida (hing) with tamarind juice)

4) **Dudhi Channige**: Split bengal gram and bottlegourd preparation with chilli powder, coriander powder, turmeric powder, ginger, green chillies, lemon juice.

5) **Alugedde song**: Potatoes in tamarind sauce (tamarind, chilli powder, sugar, fried onion)

6) **Kadalakai chutney**: Groundnut powder chutney made of fried peanuts, red chillies, asafoetida with tamarind, sugar and salt.

7) **Meen Ashege**: Fish curry with ground coconut and tamarind pulp.

8) **Thakali Chutney**: Tomato Chutney (with jaggery, turmeric, asafoetida, chilli powder)

9) **Seme Bednekai Palya**: Fried tindlas with cashewnuts, chilli powder, turmeric powder and cumin powder, sugar and salt.

10) **Bednekai Chutney**: Brinjal chutney (with fried urad dal, asafoetida or hing, red chillies and green chillies).

11) **Khichdi**: Rice and lentils with vegetables.

12) **Sigidi Pulao**: Prawn, coconut, mixed vegetable pulao flavoured with chillies, cloves, cinnamon and cardamom.

13) **Soppu Palya**: Spinach and lentil curry in tamarind pulp and scraped coconut.

14) **Rasa Meen**: Coconut-peanut gravy (with tamarind pulp and fried onions) poured over fried fish.

15) **Alugedde Kosambiri**: Potato salad with onions, green chillies, onions, grated coconut, lemon and coriander leaves.

16) **Rasa Kayi**: Vegetables in coconut gravy using spices such as pepper corns, cinnamon and cloves.

17) **Motte Palya**: Egg curry in coconut milk.

18) **Kayi Kurma**: Mixed vegetable curry with coconut milk.

19) **Dudhi Pitle**: Dry bottlegourd preparation with fried flour or besan, coriander powder.

KERALA

As in Karnataka, three main meals are consumed in a day — morning, afternoon and evening. Snacks are consumed in between with coffee or tea. The main meals are based on the South Indian's favourite cereal — rice, with accompaniments. Preparations such as the following are served for the main meals (lunch and dinner).

- Rice
- Thoren/Piralen/Kaalen/Avial/Erissery/Olan (vegetable preparations)
- Moru or Pachadi (buttermilk preparations)
- Fish or meat preparations in non-vegetarian families
- Pappadam
- Pickle

For breakfast or the first meal of the day the following preparations are common:

- Upma
- Pootu (steamed preparation made of rice flour or whole wheat flour and coconut)
- Appams (preparation made of fermented rice flour batter served with vegetable or meat/chicken curry)

Upma, Pootu and Appams are also served at tea time (4-5 p.m.).

Common snacks include:

1) **Avalose pod**: Rice flour-grated coconut, broiled till golden brown with cumin.

2) **Idiyappam**: String hoppers made of dough with rice flour pressed out in string-like form and steamed.

3) **Kozhukatta**: Steamed sweet rolls-coconut and grated molasses filling in rice flour dough coating.

4) **Sukiyan**: Balls of broiled green gram, coconut and molasses, cardamom and ghee dipped into maida batter and fried.

5) **Murukku :** Dough of rice flour, bengal gram dal, hot ghee, gingelly and cumin seeds pressed through a mould into star-like coils and then fried crisp.

6) **Kuzhalappam :** Rice flour curls with mixed spices made by rolling dough and curling it onto an oiled rod and then frying.

7) **Vada :** Thick ground dal batter with onions, green chillies fried in the shape of flattened rounds.

8) **Ada :** Soft dough of boiled, mashed tapioca and grated coconut flattened with the fingers and shallow fried on a tawa or hot stove.

Kerala has a variety of vegetable preparations — many of them prepared with generous amounts of coconut. We mentioned these earlier :

Thoren : A dry vegetable preparation made of onion/spinach/cabbage/raw banana leaf or pumpkin leaf/drumstick/plantain/tender jackfruit/tapioca/green gram with grated coconut, green chillies, curry leaves.

Piralen : A creamy curry usually made by cooking drumstick pieces in coconut milk with masalas such as coriander powder, red chilli powder, turmeric powder, garlic, cumin seeds, cinnamon, cloves and cardamom.

Kaalen : Raw (green) bananas or sweet and sour mango diced into cubes with curd, mustard seeds, fenugreek seeds, dry red chillies, asafoetida, sugar, turmeric powder. The banana kaalen is made without coconut and the mango kaalen with coconut.

Avial : Mixed vegetable (drumstick, cucumber, string beans, brinjal, potato, raw banana, jackfruit) with mango, grated coconut, chilli powder, turmeric powder, green chillies, onion, cumin seeds, cloves, curry leaves and a little curd.

Erissery : Slightly liquidy preparation of mashed cooked yam with coconut, turmeric powder, chilli powder, cumin seeds, seasoned with mustard, chopped onion, dry chillies and curry leaves.

Olan : Curry made of ash gourd, red gram (tur or arhar) and coconut milk spiced with cumin seeds, dry chilli seeds, curry leaves, onions.

Theeyal : Curry preparation of ridge gourd or brinjal with grated coconut. Onions, dry red chillies, coriander powder, fenugreek seeds, cumin seeds, turmeric powder, tomatoes and tamarind pulp are also added.

MAHARASHTRA

A three to four meal pattern is common in Maharashtra. The poor working class normally consume two to three meals, whereas, a four meal pattern is common in the middle income group. Wheat, bajra and jowar are the staple food of Maharashtra. Groundnut oil is commonly used as the medium of cooking.

A Day's Menu :

Breakfast	:	Thalipeeth Tea
Lunch	:	Varun-Bhat Polya/Bhakri Umti Karlaichi Bhaji Kakadi-chi-Koshimbeer Chanyacha dalchi chutney Usal
Tea	:	Chakli Tea
Dinner	:	Peethle-bhat Vangyachi Bhaji Chutney Papad Pickle

Few alternate breakfast dishes : Few common dishes served for breakfast include :

- Poha (Batata poha/kanda poha)

- Thalipeeth
- Upma (Sanza)
- Usal

Poha : A preparation made of rice flakes, potato, onion and grated coconut. The rice flakes are soaked in water for 2-3 minutes. The water is then drained off. Excess water is squeezed out of the rice flakes. The softened rice flakes are then added to fried onion and tomato mixture. Grated coconut is added and finally the preparation is served by squeezing lime juice on top.

Thalipeeth : A preparation made of jowar, bajra, wheat, rice, urad dal and chana dal. All these ingredients are first roasted and then ground and the flour so obtained is mixed together. A chapati, parantha or poori like preparation is made out of this flour which is called thalipeeth.

Note : Bottlegourd, radish, cucumber, green leafy vegetables, onion, pumpkin— either of these vegetables can be added to the preparation if so desired.

Upma : A preparation made of semolina, potato, onion, grated coconut and roasted peanuts. The preparation is made much the same way as poha except for the fact that semolina is used instead of rice flakes.

Usal : A sprouted pulse preparation made from moong dal, grated coconut, ginger, garlic, curry leaves and coriander leaves. All these ingredients are mixed together and served.

Note : Dry peas, Chana, Masoor dal, Moth bean, lobia can also be used to prepare the usal.

Lunch/Dinner Dishes :
Generally lunch and dinner consists of a pulse preparation, some vegetable preparation, curd preparation and chutney. The staple commonly used is wheat, bajra or jowar. (Bajra, jowar are commonly used by the rural population). Few common dishes include :

Polya : A chapati/roti made of wheat flour. Commonly eaten by the people living in the cities/urban areas.

OR

Bhakri : A roti made of jowar or bajra commonly consumed by people living in the rural areas.

Umti : A pulse preparation commonly made from arhar dal, vegetables (like onion, brinjal, tomato, bottlegourd, drumstick, garlic etc.) grated coconut, green coriander, tamarind all cooked together by boiling. Tamarind, Moong dal, masoor, malka dal may also be used for preparing umti.

Varun Bhat : Varun is a pulse preparation made from arhar dal. Jaggery and garlic may be added to the preparation. Varun is commonly eaten with plain rice (Bhat).

Peethle : A liquid preparation made from besan, raw coconut, coriander and certain spices. Besan is cooked in water along with cumin seeds, salt, coconut, coriander powder and a thin kari like preparation is ready. Peethle is comniony eaten with bhat i.e. rice.

Kari : A liquid preparation made from besan and buttermilk both cooked together by boiling.

Note : Cucumber (kakri), drumstick, jackfruit or small Pakoris (made from besan) can be put in the kari.

Masala Bhat : A fried rice preparation, made from rice, brinjal, coconut, curd, coriander, sugar and cashewnuts (any nut can be used).

Note : Instead of brinjal, peas, cauliflower, cabbage, capsicum, ridge gourd, tomato and other such vegetables can also be used to prepare Masala Bhat. (This preparation is most commonly used during festivals.)

Bhaji : A dry vegetable preparation made from either of the vegetables — bitter gourd (karli-chi bhaji), brinjal (vangachi bhaji), beans (shengachi bhaji), Onion-potato (Kanda-batata bhaji), spinach (pattar bhaji) etc.

Koshimbeer : A curd preparation made either with cucumber (kakadi chi koshimbeer), carrot (gajjar chi koshimbeer), radish (mulya chi koshimbeer) or any other vegetable.

Kakari chi koshimbeer (cucumber raita) is commonly prepared. Kakadi is just grated and then added to the curd. Salt and other masalas are added according to taste.

Chutney: Chutneys are commonly prepared in each meal. Chana dal chutney (chanya cha Dalchi chutney), tomato chutney, lasson chutney, coconut chutney are few of the common chutney prepared.

Usal: A sprouted pulse preparation consumed both at breakfast, as well as, lunch time. Usal is prepared with little gravy if served with Umti.

The dishes prepared for dinner are not much different than lunch dishes. *Except, Umti is not consumed during dinner time.*

SNACKS AND SWEET DISHES

Shrikhand, Basoondi, Pooranpoli, Sheera are the common preparations prepared in Maharashtra. They can be eaten at any time of the day along with the main meals or as a snack. They are generally served during festivals.

Shrikhand: A milk based preparation made from curd, sugar, saffron, cardamom and nuts/oilseeds. Curd is first put in a cloth which is hung on to a nail to drain off the water in the curd. The remaining thick curd is then mixed with equal amounts of sugar, some saffron, cardamom and finely grinded nutmeg and served.

Basoondi: A milk based preparation made from condensed milk. Milk is first put to boil till it thickens and then sugar is added along with dry fruits, cardamom, nutmeg to the preparation and then served.

Pooranpoli: A sweet cereal-pulse preparation made from semolina, wheat flour (refined), chana dal, sugar, nuts/oilseeds, cardamom, nutmeg. It is a poori like preparation which has chana dal filling inside. Chana dal is first steamed in water. All excess water is dried off. Sugar is then added to the dal and the mixture is cooked on slow fire. The mixture is then ground and to this paste cardamom, nutmeg powder and saffron is mixed. This forms the filling for pooranpoli.

Few *savoury snacks* include: Chidwa (rice flake preparation), Chakli (chana dal + urad dal + rice preparation), Dhokla, Pakoda, Usal, Upma, Poha etc.

Chidwa: A rice preparation made from fried rice flakes, puffed rice, groundnut (fried), Curry leaves, green chillies, salt, sugar all mixed together.

Chakli: A jalebi like round savoury preparation made from rice, chana dal, urad dal, and salt. Rice, chana dal and urad dal are first soaked in water and then coarsely ground. The batter so obtained is used to prepare chakli.

PUNJAB

Main Meals

There are three main meals in Punjab — breakfast, lunch and dinner.

Breakfast — 8.30 - 9.00 a.m.

Breakfast generally consists of the following:

- Roti (Freshly made or left over from previous day's dinner)
  or Parantha/Stuffed Parantha (Prarantha stuffed with radish/potato/cauliflower)
  or
  Missi roti (Roti made with atta and besan)
- Butter/Malai (fresh cream)
- Lassi/butter milk
- Pickle

Lunch 1 - 2 p.m.

Lunch generally consists of the following:

- Roti
- **Vegetable Preparations:** If one vegetable preparation is prepared generally dry preparation is made. If two vegetable preparations are prepared then one dry vegetable preparation and one curry preparation is made. Seasonal locally available vegetables are commonly cooked like peas, cauliflower, carrot, mustard, fenugreek, etc. in winter and bhindi (ladies finger), lauki (bottlegourd), tori, tinda, sitaphal (pumpkin), etc. in summer.
- **Curd or Raita:** (made from curd and any of the following: besan ki bundi, Lauki, roasted and mashed brinjal, boiled and grated cucumber, etc.)

Dinner 8-9 p.m.

Dinner generally consists of the following:

- Roti
- Dal (moong, chana, urad are commonly eaten. Sometimes a mixture of two or three dals is also prepared like moong and masoor, urad and chana).
- One Vegetable preparation (optional)

Other Meals

Besides main meals, in some families around 4 or 5 p.m. people have something to eat or drink. Children have milk. Adults can drink Malanji (made from roasted/boiled raw mango) or Sharbat (badam, khaskhas) etc. Some of them may have milk or tea also. Tea time snacks are not common. Though occasionally they may have pakoras (vegetables coated with besan and deep fried) or mathri (deep fried small rounds made from stiff dough of maida or refined flour).

Very often people just eat murmura/chana with gur (jaggery) or a fruit during this time.

Special Preparations

Pulses like kabuli chana, rajmah, bengal gram (whole), besan ki karhi are cooked on holidays or special occasions. They are preferably served with rice.

In winter, sarson ka saag with makki ki roti is a favourite dish.

Some Selected Recipes of the Region

Dal Makhani: Pressure cook urad dal (1 katori) (mixed with mustard oil (2 tablespoons), ginger or garlic and salt). Add chopped tomato to the cooked dal and keep it on slow fire. Add 1 tablespoon of malai to the dal and cook till it gets mixed well. Similarly, add about 4 tablespoons of malai (cream) and simmer (on slow fire) till the dal gets mixed well. Prepare baghar of onion and garlic and add to dal.

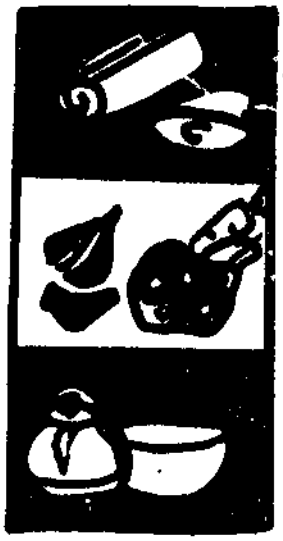
Besan ki Karhi: Take 250 g dahi or butter milk (keep it overnight for making it little sour). Churn and make lassi from it. Add a glass and half of water and 2 tablespoons of besan. Mix properly. Add turmeric, red chilli, salt, cloves according to taste. Heat oil in karahi. Put few mustard seeds and when mustard seeds start spluttering, add lassi and simmer on fire (almost for half an hour). Besan pakoras can be added to curry before serving. For making besan pakoras — Take 3 T besan, half onion, some ginger and garlic, green chilli. Make a paste. Deep fry small rounds from this mixture. Add to cooked curry.

Sarson ka saag: Take 1 kg fresh tender leaves with soft, small stalks. Clean, wash and cut. Put ginger, garlic, mustard oil (2 table spoons) and a little jaggery or sugar. Pressure cook. Grind it well with a mathani or wooden spoon. One can also use a mixer grinder for this purpose. Put it on slow fire. Add little atta/maize flour and mix well. Simmer and cook for sometime. Put oil in karhai, add onion and garlic. Fry till golden brown. Put this baghar in saag. Add butter and serve.

Chole: Pressure cook kabuli chana till tender. Heat oil/ghee in karhai. Add garlic, onion and ginger. Heat till golden brown. Put tomato and anardana or tamarind water (ground). Mix boiled chana in this masala. Serve with rice, poori or bathura.

Gajar ka Halwa: Take 1 kg ripe red carrots. Wash peel and grate. Mix 1/2 kg milk in it and put on slow fire till milk is completely soaked (no liquid left). Put little butter or ghee, roast for sometime. Add sugar, elaichi or kesar. Stir till the mixture starts leaving the sides of karahi.

Dahi Bhalla: Soak urad dal overnight. Grind it. Add ginger, green chilli, red chilli, salt according to taste. Deep fry small rounds. Soak in water for sometime. Flatten and add to curd (whipped). Add salt and spices to taste.



RAJASTHAN

Alternate Meal Patterns

A	B
Brunch	Breakfast
Light lunch	Lunch
Dinner	Tea
	Dinner

A three to four meal pattern is common in Rajasthan. The number of meals consumed varies according to the income and activity pattern. Alternative A is common to low income groups and specially in rural areas.

Wheat, bajra and jowar are the common staples of Rajasthan and the medium of cooking is til oil or groundnut oil.

A day's Menu

Breakfast	:	Sogra Rabri or Bajra Dalia
Lunch	:	Roti Gatte Kare Kumthi Sangriya Papad Chach
Tea	:	Dhopli Tea
Dinner	:	Roti Dal Tinsi sabji Papad

Few alternate breakfast dishes

Sogra : A roti/chapati made either from bajra or jowar. Wheat flour (whole) may also be used to make the roti.

Rabri : Liquid preparation made of milk/curd/butter milk. The rabri is served garnished with roasted cumin seeds, rye and salt. Generally sogra is eaten with rabri.

Bajra Dalia : Porridge prepared from bajra, curd/milk and sugar. Bajra is first cooked in water and sugar is added. Milk or curd whatever desired may be added to the preparation. Dalia can also be prepared without adding milk/curd.

The above mentioned dishes are traditional breakfast dishes, but now-a-days bread, butter, milk is commonly consumed. Alternatively stuffed parantha (potato/radish stuffed parantha) may be taken with curd and pickle.

Lunch/Dinner Dishes :

Gatte : Curry preparation made from besan. A stiff dough is made of besan in which cumin seeds and oil are added. The dough is rolled out into round strip which is then boiled in water. Next small rounds are cut and gatte are prepared. Gravy is made with oil, salt, turmeric, coriander powder and rye. Onion is optional. The gatte prepared earlier are mixed with the gravy and served.

Pitore : Another curry preparation made from besan. For this a thin dough is prepared of besan. The dough is rolled out in chapati form. Small biscuit size pieces are cut from this dough. Gravy is prepared same way as for gatte. These raw pieces are then put into the gravy and cooked by boiling.

Dal : Pulse preparation commonly made from moong (washed) or chana dal.

Dana Methi : Curry preparation made from fenugreek seeds and papad. The fenugreek seeds are boiled in water. Gravy is prepared and the boiled methi seeds are added and boiled again. Papad is then added to this gravy and served.

Vadi : Preparation made from moong dal. The moong dal is soaked in water and coarse ground. Salt, chillies are mixed to the batter and small irregular shaped balls (vadi) are made and sun dried. Vadi is prepared in the curry form or alternatively a dry preparation can be made.

Kadi : Liquid preparation made from besan and buttermilk. The two ingredients are mixed together, salt and other spices are added and the kadi is prepared by boiling the mixture.

Kadi Kheech : Kheech is a dalia like preparation made of wheat, bajra or corn. The grain is first ground coarsely. Then the ground mixture is boiled in water. When water evaporates, fat is added. Kheech is commonly eaten with Kadi.

Kare Kumthi Sangria : A dry mixed vegetable preparation. Kare, kumthi and sangria

are three beans like vegetables found in Rajasthan. These vegetables are boiled in water and then added to a thick gravy prepared with oil, spices and water and cooked till dry preparation is ready.

Dal-Bati: Bati is a baked preparation made from whole wheat flour. A stiff wheat dough is prepared. Ball sized dough is taken and baked on slow fire (traditionally the bati used to be prepared by baking in the chulhas). Potato-peas stuffing may be put in the dough while preparing bati. The cooked bati is then eaten with moong dal. This dish is commonly consumed during rainy season.

Dal-Dhokli: Liquid preparation made from moong dal and besan. Besan is kneaded into a dough after adding salt and cumin seeds to it. The dough is rolled out and small flat round pieces (mathi like) are cut out. These pieces are boiled in water till soft. Simultaneously moong dal is cooked and then the besan pieces are put into it and the two are cooked again. (This preparation is commonly eaten during rainy season and towards winters.)

Kabooli: A fried rice preparation made from rice, potato, onion, bread, tomato, cashewnuts, raisins and milk. The rice is first boiled till more than half done. Masala is then prepared for the Kabooli using fat, onion, tomato, chopped ginger, salt, turmeric. All these ingredients are fried well. To this mixture fried bread pieces, cashewnuts and raisins are added. This masala is then put in between layers of cooked rice. Milk is then poured from the top. The preparation is once again steam cooked.

Lunch/dinner dishes are common. The above mentioned dishes are alternatively used for lunch/dinner. Dal-Bati, Kadi-kheech are few special dishes eaten commonly on special occasions.

SNACKS

Mirch Vada: A pakora like preparation made from long green chillies and besan. The chillies are first boiled in water. A masala (filling) is prepared using onion, garlic, cashewnuts/raisins optional. This masala is then filled in the green chillies by making a slit in the centre. A thin besan batter is prepared. The chillies are then dipped in the batter and deep fried.

Kachori: A preparation made from refined wheat flour. It is a stuffed poori like preparation. A filling of moong dal (which is soaked in water and then fried), besan, salt, chillies is prepared. This filling is then put in the refined flour dough and poori shaped kachories are rolled out. The kachories are deep fried.

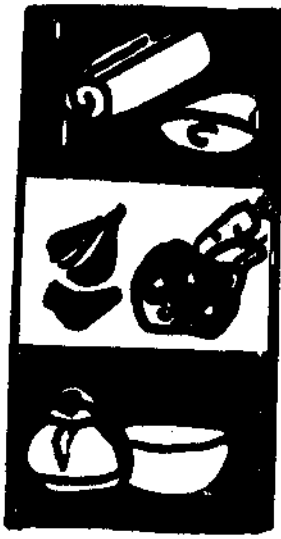
Kofta: Deep fried preparation made from boiled potatoes, onion, ginger, anar dana and besan. A thin besan batter is prepared. Boiled potato, onion and other ingredients are all mixed together and small round balls are prepared of this mixture. These balls are then dipped in besan batter and deep fried.

Seva: A deep fried besan preparation.

WEST BENGAL

Alternate Meal Patterns

A	B	C
Breakfast	**Breakfast**	**Brunch**
Lunch	Lunch	Light lunch
Dinner	Tea	**Tea**
	Dinner	Dinner (typical of working class)



A three to four meal pattern is common in West Bengal. Rice is the staple food and mustard oil is the medium of cooking in Bengali households.

A day's Menu

Breakfast	:	Luchi-Aloo checkhi
Lunch	:	Bhat Dal Bhaja (baigun bhaja or patol bhaja or kumdo bhaja etc.) Macher Jhol

	Chorchori Aambol Doi
Tea	Chire Bhaja Tea
Dinner	Bhat Dal Bhaja Macher Matha Diye Dal/Muddo Dal Patol Tarkari Aamer Tak

Few alternate breakfast dishes

- Doodh Moori
- Moori Makha
- Chire

Doodh Moori : Preparation made of puffed rice and milk. Sugar is added to the preparation. In season, mango can be added and the preparation is then called Aam Moori.

Moori Makha : Dry preparation made from puffed rice, chopped onion, chillies, grated or chopped coconut, fried groundnut seeds, mustard oil and salt. All these ingredients are mixed well and served.

Chire : A rice flake preparation. Rice flakes are first soaked in water. When it softens excess water is drained/squeezed off. Curd or cold milk is then added to the rice. Mangoes can also be mixed into this preparation. Sugar/Jaggery is used to sweeten the preparation.

Luchi-bhaji

Luchi : Preparation made from wheat flour (refined or whole). It is like the poori made in north India. Luchi is normally eaten with a vegetable preparation. Few vegetable preparations are as under :

Aloo Checkhi : A curry preparation made from potatoes. In other words it is potatoes cooked in mustard oil to which green chillies, salt and certain other spices are added. In summers other vegetables like pumpkin or parwar may be added to this. preparation. In winters alternatively cauliflower may be added.

Balgun Bhaja : Deep fried preparation made from brinjals.

Patol Bhaja : Deep fried preparation made from parwar which are deep fried.

Lunch/Dinner Dishes :

Bhat : A boiled rice preparation. Bhat is the staple food of West Bengal. One variation of Bhat is *'Bhate'*. Bhate is nothing but boiled rice with vegetables. Vegetables like potatoes, pumpkin, brinjal, etc. are cut into big pieces and boiled with rice. After the rice is cooked, the vegetable pieces are taken out and served by adding mustard oil and green chillies. Rice is eaten as such.

Macher Jhol : A curry preparation made with fish and seasonal vegetables (brinjal, parwar, fish and cauliflower, beans etc.) Normally Rohu or katla fish isused for this preparation. The fish is marinated with salt and turmeric and deep fried. Next vegetables are steam cooked in oil along with chillies, ginger, salt,black pepper and cumin seeds when vegetables are cooked, fried fish pieces are put into it and water is added and the dish is prepared by boiling.

Macher Jhal : Preparation similar to Macher Jhol, except for the fact that it is plain fish curry without the vegetables. Jhal has a thick gravy (less liquidy) and is more rich and more commonly prepared during winters or served to the guests. Normally Rohu, katla fishes are used but small fishes like Tengra, Pagda, Illish are also used to prepare Macher Jhal.

Muddo Dal or Macher Matha Diya Dal : Curry preparation made with pulse and the fish head. Commonly moong dal is used. Head of the big fishes like Rohu are first marinated with turmeric and salt and then deep fried. The head is then put into the cooked dal and boiled again. The preparation is garnished and served.

Dal : A pulse preparation served after garnishing with cumin seeds, green chillies, bay

leaf, coconut, sugar (not always). Moong and Arhar are the common pulses consumed in Bengal. Masoor and urad dals are used less frequently. Chana dal is not prepared during lunch time. It is prepared only for dinner. In Masoor dal, sugar is not put and normally onion is also used for garnishing. In urad dal ginger and aesafoetida may be used for garnishing.

Bhaja: A dry deep fried vegetable preparation. Vegetables like potatoes, brinjal, parwar, bitter gourd, cauliflower, ladies finger etc. are deep fried and served as such after sprinkling with salt.

Chorchori: A mixed vegetable preparation. Seasonal vegetables are generally used to prepare this dish. Vegetables commonly used include — potatoes, carrots, beans, brinjal, cauliflower, pumpkin, parwar etc.

Baigun Tarkari/Patol Tarkari: Tarkari is nothing but a dry vegetable preparation. When brinjal vegetable is prepared we call it Baigun Tarkari, if parwar vegetable is prepared we call it Patol Tarkari, when jackfruit is cooked we call it Achod Tarkari.

Note: Bhaja and Tarkari differ from each other in the sense that Bhaja is just a deep fried vegetable preparation. While preparing tarkari we use oil, tomato, spices and condiments and the vegetable is prepared by steam cooking.

Tak: Tak refers to chutney. The most commonly prepared Tak is 'Aamer tak' made from raw mangoes. The mangoes are boiled in water along with oil, salt, turmeric till the gravy thickens. Tomator tak is the chutney prepared from tomatoes.

Doi: A sweetened curd preparation. Normally eaten with rice at the end of the meal (Doi-Bhat) or Doi is eaten as such towards the end of the meals.

SNACKS

Chire Bhaja: A savoury preparation made from fried rice flakes, groundnut seeds, salt and black pepper all mixed well. This is same as Moori Makha served during breakfast.

Nimki: A savoury wheat flour (refined) preparation resembling the mathri commonly prepared in North India.

Kucho Nimki: A stuffed poori like preparation made from refined wheat flour. The wheat flour dough is rolled out in the form of a poori. A filling of peas is prepared. The peas are first ground and then fried in little fat. Salt, chillies, ginger, garam masala is added to it. This mixture is then used as a filling for the poori. The poori is then deep fried and kucho nimki is prepared.

This section has been compiled by the faculty with the assistance of:

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- Vimal Khandekar
- Prabha Chawla
- Asha Ahuja
- J.M. Parakh
- Officials of Rajasthan House
- Shipra Das
- S. Sengupta

ANNEXURE 4

PROFORMA ON REGIONAL MEAL PATTERNS

Fill up the proforma given on the next page. If you require more space use additional sheets. Enclose the proforma in an envelope and send it to us at the following address.

ANC-1 (PRACTICAL ASSIGNMENT)
Department of Women's Education
School of Continuing Education
Block 2, Room No. 20
Indira Gandhi National Open University
Maidan Garhi
New Delhi-110 068

Mark the envelope ANC PRACTICAL ASSIGNMENT

We hope you will collaborate with us on this research project and look forward to hearing from you. Remember to give information only on *traditional* meal patterns. You could ask your mothers or grandmothers to get reliable data.

YOU WILL BE GIVEN CREDIT WORTH 10 MARKS FOR COMPLETING THIS AND SENDING IT TO US.

ANNEXURE 4

PART A

Your Name :
Enrolment No. :
Year : 199

DETAILS ABOUT YOUR REGION

State .....

District : .....

Name of Village/town/city : .....

INFORMATION ON MEAL PATTERNS OF YOUR REGION

1) a) How many meals are taken in a day ?

.....

.....

b) List the meals with their names and timing.

.....

.....

2) a) Is there a fixed time for eating snacks with tea/coffee/milk ? Yes. No.

.....

.....

b) If yes, when are such meals taken ?

.....

.....

Mid-morning Mid-afternoon

Evening tea Bedtime

c) If no, when are snacks generally eaten ? Please specify.

.....

.....

.....

.....

.....

3) Give a day's typical menu using this chart.

Meal	Menu (List of items)	Ingredients used	Description of dish and cooking method*

*TO MAKE THINGS QUICKER

You will find it easier and quicker to use the following codes for describing cooking methods.

1) Frying
2) Steaming
3) Roasting
4) Fermentation
5) Sprouting
6) Grilling
7) Skewing
8) Baking
9) Parching
10) Boiling or boiling and simmering
11) Boiling and frying
12) Frying of Masalas
13) Soaking/Steeping
14) Preparation made by grinding (e.g. chutneys)
15) Preparation of dough

For example for an item like poori-aloo you could fill the table like this :

Meal	Menu	Ingredients Used	Description of dish and cooking method
Dinner	Poori	Atta Oil Salt	Deep fried small rounds made of atta (15, 1)
	Aloo	Potato Tomato Asafoetida Zeera Turmeric Coriander powder Red chilli powder	Fried potato with masalas (12, 10, 1)

ANNEXURE 4

PART B

REGIONAL CROPS: OILSEEDS

Groundnut : Himachal Pradesh, Punjab, Uttar Pradesh, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Orissa, Tamil Nadu, Karnataka, Andhra Pradesh

Mustard : Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Uttar Pradesh, Bihar, Orissa, West Bengal, Assam, Gujarat, Madhya Pradesh

Til : Jammu & Kashmir, Bihar, West Bengal, Orissa, Rajasthan, Gujarat, Maharashtra, Karnataka, Andhra Pradesh,

Safflower : Maharashtra, Andhra Pradesh

Sunflower : Karnataka

Chana : Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal, Gujarat, Rajasthan, Madhya Pradesh, Karnataka

Arhar (tur): Uttar Pradesh, Bihar, Orissa, Gujarat, Madhya Pradesh, Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu

Moong : Jammu & Kashmir, Orissa, Rajasthan, Maharashtra, Tamil Nadu, Karnataka, Andhra Pradesh

Urad : Jammu & Kashmir, Rajasthan, Madhya Pradesh, Orissa, Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Bihar, West Bengal

Masoor: Uttar Pradesh, Bihar, West Bengal

Rice : Jammu & Kashmir, Himachal Pradesh, Assam, West Bengal, Orissa, Karnataka, Andhra Pradesh, Tamil Nadu, Kerala

Wheat : Punjab, Haryana, Uttar Pradesh, Bihar, Rajasthan

Maize : Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Bihar, Madhya Pradesh, Gujarat

Jowar : Rajasthan, Madhya Pradesh, Maharashtra, Karnataka, Andhra Pradesh

Barley : Uttar Pradesh, Bihar, Andhra Pradesh

Bajra : Gujarat, Madhya Pradesh, Karnataka, Andhra Pradesh

Ragi : Karnataka, Kerala

SECTION

5

PLANNING DIETS – I

HOW TO STUDY THIS SECTION

Before you begin, read through

- Unit 6 (Block 2) for the basics of planning balanced diets
- Unit 7 (Block 3) for the points to remember about meal planning specifically for adults.

Section 5 is organized into subsections to make it easier for you to work through the material.

The text is interspersed with instructions and activities (in a different colour). You must remember to attempt *all* the activities. They will help you to recall important concepts and practise essential skills. You can then look through the discussion to see if you are on the right track.

Important points are highlighted throughout this section. Also, points you need to remember from your study of Blocks 2 and 3 are given once again here in numbered Boxes. You could use them as a ready reference.

You would notice the step-by-step approach to planning diets followed in this section. Spend some time on step 3. The step may appear difficult but you will learn the basics of how to decide on which foods to include in a diet. This also tells you how to decide on the quantities to be included. By the time you have finished with all the steps 1 to 7, you would be ready with the menu for a day.

One important aspect you must concentrate on is portion sizes. It is important to specify how much a person can eat at one time. Only then can we decide how much food to give at each meal.

Before you read the section in detail give it a quick glance. Try to understand the whole process first. Once you have a fair idea of this, immerse yourself in details.

SKILLS TO LEARN FROM THIS SECTION

This section tells you how to

- plan diets
- decide on the amounts to be served to each person (portion size).

Structure

5.0 INTRODUCTION

Planning meals and diets is fun ! We have already talked about the various steps in planning balanced diets in Unit 6 of Block 2. Further, in Block 3 you would remember having studied the important points to be kept in mind while planning

balanced diets for various age groups/physiological states. Now you must be really looking forward to being able to plan diets yourself. We will begin this interesting and useful task in this section.

In planning diets we must first arrive at a food plan. A food plan is a list of the foods included in a diet with their amounts. We have to then decide on how we will distribute these amounts over the day's meals. Finally, based on this, we work out a suitable menu for the day. This process will be discussed in detail in this section. To make the whole exercise come alive we will plan a diet for a person we met the other day. Her name is Pushpa.

In addition, we will be looking at some related concepts. The concept of portion size is discussed in some detail. Portion size is the amount that can be served to an individual depending on factors such as age and sex. We recognize, for example, that portion sizes for adults are larger than for children. Recording nutritive value and portion size is a skill that must be learned. We take this up in the next section with a discussion on how to evaluate cooked meals and snacks/dishes in a systematic manner.

But before that, let us set out what we should aim to achieve at the end of this section.

Objectives

After going through this section, you should be able to:

- prepare food plans for a sedentary woman belonging to the middle income group
- modify given food plans
- use a food plan to work out a suitable menu
- use given data on distribution of food amounts over the day's meals in order to decide on alternate menus.

Before starting this section do go through Block 2 (Unit 6) and Block 3 (Unit 7). You will need to familiarize yourself with *food groups, food items within each food group and use of the RDI table before you can begin to plan diets. Box 5.1 summarizes some of these concepts and ideas.*

BOX 5.1
DO YOU RECALL?

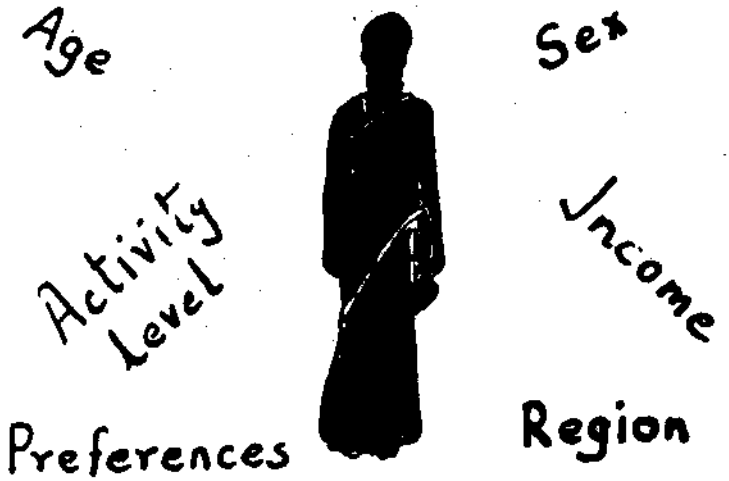
In Blocks 2 and 3, you have studied a number of important concepts and definitions. Some of these definitions are given here.

Diet	:	Dishes consumed during an entire day
Meal	:	Referring to Breakfast/Lunch/Tea/Dinner etc.
Menu	:	List of dishes included in a particular meal
Meal Pattern	:	Number of meals consumed in a day and the timing and nature of different meals
Meal Frequency	:	Number of meals consumed in a day
Snack	:	A food preparation generally served in between main meals. It is usually compact and easy to handle.
RDI (Recommended Dietary Intake)	:	The amount of a nutrient that must be consumed each day to meet the requirement of the body
Food Group	:	A number of food items sharing common characteristics. One simple function-based classification of food into groups : Energy-giving foods, body-building foods and protective/ regulatory foods.

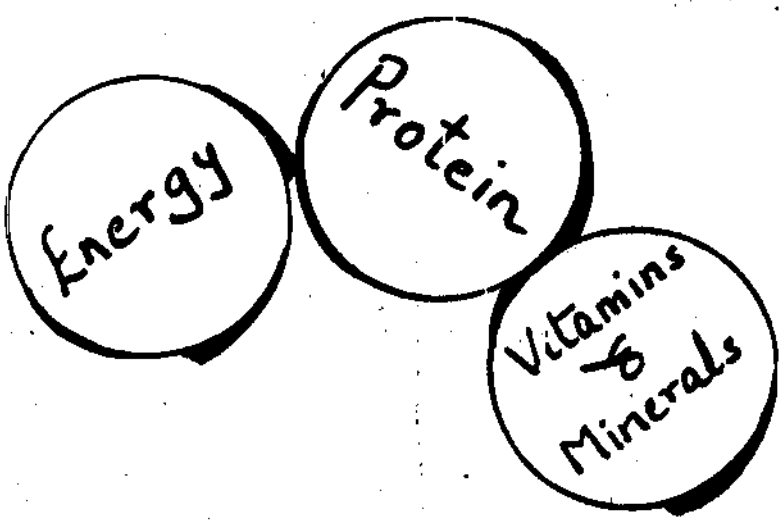
5.1 GENERAL GUIDELINES FOR PLANNING BALANCED DIETS

We need to remember certain key points before we begin to plan a diet for any person. Do you know what these are ? The following list will help to refresh your memory.

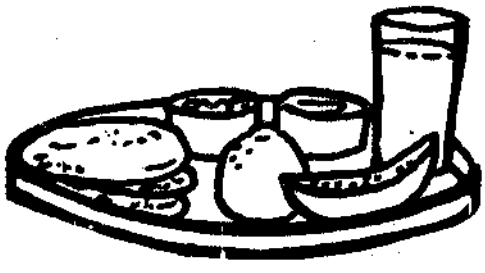
1) KEEP THE INDIVIDUAL AND HIS BACKGROUND IN MIND



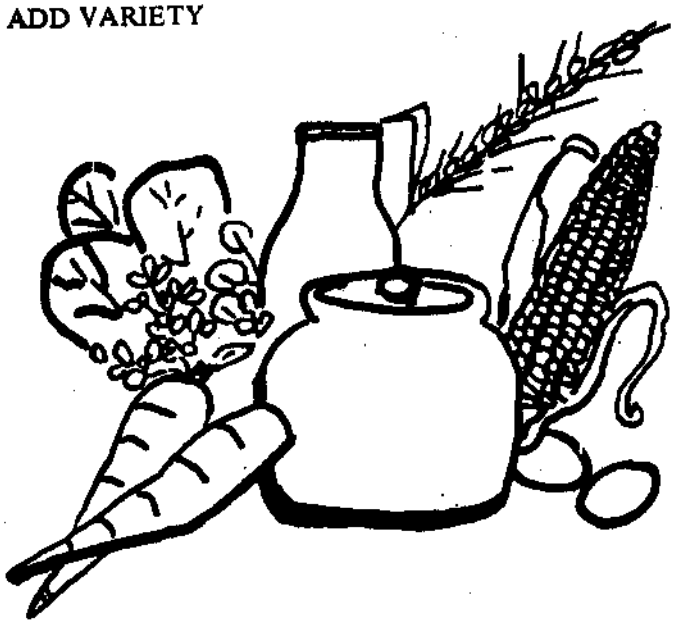
2) WATCH OUT FOR THE FOOD GROUPS



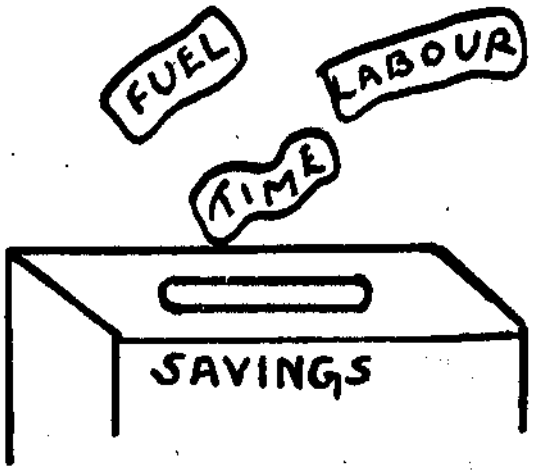
3) REMEMBER TO CONSIDER ACCEPTABILITY AND AVAILABILITY



4) ADD VARIETY



5) SAVE TIME, LABOUR AND FUEL



6) MAKE THE MEALS FILLING AND SATISFYING

5.2 HOW TO PLAN A DIET

You have already studied the steps involved in planning balanced diets in Unit 6 of Block 2. These steps are :

Step 1) Identify the individual
2) Consult RDIs for energy and protein
3) Decide on total amounts of specific food groups
4) Decide number of meals to be consumed
5) Distribute total amounts decided between meals
6) Decide on menu
7) Check day's diet for inclusion of specific food groups in the amount decided.

Now let us learn how to plan a balanced diet using these steps. We will go through the entire process keeping one particular individual in mind.

STEP 1. IDENTIFY THE INDIVIDUAL

Meet Pushpa. Pushpa is 28 years old and is a primary school teacher residing in Delhi. Pushpa belongs to a middle income group family. So, what points have you noted about Pushpa ? You can use these points to complete the following information chart.

Age	:	
Sex	:	
Income	:	
Activity Level	:	Sedentary (light)
Region	:	

Have we forgotten something? Do we need more information? Yes,we do need to know whether Pushpa is a vegetarian or non-vegetarian. Pushpa is actually a vegetarian though she does eat eggs sometimes. This will certainly influence the type of foods which we would include in her diet.

STEP 2. CONSULT RECOMMENDED DIETARY INTAKES FOR ENERGY AND PROTEIN

How much energy and protein does Pushpa need? Once we know these figures we can decide on what foods to include in her diet and in what amounts and proportions.

Look at Table 5.1.

TABLE 5.1. RDIs FOR INDIAN ADULTS (WOMEN)

Group	Particulars	Net energy (Kcal)	Protein (g)
Woman	Sedentary work	1875	
	Moderate work	2225	50
	Heavy work	2925	
	Pregnant woman	+ 300	+ 15
	Lactation		
	0–6 months	+ 550	+ 25
	0–12 months	+ 400	+ 18

Source : Nutrient Requirements and Recommended Dietary Allowances for Indians, ICMR, 1990.

Can you list the RDIs for energy and protein for Pushpa? If you remember, we

mentioned that Pushpa is a sedentary woman. So we would look for the RDIs under the category adult woman—sedentary worker. According to the table, the RDIs are:

Energy (Kcal) : 1875
Protein (g) : 50

Now we have to use this information to decide on how much total amounts of foods we need to include in Pushpa's diet. For this let us move on to Step 3.

STEP 3 : DECIDE ON TOTAL AMOUNTS OF SPECIFIC FOOD GROUPS

Let us first look back at what we did in Steps 1 and 2. We have

- identified Pushpa as an individual
- listed her energy and protein needs based on age, sex and activity level.

Now let us talk about Step 3. This is important and is the basis for all subsequent steps. After completing it we will, in fact, be ready with the foundation. Pushpa's diet will be built on this foundation.

You may find Step 3 a little complicated. So do concentrate here. We have divided the step into two parts :

- Understanding exchanges and
- Using exchanges to plan Pushpa's diet.

The first part teaches you a concept-the concept of food exchanges. The second part is the application-using exchanges to plan Pushpa's diet. Though the first part is not essential reading, we hope you will go through it. It has basically been included to give you answers to the questions.

- What is an exchange ?
- Why are exchanges useful ?

You can skip page 91 to 92 and move on to the difinition of exchanges and Table 5.2 if you so wish.

So let us begin with the first part which will describe food exchanges and why we need them.

UNDERSTANDING EXCHANGES

Let us see if we can arrive at the concept of exchanges by discovering it for ourselves. You are already familiar with the categorization of foods into groups i.e. the energy-giving group, the body-building group and the protective group. You studied this three group classification of food in Block 2. Now imagine that you have to decide on the amounts of these food groups or rather the amounts of food items within these food groups to be included in a diet. How would you do it ? You would obviously want to include foods in the amounts and proportions that would supply 1875 Kcal and 50 g protein. Now look at the following chart :

Energy-giving Group	:	Cereals
(provides carbohydrate or	:	Roots and tubers
fat)	:	Sugar, jaggery
	:	Fats and oils
Body-building Group	:	Milk
(provides protein)	:	Pulses
	:	Meat/fish/poultry/egg
Protective/regulatory Group	:	Green leafy vegetables
(provides vitamins and minerals)	:	Other vegetables
	:	Fruits

Try to specify the amounts you would need of each of these categories i.e. cereals, roots and tubers and so on. You would probably first decide on which specific items you intend to include. In other words, you may say that you want to include rice,

potato, sugar, coconut oil, milk, tur or arhar dal, eggs, amaranth, ladies finger, tomato, onion and papaya.

Then you may go back to the food composition tables and take down the nutritive value (energy and protein contents) of each of the previously mentioned items per 100 g.

Now comes the point where you may start feeling puzzled. You may tell yourself that you know the nutritive value but how to decide on the amounts to be given. Should you give 50 g rice or 80 g or 100 g? You would begin to realize that you would have to use trial and error to arrive at the amount of rice you need to give Pushpa. The same problem would arise in the case of other food items.

So, what is the answer? The answer is, in fact, *exchanges*. To understand this let us look at the foods we call cereals:

Food Group	:	Energy-giving
Food Category	:	Cereals
Food items within Category	:	Wheat, rice, ragi, jowar, bajra, maize

Now, what major nutrient do we expect cereals to provide in Pushpa's diet? The answer is, of course, carbohydrates (which supply energy). So suppose we work out the amount of each cereal which would provide a constant amount of carbohydrate, say 15 We would get a chart looking like this:

Foodstuff/Food item	Weight (g)	Carbohydrate (g)
Wheat (whole)	22	15
Rice	19	15
Ragi	21	15
Bajra	22	15
Maize (dry)	23	15

Now do you notice something interesting? The amount of each cereal item providing 15 g carbohydrate is roughly 20 g.

Suppose we prepare such a list for all cereals we commonly use we can call it a cereal exchange list. The cereal exchange becomes any cereal in amounts which provide 15 g carbohydrate. We have just seen that one cereal exchange is equivalent to 20 g of any cereal. However, we also need to know how much energy and protein one cereal exchange provides.

One cereal exchange i.e. 20 g provides 70 Kcal and 2 g protein. That's a relief, isn't it? Now you know that you can include any cereal in the day's diet in units of 20 g each. You don't even have to rush to the food composition tables each time - all cereals can be taken to provide 70 Kcal and 2 g protein for every 20 g or one exchange.

Let us take another example, say fats and oils. Now let us say that one exchange of fats and oils should provide 5 g fat. Since most fats and oils are 100% fat this would mean

One fat/oil exchange = 5 g of any fat or oil

In other words, we know that whether we include groundnut oil or coconut oil or til oil 5 g is one fat exchange. Now how much energy does this provide? Can you work it out? Remember 1 g fat provides 9 Kcal. So 5 g would provide 45 Kcal. No protein is supplied, of course.

Now on the basis of these two examples let us work out a simple description of an exchange.

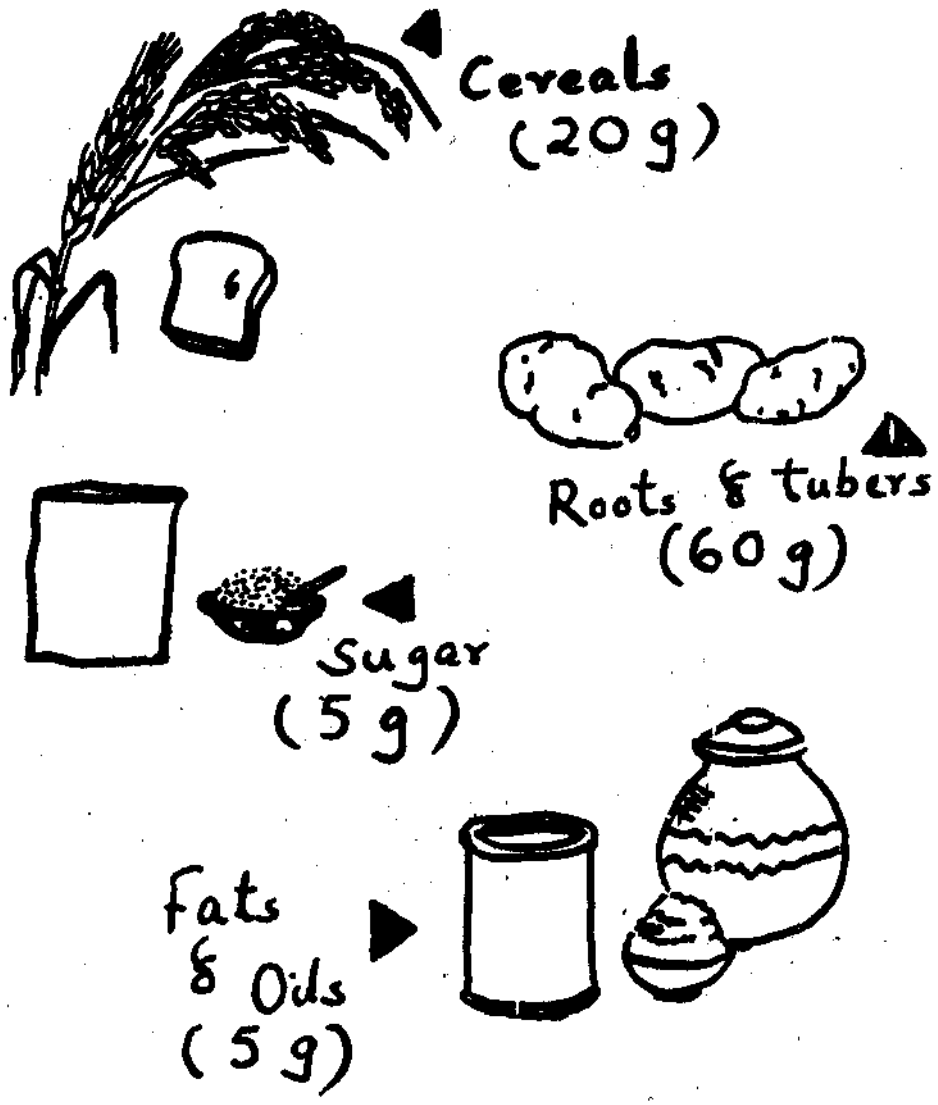
When we group together similar food items so that each supplies a constant amount of a particular nutrient (carbohydrate or protein or fat) we call the group a food exchange. In other words, each food exchange can be expressed in terms of the

weight that would provide a specified amount of either carbohydrate, protein or fat. For example we said that one exchange of fat provides 5 g fat and 45 Kcal.

[redacted]

On the basis of their content of carbohydrate, fat or protein the remaining food categories can be placed in the exchanges indicated in Table 5.2.

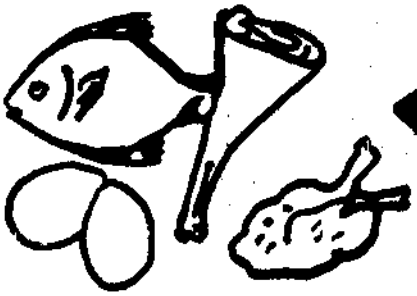
ENERGY-GIVING EXCHANGES



BODY BUILDING EXCHANGES

Milk and Milk products
(250 ml or equivalent)

Pulses
(30 g)



Meat / Fish
Poultry /
Eggs
(40 g)

PROTECTIVE/REGULATORY EXCHANGES

Green leafy vegetables
(100 g)

Other
vegetables
(100-150g)

Fruits
(80-100 g)

TABLE 5.2 FOOD EXCHANGES

EXCHANGE (FOOD GROUP)	NO. OF EX-CHANGES	AMOUNT • (g)	ENERGY CONTENT (Kcal)	PROTEIN CONTENT (g)
(Energy-giving group)				
Cereals	1	20	70	2
Roots and tubers	1	60	70	2
Sugar and jaggery	1	5	20	–
Fats and oils	1	5	45	–
(Body-building group)				
Milk	1	250 ml	170	8
Pulses	1	30	100	7
Meat/fish/poultry/egg	1	40-50	70	7
(Protective/regulatory group)				
Green leafy	1	100	negligible	negligible
Vegetables	2 #	200	40	2
Other vegetables	1	100-150	40	2
Fruits	1	80-100	40	negligible

Source: Adapted from Comprehensive Exchange List developed by Lady Irwin College, Delhi.

• Basis of each exchange : cereals 15 g carbohydrate ; roots and tubers 15 g carbohydrate ; fats and oils 5 g fat ; milk 8 g protein ; meat/fish/poultry/egg 7 g protein ; fruits 10 g carbohydrate.

2 exchanges of green leafy vegetables is equivalent to one exchange of other vegetables.

In this table we have listed the category green leafy vegetables as part of the protective/regulatory group. This group also includes the other vegetables category. We must also tell you about certain vegetables such as members of the gourd family (ghia, tori) and cucumber. These vegetables are similar to green leafy vegetables in their nutrient content (energy and protein). So remember that you can substitute some of these vegetables for part of the green leafy vegetables in the day's diet.

Now one notable omission in this table is nuts and oilseeds. If you remember, we included them in the body-building group in Unit 6 of Block 2. As we mentioned, nuts and oilseeds have a good content of protein in addition to being excellent fat sources. This puts us in dilemma. Where should we put them ? We would prefer to include them as part of a miscellaneous category. So, if you want to include them, add a miscellaneous group and mention the nuts/oilseeds you would like. Don't forget to count the energy and protein contribution. *It is a good idea to reduce one fat exchange for every 10 g of nuts and oilseeds you include.*

You would need to memorize Table 5.2. But don't worry. By the time you've finished this section you would have worked on it so many times that it would be quite familiar. *You do not have to remember the basis for each exchange (given as a footnote).*

Have you noticed how Table 5.2 clearly brings out the relationship between exchanges and amounts ? It says, for example, that :

- One cereal exchange is 20 g.
- One roots and tubers exchange is 60 g.
- One milk exchange is 250 ml, and so on for the others.

It also gives the energy and protein contribution of each exchange. So suppose we include 3 exchanges of cereal in a diet we would know that :

3 exchanges of cereal means 60 g (20 × 3 = 60) providing 210 Kcal and 6 g protein (70 × 3 = 210, 2 × 3 = 6).

How much have you understood of Table 5.2 and the concept of exchanges? For a quick check, work through Activity 1.

ACTIVITY 1

a) The following table lists four of the exchanges (cereal, milk, pulses, fats and oils) included in a diet. Fill in the missing details.

EXCHANGE	AMOUNT (g)	NO. OF EXCHANGES	ENERGY (Kcal)	PROTEIN (g)
Cereal		8		16
Milk	500 ml	2	340	
Pulses	90		300	
Fats and oils	40	8		

b) Suppose a diet provides 2430 Kcal. The number of exchanges related to the energy giving group are as follows:

EXCHANGE	NO. OF EXCHANGES	ENERGY (Kcal)	PROTEIN (g)
Cereals	14		
Roots and tubers	2		
Sugar and jaggery	7		
Fats and oils	8		

Calculate the energy and protein contributions of each exchange.

We have so far described the concept of food exchanges and how they are worked out. One more point needs to be emphasized. *There can be considerable variation within an exchange list regarding amounts of individual foodstuffs*, e.g.

i) We designated one pulse exchange as 30 g providing 7 g protein. Soyabean, for example, has much more protein than other pulses. One exchange of pulse as soyabean would be only 16 g.

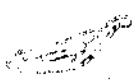
ii) We designated one exchange of meat/fish/poultry/egg as 40–50 g. One exchange as egg is 50 g while one exchange as chicken is 27 g based on 7 g protein.

We are ignoring such differences within exchange lists for the time being to make things simpler for you, with two exceptions i.e.

a) One exchange of milk as cottage cheese (paneer) = 50 g. This is because 50 g paneer is obtained from about 250 ml milk and supplies the same protein i.e. 8 g.

b) One exchange of fruits as banana = 40 g of banana. This is because banana contains much more carbohydrate than other fruits (The fruit exchange is based on carbohydrate). Similarly 60 g mango is one exchange.

50 g paneer = One milk exchange



40 g banana = One fruit exchange

60 g mango = One fruit exchange

USING EXCHANGES TO PLAN PUSHPA'S DIET

Now let us prepare a *food plan* for Pushpa. What is a food plan? *A food plan is a list of the total amounts of the specific food exchanges which should be included in a day's diet with their energy and protein contributions.*

Let us consider Table 5.3.

Table 5.3 : Food Plan for Pushpa

FOOD GROUP	EXCHANGE	TOTAL NO. OF EXCHANGES/ DAY	TOTAL AMOUNT (g)/DAY	ENERGY (Kcal)	PROTEIN (g)
Energy-giving	Cereals	10	200	700	20
	Roots and tubers	1	60	70	2
	Sugar/jaggery	5	25		—
	Fats and oils	7	35		—
Body-building	Milk	2	500 ml	340	16
	Pulses	2	60		
	Meat/fish/poultry/ egg	—	—	—	
Protective and Regulatory	Green leafy vegetables	1	100	neg.*	neg.*
	Other vegetables	2	200-300	80	4
	Fruits	2	160-200	80	—
			TOTAL	**1885**	**56**

* negligible

You know that one cereal exchange is 20 g. So when we include 10 exchanges in the food plan (Table 5.3), we are including 10 × 20 = 200 g of cereal in the day's diet. Similarly, you can look up the amount per unit for the others from Table 5.2 and accordingly calculate. You would arrive at the same figures as in Table 5.3. You would also notice that we don't use fractions.

A FOOD PLAN TELLS YOU HOW MUCH OF DIFFERENT FOODS TO INCLUDE IN A DAY'S DIET

An alternate food plan for Pushpa

The next question that might arise in your mind is whether the pattern given in Table 5.3 is fixed or whether we can vary it. For example, why don't we give 2 cereal exchanges and 15 exchanges of fats and oils? This is because nutrients need to be supplied in the *right amounts and proportions.* If we include so much of fat and so little cereal the diet would not provide nutrients like carbohydrates and fats in the right amounts and proportions for Pushpa. It would also be quite unacceptable! This would mean eating only two chapatis, no rice and consuming fifteen teaspoons of oil as part of other dishes in the day's diet (e.g. oil in dal or vegetable preparations). However, do remember that the pattern we have given is not the only option. One can think of ways of increasing or decreasing certain food exchanges so as to provide 1875 Kcal and 50 g protein for a person belonging to the middle income group such as Pushpa.

You can make changes within each of the food groups. e.g.

a) If you decrease cereal, you would probably increase roots and tubers. The amount of roots and tubers included should not exceed 2 exchanges.

b) If you increase the amount of meat/fish/poultry/egg to 2 exchanges (as you would have done if Pushpa were non-vegetarian), you would probably omit pulse or occasionally you may give one exchange.

c) If you increase green leafy vegetables to two exchanges, other vegetables could decrease to one exchange.

ACTIVITY 3

Now on the basis of the suggestions you have just read, can you modify the food plan ? Use the space given here. (Remember not to give exchanges in fractions).

Your Food Plan for Pushpa

FOOD GROUP	EXCHANGE	NO. OF EXCHANGES/ DAY	TOTAL AMOUNT PER DAY	ENERGY (Kcal)	PROTEIN (g)
Energy-giving	Cereals				
	Roots and tubers				
	Sugar/jaggery				
	Fats and oils				
Body-building	Milk				
	Pulses				
	Meat/fish/poultry/egg				
Protective and Regulatory	Green leafy vegetables				
	Other vegetables				
	Fruits				

DISCUSSION

You would have worked out a suitable alternative food plan for Pushpa based on our suggestions. Now here is our alternative plan (Table 5.4).

Table 5.4 : Alternative Food Plan for Pushpa

FOOD GROUP	EXCHANGE	NO. OF EXCHANGES/ DAY	TOTAL AMOUNT PER DAY (g)	ENERGY (Kcal)	PROTEIN (g)
Energy-giving	Cereals	9	180	630	
	Roots and tubers	2	120	140	
	Sugar/jaggery	5	25	100	
	Fats and oils	7	35	315	
Body-building	Milk	2	500 ml	340	16
	Pulses	1	30	100	7
	Meat/fish/poultry egg	1	50	70	7

Table 5.4 (Contd.)

Protective and Regulatory	Green leafy vegetables	1	100	—	—
	Other vegetables	3	300-450	120	6
	Fruits	2	160-200	80	
			Total	1895	58

Now compare this food plan with that given in Table 5.3. Do you notice that we have decreased the amount of cereal to 9 exchanges and increased the amount of roots and tubers to 2 exchanges?

One egg is added (i.e. 1 exchange of meat/fish/poultry/egg). Can you spot any other changes? Remember that this food plan also provides about the same calories and protein as the one given earlier.

We have now come to the end of Step 3. We have prepared a food plan suitable for Pushpa. Now we will move on to Step 4 in which we will decide on the number of meals to be consumed keeping Pushpa's preferences and daily routine in mind. Then in Step 5 we distribute food amounts over these meals as you will see. But first, Step 4.

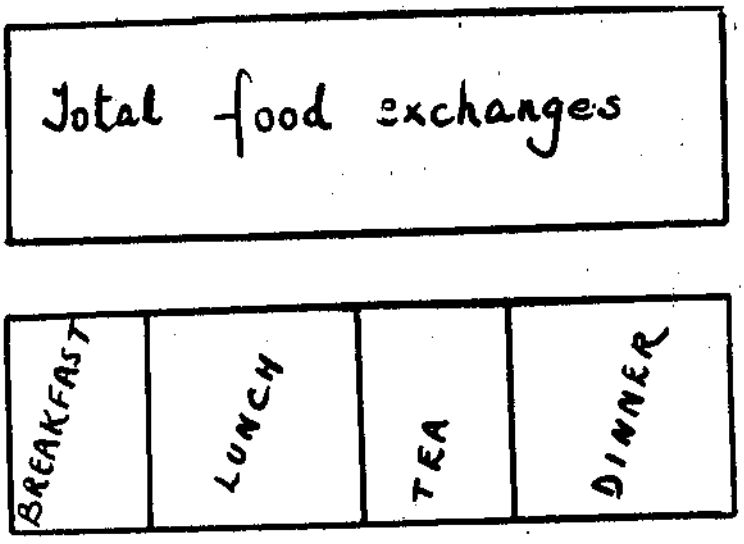
STEP 4. DECIDE ON NUMBER OF MEALS TO BE CONSUMED

Once we have decided on the total amounts of the various food exchanges to be consumed, we need to decide on how many meals would be consumed by Pushpa. This would, of course, depend on the daily routine. Since she is a school teacher she could have an early breakfast followed by a mid-morning snack, lunch, tea and then dinner. On some days she may prefer to omit the mid-morning snack. In other words she would consume 4-5 meals during a typical working day i.e.

Breakfast Mid-morning Lunch Tea Dinner	OR	Breakfast Lunch Tea Dinner

STEP 5. DISTRIBUTE TOTAL AMOUNTS DECIDED BETWEEN MEALS

What do we mean by 'distributing' total amounts decided between meals? Let us take a look at the food plan given in Table 5.3. We decided to give 10 exchanges of cereal and 1 exchange of roots and tubers over the whole day. Now we have to decide how much of cereal, roots and tubers we would include in each of the meals. For example we may want to give say 2 exchanges of cereal for breakfast, 3 exchanges for lunch and so on. This is the meaning of the phrase 'distributing total amounts'.



Before we begin the exercise of distributing the exchanges over the meals we should take note of the following general points.

- Include cereal in all main meals e.g. breakfast, lunch and dinner. Sometimes, however, a cereal may not find a place in the mid-morning or mid-afternoon meals.
- Include some fat in each of the meals.
- Include some of the sugar exchanges in breakfast and tea (i.e. for tea, milk or other beverages). Adjust the remaining exchanges in lunch or dinner depending on when you decide to serve the dessert.
- Include at least one of the food exchanges from the body-building food group in each main meal e.g. milk and milk products (curd, cottage cheese) OR meat/fish/poultry/egg OR pulse.
- Include at least one of the food exchanges from the protective/regulatory group in each main meal. Not more than two foods from the body-building group or from the protective/regulatory group should find a place in each meal.

It is possible that a meal would include all exchanges from the energy-giving group e.g. a meal like lunch may include cereals, roots and tubers (potato), fat as well as sugar in the form of a dessert. However this is not true of the other two food groups. As we mentioned earlier, in the case of both the body-building and protective/regulatory groups, not more than 2 different kinds of food exchanges should be included in a meal i.e.

i) it is possible to include combinations such as:
   - pulse + milk product (e.g. dal, curd) OR
   - milk product + meat (e.g. meat preparation, kheer) OR
   - pulse + meat (e.g. poushtik roti (atta-besan), meat preparation)

ii) It is possible to include combinations such as:
   - fruit + green leafy vegetable OR
   - green leafy vegetable + other vegetables OR
   - fruit + other vegetables

When we give both green leafy vegetables and other vegetables, we must remember that we don't need to include two vegetable preparations. Instead we may serve other vegetables as salad or as part of another preparation such as a dal.

Besides all these specific points, there is one all important consideration—portion size. This refers to how much of any particular dish/food item a person can be expected to eat at one time. We can expect Pushpa to eat about 60 g cereal and about 30 g pulse for a main meal like lunch or dinner. (We will return to this concept in Sub-section 5.3) Similarly we could give about 200-250 ml milk at a time. Vegetable preparations can be made of 100-150 g vegetables for a particular main meal.

Table 5.5 : Distribution of Food Exchanges Over the Day's Meals

FOOD GROUP	FOOD EXCHANGE	EXCHANGES FOR DAY'S MEALS: BREAK-FAST	LUNCH	TEA	DINNER	FOOD EXCHANGES (TOTAL)
Energy-giving	Cereals	2	3	2	3	10
	Roots and tubers	—	1	—	—	1
	Sugar/Jaggery	1	—	2	2	5
	Fats and Oils	1	2½	1	2½	7
Body-building	Pulses	—	1	½	½	2
	Milk	1	—	from day's exchanges for milk taken from breakfast	1	2
Protective/ regulatory	Green leafy vegetables	—	—	—	1	1
	Other vegetables	—	1½	—	½	2
	Fruits	1	—	1	—	2
		(415)	(552)	(315)	(603)	

• These figures in brackets indicate energy contributions of each meal based on the exchanges listed.

How did we decide on this distribution? Roughly, breakfast and tea should provide 1/3rd total calories. Lunch should provide 1/3rd total calories and so should dinner.

This diet, as you know, provides 1885 Kcal. One-third of this would mean about 628 Kcal. You would notice that our food distribution allocates more than 1/3rd calories for breakfast and tea together and less for lunch and dinner. This much variation is quite acceptable.

ACTIVITY 4

Now you decide how to distribute the food exchanges (in Table 5.4 i.e. alternative plan). Here is a table for you to fill in as you judge best. You could stick to the same meal pattern or change it to one more suitable in your region.

Distribution of Food Exchanges Over the Day's Meals

FOOD GROUP	FOOD EXCHANGE	EXCHANGES FOR DAY'S MEALS	FOOD EXCHANGES (TOTAL)
Energy-giving	Cereals		
	Roots and tubers		
	Sugar/Jaggery		
	Fats and Oils		
Body-building	Pulses		
	Milk		
	Meat, fish, poultry, egg		
Protective/ regulatory	Green leafy vegetables		
	Other		

Vegetables
Fruits

DISCUSSION

Remember that Pushpa belongs to the middle income group. What would be the most suitable meal pattern in your region? You would know best. Once you have decided on a suitable meal pattern, you can distribute the exchanges over the day's meals. The total exchanges should of course tally with the amounts you have distributed or allotted for each meal.

6) DECIDE ON THE MENU

Now, the next step in diet planning is to decide on the menu. The menu would, of course, be based on what we have done in Step 5. Study Table 5.6 thoroughly.

TABLE 5.6 THE DAY'S MENU

1 MEAL	2 MENU	3 AMOUNT OF DISH IN HOUSEHOLD MEASURES	4 INGREDIENT	5 AMOUNT OF INGREDIENT (g)
Breakfast	• Mango milk shake	One glass	Milk Mango Sugar	190-200 ml 60* 5
	• Buttered toast	Two small slices	Bread Butter	40 5
Lunch	• Rice	½ full plate	Rice	40
	• Chapati	One	Atta	20
	• Green gram dal	One Katori (medium)	Green gram dal Tomato Onion Fat	30 75 7–8
	• Beans aloo (Potato-beans vegetable)	One Katori (medium)	Beans Potato Fat	100 60 5
Tea	• Tea	One cup	Milk	50–60 ml
	• Wheat-soya biscuits	Two biscuits	Atta Soya flour Sugar Fat Milk	40* 7–8* 10 5 5
Dinner	• Chapatis	Two	Atta Fat	40 a little
	• Palak Kofta curry	One Katori	Spinach Besan Tomato Onion Fat	100 10–15 75 10
	• Rice Kheer	One bowl	Rice Milk Sugar	20 250 10

*7-8 g soya flour is equivalent to half a pulse exchange; 60 g mango is one fruit exchange.

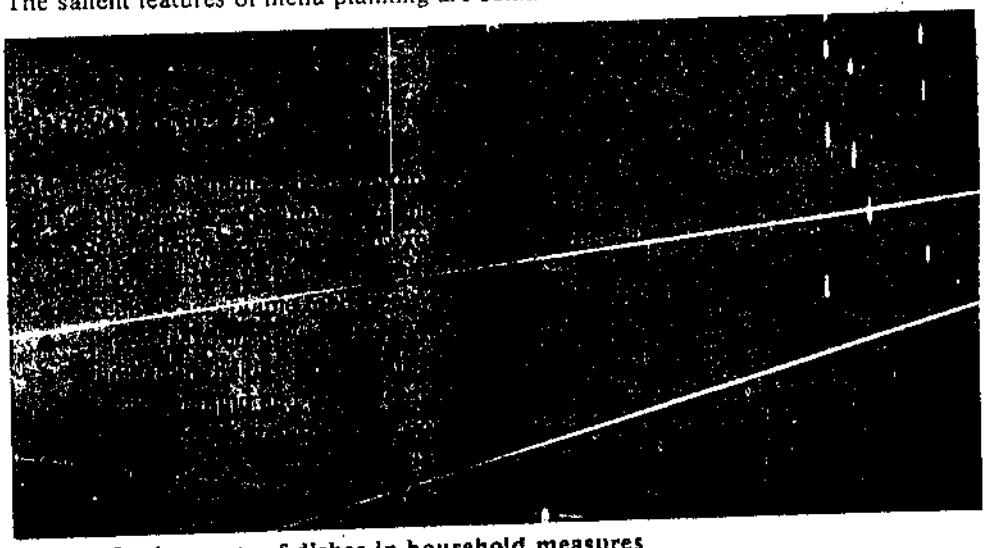
Have you noted the five columns in the table? Let us take each and discuss it separately.

Column 1 : Meal

This column lists the meals consumed during the day. In Pushpa's case, she consumes four meals — breakfast, lunch, tea and dinner.

Column 2 : Menu
Now we translate the amounts of different food exchanges arrived at in the previous steps into a list of dishes we can serve for each meal. For example, for lunch we had decided to give 60 g cereal, 60 g roots and tubers, 12–13 g fat, 30 g pulse, 150–225 g other vegetables. One possible menu is given in the table : rice, chapati, green gram dal, beans–aloo vegetable (potato–beans vegetable).

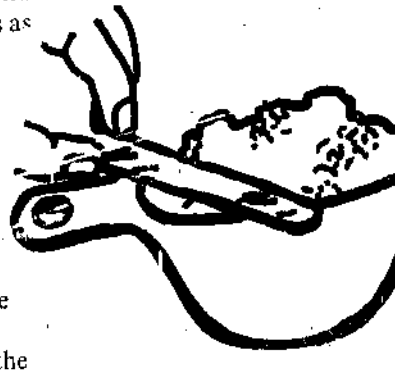
The salient features of menu planning are summarized in Box 5.2.



Column 3 : Amounts of dishes in household measures
In this column we have to give the amount of each dish we serve in household measures e.g. one glass mango milk shake. It is also important to specify the size of the measure i.e. small, medium or large. The sizes of measures used in Table 5.6 are all medium-sized.

Column 4 : Ingredients
Once we have decided on the menu we must next list the ingredients that go into the preparation of each item e.g. for a green gram dal preparation we would use green gram dal, tomato, onion and fat.

Column 5 : Amount of ingredient in grams
In this column list the amount of each ingredient in grams. Refer to the section on weights and measures for the standard measures equivalent to gram weight for each ingredient. This will make measuring easier for you since you already have the standard measures as part of your practical kit.



STEP 7. CHECK DAY'S DIET FOR INCLUSION OF SPECIFIC FOOD GROUPS IN THE AMOUNTS DECIDED

The amount of ingredients listed in Column 5 should correspond to the number of exchanges already decided upon. To make sure check Columns 4 and 5 with Table 5.5. Initially it will be easier for you to understand gram weights in terms of household measures. This is where your practical kit will help. You can correlate the amounts in Column 5 with the amount in terms of standard measures—cups or spoons or in terms of slices or size in the case of fruits.

By going through all the steps mentioned in the preceding discussion we have arrived at an adequate and acceptable diet for Pushpa. You would have noticed that this diet is :

Individual – specific (suitable for Pushpa)
Region – specific (suitable for North India)
and
Income – specific (suitable for the middle income group)

ACTIVITY
Now suppose Pushpa was living in your region. You would then know best about the foods and meal patterns that would be acceptable. So why don't you try to plan a diet for Pushpa keeping your region in mind ? You can change the distribution table and the menu (i.e. Tables 5.5 and 5.6). Alternatively, you can use the distribution table

you arrived at in Activity 4. We are sure you're waiting to begin ! Use the space given here.

DISCUSSION

Congratulations! You have planned your first diet. By now you should have arrived at a list of dishes you would serve at each meal. For each meal you should have listed the ingredients and their amounts in grams as given in Table 5.6.

5.3 PORTION SIZE: HOW MUCH IS ENOUGH?

We have so far tried to understand the process of planning balanced diets. Let us now introduce a related concept that we have used but not defined. This is the concept of portion size. *Portion size refers to the amount of a particular snack or dish we would serve to a given individual at one time.* Portion size depends on the age and sex of an individual as well as his/her capacity to eat. Also, in the case of an adult man/woman the higher the activity, the more the portion size.

In the case of Pushpa, for example, we decided to give no more than 60 g cereal at the main meals i.e. lunch/dinner. This corresponds to the portion size for an adult female—one full plate (not heaped) of rice or three chapatis, each made from 20 g wheat flour. If rotis or chapatis are made of more flour, the number consumed would be proportionately less. Similarly, why do we give Pushpa dal made of 30 g raw pulse? This is again because this corresponds to the average portion size offered to an adult.

Average portion size for an adult man (sedentary)

1 full plate rice or 3-4 chapatis.
1 katori dal/curry.
1 katori vegetable preparation.

The preschooler can be served roughly half the amounts given to an adult sedentary woman. As the child grows the amounts served gradually approach those served to adults.

The word "serving" also conveys the same concept. One serving would be equivalent to one portion. *The "size of serving" or "portion size" would mean the amounts served at one time.* This would vary as we have already mentioned depending on age and sex in the case of adults. The amounts in grams per serving for an adult man, are as follows (given for individual food items):

Food Item	Amount per serving (g)
Milk	250
Cottage Cheese (paneer)	50
Processed cheese	25–30
Meat	100
Egg	50
Cereals	80
Chidwa (rice flakes)	40
Potato	80
Pulses	30
Leafy vegetables	100
Other vegetables	100
Fruits	100
(except amla	25
lemon)	25
Ghee	5
Sugar	5
Nuts	10

This means we would serve a rice preparation made for a main meal from 80 g rice or rotis made from 80 g atta to an adult man. If we prepare poha, we would make it out of 40 g rice flakes. You could work out the equivalents for other food preparations.

5.4 SOME MORE HINTS

You have studied the process of diet planning using the example of a sedentary woman – Pushpa.

Did you realize that once the food plan has been decided you can vary the distribution of exchanges over the meals? You can also vary the menu.

To go over the steps in diet planning you could revise :

Table 5.2 : Food Exchanges
Table 5.3 : Food Plan for Pushpa
Table 5.5 : Distribution of Food Exchanges over the Day's Meals
Table 5.6 : The Day's Menu

This will quickly take you over the process and illustrate the major points.

In brief, planning a diet would mean :

- Making a food plan based on exchanges
- Distributing exchanges over meals
- Deciding on the menu based on this distribution.

You should now be thoroughly familiar with the *process* of diet planning. *This same process will be followed whatever the activity level, age or physiological state* (pregnancy, lactation) as you will find in the next section.

Now one last word before we move on. Do we have to do this planning exercise day-to-day? As a matter of fact you should devise some short cuts. Once you have planned a diet you get a fair idea of how much of different foods to include in a day's diet. Keeping to this pattern will help you to meet nutrient needs. You must also remember to use the standard measures in your practical kit. Using them you can convert gram weights into standard measures. And you have a fairly accurate measure of how much to eat.

However, do wait till you have gone through Section 6. You will then be able to work out the amounts you need for your entire family.

5.5 SUMMING UP

You learnt that diet planning consists of the following seven steps :

1) IDENTIFY THE INDIVIDUAL
2) CONSULT RDIs FOR ENERGY AND PROTEIN
3) DECIDE ON TOTAL AMOUNTS OF SPECIFIC FOOD GROUPS OR IN OTHER WORDS — PREPARE A FOOD PLAN BASED ON EXCHANGES
4) DECIDE NUMBER OF MEALS TO BE CONSUMED
5) DISTRIBUTE EXCHANGES BETWEEN MEALS
6) DECIDE ON MENU
7) FINAL CHECK

We learnt that this process is common to planning any diet whether for an adult or child, a lactating woman or an old person. The amount, of course, will vary.

One concept that is particularly important in diet planning is the idea of exchanges. Exchanges are groups of similar food items (e.g. cereals or pulses or milk and milk products). An exchange is expressed in terms of a particular weight of a food item that would provide a specified fixed amount of either carbohydrate or protein or fat.

Cereals, for example, are grouped together into the cereal exchange. The cereal exchange is expressed as a particular weight i.e. 20 g. This much cereal would provide a fixed amount of carbohydrate i.e. 15 g.

In other words to specify a food exchange we must (i) indicate which one it is out of the following: cereals, roots and tubers, sugar, fats and oils, milk, pulses, meat/fish/poultry/eggs, green leafy vegetables, other vegetables or fruits. This is what gives an exchange its name and (ii) specify the amount/exchange for each of the above exchanges. (This is of course based on a fixed contribution of carbohydrate or protein or fat.)

You have also studied the concept of portion size. Before deciding on how to distribute foods over the meals in a day we must first know how much the person we are planning for is likely to eat i.e. portion size. This is of course quite variable but there are approximate guidelines for how much an adult man, for example is likely to eat at one time.

DO SEE THE VIDEO PROGRAMME "PLANNING BALANCED DIETS" AT YOUR STUDY CENTRE

SECTION

6

PLANNING DIETS – II

HOW TO STUDY THIS SECTION

Before you begin, read through Block 2 (Units 7 to 10) and Section 5 of the Practical Manual.

Go through the sub-section on planning diets for various age groups and physiological states. Compare food plans and study the

- influence of activity level in the case of adults
- [illegible] in food exchanges made in the case of pregnancy and lactation
- [illegible] made from early childhood to adolescence.

[illegible] the food plans and make your own conclusions about which [illegible] to remain the same. It will then be easier to remember the [illegible] which change based on age, sex, activity level or physiological state.

[illegible] handy. You can fill up Chart 1 given as Activity 1 in this section [illegible] Block 2. This will help you to recall the [illegible] to remember in [illegible] and diets for adults, pregnant women, lactating women, infants, [illegible] adolescents. You would then find it easy to understand the specific [illegible] food plan.

[illegible] thing. At the end of this section you will find an interesting [illegible] on (Annexure 6). Questions and activities [illegible] with the [illegible] should try to attempt them. You [illegible]

SKILLS TO LEARN FROM THIS SECTION

You will learn how to

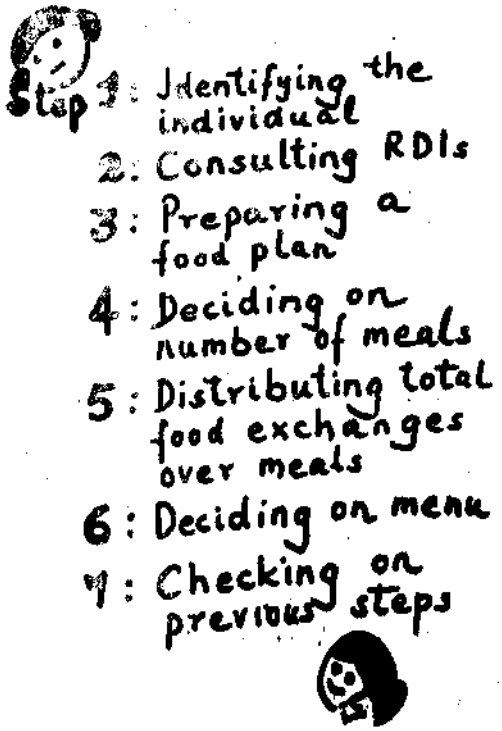
- modify food plans based on individual needs and preferences
- record nutritive value and portion size
- evaluate cooked meals and snacks.

Structure

6.0 INTRODUCTION

Do it yourself !

Can you ? We are sure you would have mastered the basic diet planning skills by now. Next you need to learn how we use the same process to plan diets for individuals of different ages as well as for physiological states such as pregnancy and lactation. You will find food plans in this section which are satisfactory for meeting nutrient needs. But we have deliberately not given distribution tables or menus. We think you will be the best person to work them out based on the meal patterns of your region. There should be no problem since you have already learnt the steps to follow in planning a diet.



Remember to use your practical kit to find out the equivalents in terms of the gram weights mentioned for each food plan. On the basis of this you can even work out the amounts your family would need to eat in a day. In fact once you have a rough idea, you don't need to measure foods all the time. Now let's list what we expect to achieve by the end of this section.

Objectives

After studying this section, you should be able to

- identify the changes that become necessary in food plans depending on changes in energy and protein needs
- modify food plans depending on individual preferences and needs
- differentiate between food plans for different age groups and activity levels
- compare food plans for pregnancy and lactation with that for non-pregnant, non-lactating women
- describe the characteristics of infant feeding schedules and diets for the elderly
- plan nutritious snacks
- record nutritive value of snacks and dishes.

6.1 FOOD PLANS FOR VARIOUS AGE GROUPS/ PHYSIOLOGICAL STATES

This discussion is meant to help you to understand the variations in the number and type of food exchanges that arise due to factors such as age and activity level. You are aware that in physiological states such as pregnancy and lactation, the nutrient needs of women increase sharply. This is reflected in the food plans for pregnancy and lactation.

Activity levels play an important role in the case of adults—both men and women. The higher the activity, the more would be the need for energy. In other words, the number of food exchanges included such as cereals, roots and tubers would increase. The amount of fats and oils to be included would also increase marginally.

The examples taken here are drawn from the middle income group. Most adults belonging to the middle income group would be either sedentary or moderate workers and hence the heavy work category is not discussed. The latter includes construction workers, mine workers and others. Usually heavy workers belong to the low income group.

Table 6.1 Food Plans for Various Age Groups and Physiological States*

Exchange	Adult Man (Sed)	Adult Man (Mod)	Adult Woman (Sed)	Adult Woman (Mod)	Woman (Sed)	Pregnant Woman (Mod)	Lactating Woman (Sed)		Lactating Woman (Mod)	Preschooler (Mod)			School Child		Adolescent				
							0-6 Mths	6-12 Mths	0-6 Mths	6-12 Mths	1-3 yrs	4-6 yrs	7-9 yrs	10-12 yrs Boys	10-12 yrs Girls	13-15 yrs Boys	13-15 yrs Girls	16-18 yrs. Boys	16-18 yrs. Girls
Cereals	14	19	10	12	11	14	12	12	15	15	4	8	9	12	10	14	10	16	9
Roots and tubers	2	2	1	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2
Sugar/Jaggery	7	7	5	7	7	8	8	7	8	8	4	7	6	6	7	6	7	7	7
Fats and Oils	8	11	7	8	7	9	8	7	11	9	4	6	7	8	7	8	6	9	7
Milk	2	2	2	2	2	2	2½	2	2½	2	2	2	2	2	2	2	2	2	2
Pulses	2	2	2	2	2	2	2	3	2	3	1	1	2	2	2	2	2	2	2
Meat fish poultry/egg	1	—	—	—	1	1	1	—	1	—	—	—	—	—	—	1	1	1	1
Green Leafy	1	2	1	1	2	2	2	2	2	2	1½	1	1	1	1	2	2	2	2
Other vegetables	2	2	2	2	2	3	3	2	3	3	1	1½	2	2	2	3	2	3	2
Fruits	3	3	2	3	2	2	2	2	2	2	2	2	3	3	3	2	2	2	3
Total Energy/ protein Kcal/g	2430/73	2885/78	1885/56	2220/62	2175/69	2535/77	2435/77	2275/69	2780/83	2635/79	1240/37	1690/46	1945/56	2220/62	1965/56	2450/77	2060/67	2655/81	2075/65
RDI	2425/60	2875/60	1875/50	2225/50	2175/65	2525/65	2425/75	2275/68	2775/75	2625/68	1240/22	1690/30	1950/41	2190/54	1970/57	2450/70	2060/65	2640/78	2060/63

Sed Sedentary
Mod Moderate
Mths Months
Yrs Years

* Developed by author

Table 6.2 : Weight Equivalents of the Food Plans for Various Groups and Physiological States*

Exchange	Adult Man (Sed)	Adult Man (Mod)	Adult Woman (Sed)	Adult Woman (Mod)	Pregnant Woman (Sed)	Pregnant Woman (Mod)	Lactating Woman 0–6 mths (Sed)	Lactating Woman 0–6 mths (Mod)	Lactating Woman 6-12 mths (Sed)	Lactating Woman 6-12 mths (Mod)	Preschooler 1-3 years	Preschooler 4-6 years	School Child 7-9 yrs	School Child 10–12 yrs Boys	School Child 10–12 yrs Girls	Adolescent 13–15 yrs Boys	Adolescent 13–15 yrs Girls	Adolescent 16–18 Boys	Adolescent 16–18 Girls
Cereals	280	380	200	240	220	280	240	240	300	300	80	160	180	240	200	280	200	320	180
Roots and tubers	120	120	60	120	120	120	120	120	120	120	120	120	120	120	60	120	120	120	120
Sugar/Jaggery	35	35	25	35	35	40	40	35	40	40	20	35	30	30	35	30	35	35	35
Fats and Oils	40	55	35	40	35	45	40	35	55	45	20	30	35	40	35	40	30	45	35
Milk	500	500	500	500	500	500	625	500	625	500	500	500	500	500	500	500	500	500	500
Pulses	60	60	60	60	60	60	60	90	60	90	30	30	60	60	60	60	60	60	60
Meat/fish/ poultry/egg	1	—	—	—	1	1	1	1	1	1	—	—	—	—	—	1	1	1	1
Green leafy veg	100	200	100	100	200	200	200	200	200	200	50	100	100	100	100	200	200	200	200
Other Vegetables	200-300	200-300	200-300	200-300	200-300	300-450	300-450	200-300	300-450	300-450	100-150	150-200	200-300	200-300	200-300	300-450	200-300	300-450	200-300
Fruits	240-300	240-300	160-200	240-300	160-200	160-200	160-200	160-200	160-200	160-200	160-200	160-200	240-300	240-300	240-300	160-200	160-200	160-200	240-300

Figures are in grams except for milk ; figures for milk are in terms of milliliters (mL)

Sedentary — B-Boys

Mod–Moderate — G–Girls

Mths–Months

Yrs–Years.

* Developed by author.

Table 6.1 gives you an idea of how food plans vary depending on age and sex. The effect of activity levels is illustrated in the case of both adult men and women. You can also see the changes in the food plan when a woman is pregnant or lactating.

We have left out infancy and old age in this table. We will discuss their special aspects in Sub-section 6.2.

Table 6.2 gives you the weight equivalents of the food plans. You could convert these weights into standard measures using the charts given in Section 1 (Annexure 1). *Use your practical kit in measuring out the amounts needed for family meals and diets.*

Now, after going through Tables 6.1 and 6.2, you would like to ask many questions. You will find answers to most of these questions in the following discussion. Important aspects are also highlighted. So read this section carefully.

1) **Amounts of respective food exchanges**

a) These food plans have been prepared keeping in mind vegetarians or vegetarians who consume eggs. For non-vegetarians, the amount of pulse can be decreased or omitted and the amount of meat/fish/poultry can be increased upto 2 exchanges.

b) Not more than three exchanges each of other vegetables or fruits should be included in any food plan for individuals belonging to the middle income group. Upto 3 exchanges can be given provided cheaper fruits and vegetables are selected. Also when 3 exchanges of fruit are given part of it can be assumed to be banana since it is a cheaper fruit commonly consumed.

c) Roots and tubers can be omitted or reduced to one exchange and appropriate adjustments made in the cereal category.

Now before you study the trends across age, activity level and different physiological states, let us discuss some rules of the thumb.

Up go the energy needs!
So what do we do?
Add more cereals first and foremost
If it's still not enough
Up go sugar, fats and oils.

Up go the protein needs!
So what do we do?
Add more pulses and
If there's money to spare,
Up go milk and eggs or meat.

Up go vitamin and mineral needs!
So what do we do?
Include the richest sources
The cheapest and best
Up go nutritious fruits and vegetables.

---

2) **Changes with activity level**

As activity level increases, energy requirements increase. Hence more of energy-giving foods need to be included. Compare the food plan for a moderately active woman with that of a sedentary woman. Which exchanges have gone up? Do you notice the increase of exchanges in the energy-giving group?

3) **Changes with age**

a) Upto the age of 9 years the food plans for boys and girls are the same because RDIs are identical. After that RDIs are different for boys and girls and therefore, separate food plans have to be prepared.

b) There is an increase in the number of food exchanges offered once the preschool stage is past. During the school years patterns are quite similar to those for the adult. You would notice that the food plans for preschoolers include less cereal, pulse, and even fruits and vegetables. We must be careful about their diets. It is important not to give too much. For the older children, there is not much variation in the amounts of milk, pulses, green leafy vegetables, other vegetables and fruits. These are roughly similar. Now that we have realized this it becomes easier to pinpoint the differences.

4) **Changes due to pregnancy and lactation**

a) The plans are based on activity levels (sedentary or moderate).

b) It becomes necessary to include better quality proteins in sufficient amounts (i.e. protein derived from milk and meat/fish/poultry/egg). Suitable cereal-pulse combinations are also adequate to meet protein needs.

c) Since energy needs increase, the number of exchanges of cereals, fats & oils and sugar/jaggery also increase.

5) **Meeting vitamin and mineral needs**

We have to make a special mention of vitamins and minerals because these plans have been made keeping RDIs for energy and protein in mind. They would meet vitamin and mineral needs only if suitable food sources are selected and included. We have to particularly keep in mind the nutrients of crucial importance for a particular age group or physiological state. For example, we have to ensure that we select vitamin A - rich fruits and vegetables for preschoolers and iron sources in the case of pregnant women.

ACTIVITY 1

1) Fill up the following chart based on information given in Block 3. The important points for pregnancy are listed to help you.

Chart 1 : Important Points to remember about Age Groups/Physiological States

	Pregnancy	Lactation	Old Age	Infancy	Preschool years	School years and Adolescence
Important nutrients • Energy • Protein • Iron • Calcium						
Key points to remember : • Increase meal frequency (6 meals) • Have plenty of fluid • Include good snacks between main meals • Avoid too much fat or sugar • Avoid foods poorly tolerated • Take care to include sources of iron, calcium, some animal protein in each meal						

6.2 TWO SPECIAL CASES: INFANCY AND OLD AGE

Let's talk about infancy first.

In Unit 9 of Block 3 we described the feeding schedules of infants 0-4 months, 4-6 months, 6-8 months and 8-12 months. You would have noticed the difference between a feeding schedule and the meal patterns specified for children and adults. A specific time is mentioned in this case along with the item being offered.

What are the important points you need to keep in mind? These are:

i) Calculate RDIs on the basis of body weight for energy and protein.

ii) Decide on the frequency of feeding depending on the age and the needs of the particular infant. Remember that a feeding schedule need not be imposed on the infant and is very much dependent on age.

iii) Offer supplements between four to six times a day (solid or liquid). This would be influenced by the age of the infant.

Drawing up a food plan for an infant is rather complicated. This is mainly because we have to work in fractions of an exchange. Also the exercise is relevant only for the older infant. Here's an example of a food plan for an infant.

Age = 7 months
Weight = 7.5 kg
RDI for energy (Kcal) = 98/kg
RDI for protein (g) = 1.65/kg
Total RDI for energy (Kcal) = 735
Total RDI for protein (g) = 12.4

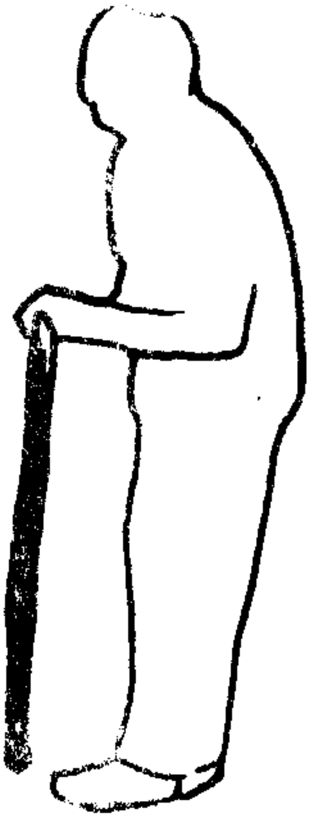
Exchange	No. of exchanges	Energy (Kcal)	Protein (g)
Cereals	1	70	2
Roots & tubers	1	70	2
Sugar	2	40	—
Fats & oils	1½	68	—
Milk Breast	500 ml	325	5.5
Cow's	125 ml	85	4.0
Pulses	½	50	3.5
Meat/fish/poultry/egg	—	—	—
Green leafy vegetables	½	—	—
Other vegetables	¼	10	1
Fruits	½	20	—
	TOTAL:	738	18

Now that is rather complicated, isn't it? You would have a sigh of relief if we tell you that we don't expect you to be able to work this out at this stage. Further, these amounts are likely to be quite variable depending on the little one's whims and fancies! Whatever we do is just in the nature of a guideline.

Let us now talk about preparing a food plan for an older person.

You learnt about the special needs of the elderly in Block 3. We mentioned the modifications we need to make in the diet. First and foremost we showed you how the energy needs of the older person decrease. Use the formula you learnt in Unit 7 of Block 3. Next we described the changes in the type of diet given to an older person. Can you list them in the following chart?

DIET CHANGES IN OLD AGE



Quantity of Foodstuffs	Type of Foodstuffs	Consistency/ Texture	Meal Frequency
Reduce total intake of fat	Saturated fats to be limited		

Now let us prepare a food plan for a 75 year old man.

Age : 75 years

Sex : Male

Activity level : Sedentary

RDI for energy : $\frac{70 \times 2425}{100} = 1698$ Kcal (70 per cent of RDI for young adult)

Let us assume that protein needs remain the same i.e. 60 g. The food plan would be as follows :

Exchange	No. of exchanges	Energy (Kcal)	Protein (g)
Cereals	8	560	16
Roots & tubers	1	70	2
Sugar	2	40	–
Oils	7	315	–
Milk (skim)*	2	190	16
Pulses	2	200	14
Meat*/fish/poultry/egg	2	140	14
Green leafy vegetables	2	40	2
Other vegetables	2	80	4
Fruits	2	80	—
		1715	68

* Lean meat or less fatty meat
skim milk – milk with cream removed

PRACTICAL POINT [illegible]

Making skim milk: Boil whole milk. Allow it to cool. Remove the [illegible] on top. This will result in substantial reduction [illegible] milk.

Making lean meat: Remove all white fatty portion [illegible] pieces and keep in a refrigerator or cool place. [illegible]

As you already know, we must try to cut down on sugar and fat intake in old age. The fat consumed should be vegetable oils rather than saturated fats such as ghee and butter. Do remember that coconut oil is also saturated. Cholesterol sources should also be avoided or their consumption should be decreased. Cholesterol sources include whole milk, organ meats and egg yolk.

ACTIVITY 2

ASK YOURSELF

- How does the plan for adults change based on sex? Which exchanges change?

  .....

  .....

  .....

- Why do food plans change in pregnancy and lactation? Which exchanges change?

  .....

  .....

  .....

- What changes take place in food plans as the child moves from the 1–3 years category to the 4–6 years age category?

  .....

  .....

  .....

- How is the food plan for an older adult different from that of a young adult?

  .....

  .....

  .....

6.3 MONEY MATTERS!

Money does matter. We can't complete this discussion without talking about money matters, can we? We have planned diets for individuals belonging to the middle income group. How would the diet change for persons belonging to the low and high income groups? To answer this question let's list out the foods which are cheaper and those which are expensive.

	Cheaper foods	Expensive foods
Energy-giving group	Cereals Roots and tubers	Fats and oils
Body-building group	Pulses Eggs	Milk Meat/fish/poultry
Protective and regulatory group	Green leafy vegetables	Fruits Some in the Other vegetables category

Good value for money?

Based on this can you predict which food exchanges would tend to rise in low income diets and which would tend to fall? Yes, you're right. Cereals and roots and tubers would increase whereas milk, meat/fish/poultry/eggs and fruit would decrease compared to the middle income group. The amount of other vegetables would tend to decrease as well. In each food category the cheapest items are selected.

We must also remember that persons belonging to low income groups such as construction labourers often do heavy, strenuous work. This pushes up their energy needs and increases the reliance on cereals.

Least cost balanced diets were worked out by ICMR in 1981 based on the following constraints :

1) Energy derived from cereals to be not more than 75% of total RDIs.
2) Ratio of cereal protein to pulse protein to be kept between 4 : 1 and 5 : 1.
3) Energy derived from refined carbohydrates (sugar or jaggery) kept around 5% and total calories from fat and sugar not to exceed 20% of the total calories supplied by entire diet.
4) Energy derived from fat or oil not to exceed 15% of total calories.
5) Minimal amount of milk, fruits, other vegetables and omission of meat, fish, poultry.

The *lower limits* for certain exchanges in the case of adults are : Milk – ½ to 1 ; Fruits – 1 ; Other vegetables – 1.

Affluent Indians, on the other hand, tend to :

- eat more pulses, vegetables, milk (and flesh foods in the case of non-vegetarians)
- include more of refined cereals
- eat more fat and sugar.

While the first is a desirable trend the other two are not. This must also be viewed in the context of the sedentary life style of the affluent.

It is strongly recommended that visible fat intake should not contribute more than 20% of the total calories while sugar could contribute about 5%.

A balanced diet for a rich person would of course include less cereals/roots and tubers and about the same or a little more sugar and fat as compared to a diet for a middle income group person. Milk and meat/fish/poultry/eggs may be emphasized more than pulses. Intake of fruits, other vegetables could also go up.

The *upper limits* for specific exchanges in the case of adults are given here :

Milk-3
Meat/fish/poultry/eggs-3
(in this case pulse may be reduced to 1 or omitted)
Fruit-3
Other vegetables-3

6.4 RECORDING NUTRITIVE VALUE AND PORTION SIZES

Suppose you are asked to indicate the nutritive value and portion size/number of servings of a particular recipe for a snack or dish. What would be the best way to do it ?

Let us take a recipe for poha as an example. This is usually how the recipe will be written out :

POHA	
Ingredients	**Amount**
Rice flakes	100 g
Fat (oil)	20 g
Mustard seeds	2 g
Curry leaves	5 g
Salt	to taste
Haldi (turmeric)	a pinch
Onion	25 g
Red chilli powder	a pinch

Method :

1) Clean rice flakes.
2) Put the rice flakes into a sieve and keep under running water till the flakes soften. Drain.
3) Heat fat.
4) Add mustard seeds. Allow them to splutter. Then add onion and curry leaves.
5) Fry till light brown.
6) Add rice flakes, salt, haldi, red chilli powder. Mix thoroughly.
7) Cook till rice flakes are soft and water is fully absorbed.
8) Serve hot.

If you look at the ingredients carefully, you would notice that the following contribute varying but fairly substantial amounts of nutrients (the others contributing negligible amounts) :

Rice flakes	—	100 g
Fat (Oil)	—	20 g
Onion	—	25 g

We can calculate the nutritive value based on these items using this table.

NAME OF DISH : POHA		No. of Servings :	
Ingredients	Amount (g)	Nutritive Value	
		Energy (Kcal)	Protein (g)
Rice flakes	100		
Fat (Oil)	20		
Onion	25		

Can you now fill up the nutritive value column using the food composition tables ?

The next question is how much would we serve to an adult man ? Look at the amount of rice flakes, compare it to the amount per serving mentioned earlier for an adult man. Obviously this much would be able to serve two men i.e. roughly two servings or two portions. You can enter the number 2 in the top right hand corner.

We can also calculate how much of various nutrients are provided by one serving of the recipe. Divide the nutritive values already obtained by 2 to get the nutritive value/serving.

This example shows you how to record the energy and protein content of a particular snack or dish. It is possible that you may want to know how much iron or calcium or vitamin A the snack would provide. In such cases you can add one more column as indicated here :

Ingredients	Amount (g)	Nutritive value		
		Energy (Kcal)	Protein (g)	Vit. A (μ g)

Here the entry for vitamin A can be substituted by calcium or iron or all three can be entered. The content of any of the other nutrients can also be similarly indicated.

Always remember to clearly indicate amounts of ingredients in grams and the units of the nutrients whether expressed in grams, Kcal or micrograms.

6.5 EVALUATING COOKED MEALS AND SNACKS

Imagine that you have decided to enter a recipe contest for nutritious snacks for children. Yours would be one of several entries. Do you know how comparative evaluation would be carried out? If evaluation is done systematically, the following steps would be necessary:

(i) Observing the cooked product-appearance (colour, shape, size).

(ii) Tasting the cooked product (flavour, texture).

(iii) Noting down the ratings: Based on the assessment of appearance and taste, a score card like this can be filled:

Score Guide	Good	3
	Satisfactory	2
	Poor	1

NAME OF THE PRODUCT:

PERSON WHO PREPARED THE PRODUCT:

QUALITY CHARACTERISTICS AND SCORES			
COLOUR	SHAPE & SIZE	FLAVOUR	TEXTURE

FINAL SCORE:

Comments would be entered in each column – whether good/satisfactory/poor with the corresponding score. Then a common score for the product as a whole would be arrived at taking into account all these comments. For example, the product may be considered good in each of the quality characteristics tested. In that case the final score would be 3. However, if different quality characteristics are rated differently e.g. 3 + 2 + 3 + 3 for colour, shape/size, flavour, texture respectively a common score would have to be worked out. An average score would be 11 divided by 4 i.e. 2.7 or to round it off, a score of 3. To give another example. Suppose the scores were 2 + 1 + 3 + 2 = 8. The average score would be 2.

6.6 SUMMING UP

This section discussed food plans for various age groups and for physiological states such as pregnancy and lactation. You learnt how activity level influences food plans in the case of adults.

By now you have understood ways in which food plans vary. You should also have a fair idea of how food plans can be modified to accommodate personal likes and dislikes as well as acceptability of different foods. We have worked out several questions in Annexure 6. You could look at Questions 1 and 3 for information on this aspect. Detailed guidelines are given on how to answer these and other questions in Annexure 6.

The special cases of infancy and old age were discussed in some detail. You will however not be expected to plan diets for these two groups since this requires more specialized skills.

You need not be overawed by the whole exercise of planning. Most of the questions you will be required to attempt would ask you to compare food plans or modify given food plans. You will find detailed guidelines in Annexure 6. You can also be asked to prepare menus based on given food plans and distribution tables.

This, of course, does not mean that you cannot plan diets for yourself and your family. Of course you can. We don't want to burden you with remembering so many numbers and tables for the examination. We just want you to be able to demonstrate diet planning skills.

So Good Luck and Happy Planning!

DO SEE THE VIDEO PROGRAMMES
ON MEAL PLANNING
AT
YOUR STUDY CENTRE

ANNEXURE 6 QUESTIONS FOR DISCUSSION

Now let's have some fun. For a change we've listed some questions for discussion and worked them out too. Now all you have to do is read carefully. You would be expected to attempt questions similar to these in your assignments and term-end examination.

A guide is given here to what the questions discuss :

Question 1 : Modifying a given food plan for a sedentary woman.

2 : Commenting on four menus for main meals from different regions.

3 : Modifying given food plan for a sedentary man. Working out a satisfactory distribution table.

4 : Comparing food plans for a non-pregnant woman with those for pregnant and lactating women. Working out suitable distribution tables for the above categories.

5 : Evaluating given food plans for preschoolers. Commenting on suitable meal frequency.

6 : Planning a suitable snack for a pregnant woman.

7 : Indicating suitable food selections for packed lunches, tea-time meal, breakfast for a 10 year old.

8 : Giving adolescents dietary advice.

9 : Evaluating a given diet.

10 : Calculating energy and protein content of a diet.

QUESTION 1: Shanti is a 30 year old sedentary woman. She does not like green leafy vegetables but does consume eggs. How would you modify the food plan for an adult woman (sedentary) in Table 6.1 to make it suitable for Shanti ?

DISCUSSION 1

Alternative 1

i) You could consider omitting green leafy vegetables but that would mean including another iron source in the diet. Selecting whole grain cereals and pulses might help.

ii) You could include one egg.

The net effect of these changes on energy and protein would be + 70 Kcal and + 7 g protein.

We may decide to give cheaper other vegetables upto 3 exchanges to compensate for the lack of green leafy vegetables. This would increase the cost of the diet even if seasonal vegetables are included.

The further effect of this would be
+ 40 Kcal and + 2 g protein
Total effect of changes would be
+ 110 Kcal and + 9 g protein

To offset this suppose we decrease cereal exchanges by 1 and fat exchanges by 1.

This would mean
− 70 − 45 = −115 Kcal and − 2 g protein

	Add (+)	Subtract (−)	Net addition/subtraction
Energy (Kcal)	110	115	−5
Protein (g)	9	2	+7

The original food plan provided 1885 Kcal and 56 g protein. The new food plan would provide 1880 Kcal (1885–5) and 63 g protein (56 + 7).

Alternative 2

i) You may decide to leave the green leafy category untouched and suggest some

interesting ways to eat the vegetable. In that case you would not alter the other vegetable category.

Alternative 3

i) You could add an egg
The net effect of this would be :
+ 70 Kcal and + 7 g protein

How do we compensate ? We could decrease on roots and tubers to one exchange.

This would mean
– 70 Kcal and – 2 g protein

In other words

	Add (+)	Subtract (–)	Net addition/subtraction
Energy (Kcal)	70	70	0 (70 – 70 = 0)
Protein (g)	7	2	+ 5 (7–2 = 5)

QUESTION 2 : Four traditional meals are listed here from Kerala, Maharashtra, Karnataka and Punjab.

i) Are they balanced ?
ii) Look at examples A & C. Can you identify one common feature which shows the regional availability of a certain food ?

A. Sharda works as a typist in a private firm. She is 25 years old and resides in Kottayam, Kerala. Sharda carries a packed lunch wrapped in banana leaves and newspaper. One particular day the packed lunch consisted of the following dishes :

Rice
Thoren (dry vegetable)
Sambar
Curd

On a holiday Sharda cooks a more elaborate meal including :

Rice
Avial (mixed vegetable preparation with coconut)
Erissery (raw banana and coconut preparation)
Kadala curry (chana curry)
Pappadam (papad)
Pickle

B. Mohini is a Maharashtrian housewife. What is she cooking today ?

Name of dish	Ingredients
Masala Bhath	Rice, brinjals, coconut, curd, spices, coriander & curry leaves, oil
Panchras Amti	Tur (arhar) dal, raw bananas, brinjal, potato, coconut, onion, spices, oil
alachi Usal	Vaal (fried beans), coconut, jaggery, coriander leaves; oil

C. We visited a Kannada household. They served us :

- Bisi bele bhath
- Yogirathna
- Obbattu

The description of these dishes is given here:

Dish	Ingredients	Description of dish
Bisi bele baath	Rice, tur dal, brinjal, carrots, drumstick, coconut, ghee	Fried rice with dal and vegetables
Yogirathna	Potatoes, peas, vegetable marrow, ashgourd, carrot, cauliflower, coconut milk, tomato, oil	Curry with mixed vegetables in coconut milk
Obbattu	Bengal gram dal, sugar, maida (refined flour), rice flour, ghee/oil	Balls of maida with sweet bengal gram filling rolled out in rice flour and baked on hot tawa with oil

D. A typical meal in winter from Punjab.

Dish	Description
Lassi	Curd preparation
Makki ki roti	Rotis of maize flour
Sarson da saag	Mustard leaves preparation

DISCUSSION 2 : All examples A to D illustrate balanced traditional meals. Isn't that amazing! You would notice, of course, that emphasis on various food groups is different.

To answer the second question, A is a Keralite meal and C is a Maharashtrian meal. Both Kerala and Maharashtra have an extensive coastline. This means a high consumption of fish. However, both A and C are vegetarian meals. But then do A include one item abundant in coastal areas. Look carefully, you'll identify it.

QUESTION 3 : Mohan Singh is a college lecturer in Chandigarh, Punjab. It is customary for him to follow a four meal pattern — breakfast, a packed lunch, tea-time snack and dinner. He is particularly fond of non-vegetarian food but does not consume fish. He also does not eat too many sweets.

Now answer the following questions :

i) What is the activity level of Mohan Singh ?

ii) Do you think the food plan for an adult man of this activity level given in Table 6.1 is suitable for Mr. Singh ?

iii) List the modifications, if any, in the food plan. How would you distribute the amounts over the four meals ?

DISCUSSION 3 :

i) Mohan Singh is a sedentary man since he is a lecturer.

ii) The food plan given in Table 6.1 is suitable for Mohan Singh if we substitute meat for the egg included as part of the meat/fish/poultry/egg group.

OR

We could decide to give both meat and egg on a particular day and hence we might like to reduce the amount of pulse.
In this case :

Modifications in Exchanges	Change in Energy (Kcal)	Change in Protein (g)
Reducing pulse to one exchange	– 100	– 7
Adding one exchange meat	+70	+7
Net result	– 30	0

Now what do we do to increase the calorie content by 30 Kcal ?

- We could add 1½ exchanges sugar (+ 30 Kcal) but this would mean exceeding the limit of 5% of total calories mentioned in Sub-section 6.3. But we prefer not to work in fractions and most important, Mohan Singh does not like sweet items. What is the other alternative ?
- We could add one exchange of fat and reduce one exchange of sugar
  + 45 Kcal – 20 Kcal = + 25 Kcal

The revised food plan would therefore be :

Exchange	No. of exchanges	Energy (Kcal)	Protein (g)
Cereals	14	980	28
Roots & tubers	2	140	4
Sugar/Jaggery	7 – 1 = 6	140 – 20 = 120	—
Fats & oils	8 + 1 = 9	360 + 45 = 405	—
Milk	2	340	16
Pulses	1	100	7
Meat/fish/poultry/egg	2	140	14
Green leafy vegetables	1	negl.	negl.
Other vegetables	2	80	4
Fruits	3	120	—
		2425	73

Now suppose we follow this food plan. Let us proceed to distribute these amounts over the four meals.

	Breakfast	Lunch	Tea	Dinner	Total
Cereals	3 (210)	4 (280)	3 (210)	4(280)	14
Roots & tubers	1(70)			1(70)	2
Sugar/jaggery	2(40)		2(40)	2(40)	6
Fats and oils	1(45)	3(135)	2(90)	3(135)	9
Milk	½(85)	1(170)	½(85)		2
Pulses				1(100)	1
Meat/fish/poultry/eggs	1(70)			1(70)	2
Green leafy vegetables		1			1
Other vegetables	¼(10)	1(40)	¼(10)	½(20)	2
Fruits	1(40)		1(40)	1(40)	3
	(570)	(625)	(475)	(755)	

(Figures in brackets indicate calorie values)

Do you think this distribution is satisfactory ?
Breakfast + tea should provide 1/3 of total calories and Lunch 1/3 and Dinner 1/3 of total calories. Of course minor variations are quite acceptable such as an additional 50 Kcal or a deficit of 50 Kcal. Now,

⅓ × 2425 = 808 Kcal

This means lunch supplies 625 Kcal in comparison to 1045 Kcal provided by Breakfast and Tea together.

Now can you decide which exchanges you would like to shift from Breakfast or Tea to Lunch ?

You could decide to shift one cereal exchange from tea-time to lunch.

What else would you do ?
Remember not to omit the body-building or protective exchanges from any meal. You could of course shift fruit from breakfast to lunch. You could also decide to shift one

exchange of roots and tubers to lunch from breakfast. Now the distribution table would look like this :

	Breakfast	Lunch	Tea	Dinner	Total
Cereals	3	5	2	4	14
Roots & tubers	—	1	—	1	2
Sugar/Jaggery	2	—	2	2	6
Fats & oils	1	3	2	3	9
Milk	½(85)	½(170)	½(85)	—	2
Pulses	—	—	—	1	1
Meat/fish/poultry/eggs	1	—	—	1	2
Green leafy veg.	—	1	—	—	1
Other veg.	¼	1	¼	½	2
Fruits	—	1	1	1	3

You could write down the energy values on the side in brackets as shown for milk and total up for each meal.

QUESTION 4 : The following table shows the exchanges allocated for a sedentary woman, for a sedentary pregnant woman and sedentary lactating woman (0–6 months of lactation).

	Sedentary woman	Sedentary pregnant woman	Sedentary lactating woman (0–6 mths)
Cereals	10	11	12
Roots & tubers	1	2	2
Sugar/Jaggery	5	7	8
Fats & oils	7	7	8
Milk	2	2	2½
Pulses	2	2	2
Meat/fish/poultry/eggs	—	1	1
Green leafy veg.	1	2	2
Other vegetables	2	2	3
Fruits	2	2	2

i) Now indicate the differences in exchanges in each case. Why do you think these changes were made ?

ii) Give suitable distribution tables for the pregnant and lactating women.

DISCUSSION 4 : (i) *The Energy-giving Group*

- The cereal exchange has been increased from 10 to 11 (pregnancy) and 12 (lactation).
- The roots and tubers exchange increased from 1 to 2 (pregnancy and lactation)
- The sugar and jaggery exchange has been increased from 5 to 7 (pregnancy) and 8 (lactation)
- The fat and oil exchange has increased from 7 to 8 (lactation)

These changes have been necessitated by the increase in energy needs in pregnancy and lactation. This increase is sharp—from an energy RDI of 1875 Kcal for the sedentary woman to an energy RDI of 2175 Kcal for pregnancy and 2425 Kcal for lactation.

The Body-building Group

- The milk exchange remains unchanged in pregnancy and is increased in lactation to 2½ exchanges.
- The meat/fish/poultry/eggs exchange is included in both pregnancy and lactation.

There is a sharp increase in members of this group in lactation. In pregnancy also there is an increase. These changes have been made because of the increase in protein needs in pregnancy and lactation. While the sedentary woman needs 50 g protein, the pregnant woman needs 65 and the lactating woman needs 75 g protein.

The Protective/regulatory Group

- The green leafy vegetable exchange increases from 1 to 2 exchanges in pregnancy and lactation.
- The other vegetables exchange increases from 2 exchanges to 3 (lactation).

These changes are made to provide additional amounts of vitamins and minerals in both physiological states.

(ii) Now what points would you have to keep in mind while distributing exchanges for a pregnant or lactating woman ?

First you could imagine that the pregnant and lactating women are living in your region. So you would have to keep the common meal patterns in mind and any special dishes/foods/snacks you would like to serve.

In addition we would have to remember to :

- include foods from all three groups in all main meals
- increase meal frequency
- serve substantial snacks mid-morning or in the evening or both
- include plenty of fluid
- keep consumption of tea within reasonable limits, and avoid coffee, particularly in pregnancy
- give sources of iron & calcium (pregnancy) and calcium, vitamin A, vitamin C (lactation) i.e. include selected fruits and vegetables in the main meals.

Now suppose we decide to give a 5 meal pattern in the case of the pregnant woman

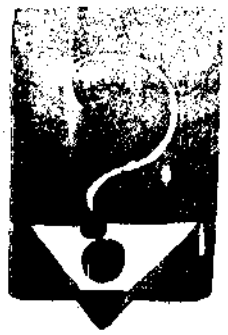
	Breakfast	Mid-morning	Lunch	Tea	Dinner	Total
Cereals	2(140)	2(140)	3(210)	1(70)	3(210)	11
Roots & tubers			1(70)		1(70)	2
Sugar/Jaggery	1(20)	2½ (50)	2(40)	1½(30)		7
Fats and oils	1½(68)	1½(67)	2(90)		2(90)	7
Milk	1(170)		½(85)	¼(43)	¼(42)	2
Pulses		1(100)			1(100)	2
Meat/fish/poultry/eggs	1(70)					1
Green leafy veg.			1(20)		1(20)	2
Other veg.	½(20)		1(40)		½(20)	2
Fruits	1(40)			1(40)		2
	(528)	(357)	(555)	(183)	(552)	

You would notice that the three main meals are fairly substantial. Provision has also been made for a snack to be served mid-morning.

Now can you distribute the exchanges in the case of the lactating woman ? A blank table is provided here for your use. You could do your rough work in pencil first and then enter the figures in ink.

	Breakfast	Mid-morning	Lunch	Tea	Dinner	Total
Cereals						
Roots & tubers						
Sugar/Jaggery						
Fats and oils						
Milk						
Pulses						
Meat/fish/poultry/eggs						
Green leafy veg.						
Other veg.						
Fruits						

QUESTION 5 : Look at the food plans given here for Mohan and Varun. Mohan is 2 years old and Varun is 5 years old.



	Food plan for Mohan	Food plan for Varun
Cereals	5	8
Roots and tubers	1	2
Sugar/Jaggery	4	7
Fats & oils	4	6
Milk	2	2
Pulses	1	1
Meat/fish/poultry/eggs	—	—
Green leafy vegetables	1	1
Other vegetables	1	1½
Fruits	2	2

i) Evaluate the food plans based on the following aspects :
   a) the amount of cereals and roots and tubers
   b) the amount of green leafy vegetables
   c) the amount of other vegetables

ii) Would there be any difference in the meal frequency you would consider appropriate for Mohan and Varun ?

DISCUSSION 5 : (i) (a) The amount of cereals may be difficult to consume in the case of Mohan. It is usually a good idea to give upto 2 exchanges of roots and tubers to cut down proportionately on the more bulky cereals. In the case of Varun we would make very few changes.

b) The amount of green leafy vegetables can be reduced to 1/2 an exchange in the case of Mohan. The child might not be able to consume one exchange and in fact usually does not like to either ! It will take imagination on your part and ingenuity.

c) The amount of other vegetables is appropriate.

ii) While a 6 meal pattern might be more suitable for Mohan, a 5 meal pattern might be appropriate for Varun.

QUESTION 6 : Think of a suitable snack for a sedentary pregnant woman which provides 1/4 the RDIs for energy and protein.

DISCUSSION 6 : A good snack for a pregnant woman should be rich in calcium or iron or both if possible in addition to being rich in energy and protein. About ¼ th or more of the RDIs for these nutrients should be provided.
Consider the following food squares. Which one would you pick in order to provide good amounts of energy, protein, calcium or iron ?

1 Cereal	2 Green leafy Vegetables	3 Fats or oils	4 Cereal products
5 Meat	6 Pumpkin	7 Sugar	8 Pulses
9 Mango	10 Jaggery	11 Tilseeds	12 Groundnuts
13 Besan	14 Dry fruits	15 Fish	16 Milk
17 Milk product	18 Potato	19 Onion	20 Tomato

For example if we want to serve Marunda we would select the following food squares.

1.	Cereal – wheat
11.	Til seeds
8.	Pulses – urad dal
7.	Jaggery or gur
3.	Fat

The amounts are indicated here :

Wheat	50 g
Til seeds	20 g
Urad dal	50 g
Gur	100 g
Fat	5 g
Water	50 ml.

Marunda is roasted wheat, urad dal and til balls made with sugar or jaggery syrup.

The nutritive value of this snack can be calculated and recorded as follows:

NAME: *MARUNDA*

Ingredients	Amount (g)	Nutrient Contribution	
		Energy (Kcal)	Protein (g)
Wheat	50	173	5.9
Til seeds	20	113	3.7
Urad dal	50	174	12.0
Jaggery	100	383	—
Fat	5	45	—
		888	21.6

Can you indicate how much of this you would serve?

Once you have decided which proportion of the recipe (1/2, 1/4, 1/3, 2/3) you would serve you can compare it with 1/4th of the RDI for a pregnant women (sedentary).

You could decide to serve 2/3 this recipe. Now we can compare the nutritive value against one-fourth the recommended dietary intakes for a pregnant woman:

Nutrient contribution of recipe (2/3)	1/4 RDI
592 Kcal 14.3 g protein	544 Kcal 16.3 g protein

Now coming back to the question:

1) Decide on which snack you would like to give based on ingredients you will select from the foods indicated earlier (see food squares).
2) Work out the nutritive value.
3) Decide on what proportion of the total amount you would serve.
4) List the energy and protein contribution of this recipe proportion (1/3, 1/2 etc.)
5) Compare these figures with 1/4th of RDI for pregnant women (sedentary).

QUESTION 7: Shweta is a 10 year old. Shweta loves milk and milk products. She has a glass of milk morning and evening and also likes curd. Shweta also has a preference for sweet preparations. We must also add that she dislikes foods with a lumpy or porridge – like consistency such as khichri. She also dislikes green leafy vegetables when given in the form of a vegetable preparation.

Now let us play the food square game again.

Indicate the square numbers corresponding to the foods you would like to include in

i) a packed lunch

ii) tea-time meal

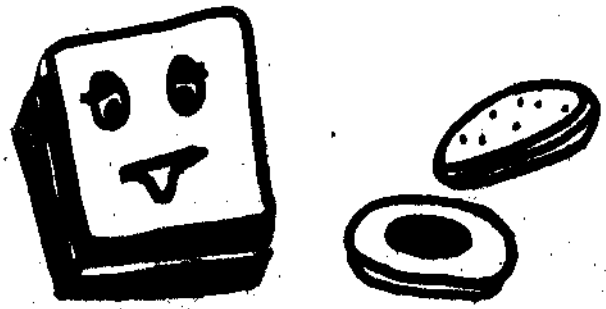
iii) breakfast

(Note: The food squares such as wheat, rice also include their products such as wheat flour, rice flour, rice flakes, and so on).

DISCUSSION 7: We must keep Shweta's preferences in mind. We could include milk/curd/paneer. We should also include green leafy vegetables in some other form as part of another preparation or dish but not as a vegetable preparation. Shweta would probably like a sweet made out of green leafy vegetables. Why not something like sweet besan-spinach burfi in two layers.

You could prepare the burfi as shown in the figure—one layer plain and another layer with the spinach mixed in.

1 **Bread**	2 Wheat	3 **Butter**	4 **Rice**	5 **Milk**
6 **Mango**	7 Coriander leaves	8 **Til seeds**	9 **Capsicum**	10 **Potatoes**
11 **Sugar**	12 Onion	13 **Potatoes**	14 **Fish**	15 **Paneer**
16 **Pumpkin**	17 Moong dal	18 **Eggs**	19 **Tomato**	20 **Papaya**
21 **Spinach**	22 Chana dal	23 **Meat**	24 **Ragi**	25 **Jaggery**
26 **Carrots**	27 Curd	28 **Bajra**	29 **Methi**	30 **Urad dal**
31 **Groundnuts**	32 Soyabeans	33 **Bengal gram**	34 **Peas**	35 **Arhar dal**
36 **Oil**	37 Coconut	38 **Beans**	39 **Rajmah**	40 **Ladies Finger**



Or you could think of a dish like stuffed idli with a sweet filling of the green leafy vegetables with jaggery.

It may be quite different from what you are used to but it is fun to be innovative, isn't it ? You could probably think of several interesting ways in which you can incorporate green leafy vegetables in the child's meals.

This question is otherwise quite simple and you should be able to attempt it with no problem at all using the following guidelines.

For

i) Include items from all three food groups. You could add a sweet item as well.
ii) Give a balanced snack rich in energy, protein, iron/calcium at tea time along with milk.
iii) Give milk and any preparation suitable for your region.

QUESTION 8 : People always want advice from you if they know that you have some knowledge of nutrition. What advice would you give in the following cases ?

A. Joginder loves hockey. He is disappointed because he was not selected for the college team. His coach said that he tires out too fast and is not muscular enough. His problems are not related to any illness. A friend at college told him to eat more. Joginder decides to eat more high-calorie snacks. At regular mealtimes he is not very hungry, so he eats less than usual. He has gained weight but has actually lost endurance and still gets tired easily.

What would you tell him ? Tick the right answer :

i) Continue with what you're doing. The change in diet will take some time to be effective.
ii) Select better snacks which are rich in energy as well as protein, iron or calcium. Remember to drink more fluids.
iii) Select better snacks which are rich in protein, iron or calcium. You should also have enough water or fruit juice.
iv) Continue with what you're doing but drink more fluids. You lose fluids when you exercise.

B. Kshama, a 16 year old, has decided that she needs to lose weight. Her best friend has tried a 'diet' recently in which she ate no cereal or potatoes, no sugar or fat and as much fruit juice as she wanted. She tells Kshama that the diet is wonderful. Kshama tries the diet but finds herself lacking energy and the diet quite boring. She quits the diet and decides that being fat is her fate.

What would you tell her ? Pick the right answer:

i) Cereal and potatoes are full of carbohydrates so they are fattening. Leave them out but there's no need to drink fruit juice.

ii) Fruit juices are low in calories so it's good to include them. In any case they provide minerals.

iii) Include fruit juices by all means but don't leave out cereals or potatoes. You do need them because they provide energy. Leaving out sugar and fat is fine.

iv) Include fruit juices by all means but don't leave out cereals. Potatoes are optional. They contribute needed carbohydrates. Leave out sugar if you like but fat is essential.

DISCUSSION 8 : A (ii) B (iv)

QUESTION 9 : Sarla, a housewife, has decided to keep a food diary for herself. The following is a faithful record of what she ate on Day 1.

8.30 a.m.	Breakfast	Tea Buttered slices Fried egg
2.00 p.m.	Lunch	Poories Chana Dal Capsicum-potato vegetable Tomato, onion, cucumber salad
5.00 p.m.	Tea-time	Tea Samosa
9.00 p.m.	Dinner	Pulao Parantha Rajmah curry Kheer

Which comments are applicable to her day's diet ? Tick the ones you think you would agree with. You can tick more than one.

i) Breakfast is fine

ii) Add a good snack mid-morning

iii) More milk is a good idea

iv) Too much of rice in dinner

v) Cut down on vegetables in lunch

vi) No fruits in this diet

vii) Dinner is interesting and nutritious too

viii) Plenty of variety

ix) Fried foods are the best part of the meals

x) There seems to be too much fat.

Now on the basis of this what suggestions would you give to Sarla on improving her diet ?

DISCUSSION 9 : We would agree with all the statements except (ix). Too many fried preparations are offered in the day pushing up the fat intake. You could therefore tell Sarla to cut down on fried foods.

QUESTION 10 : Here is a list of the amounts of various foods included in Sarla's diet (Question 9). Fill in the blank columns. Calculate the total energy and protein contribution of Sarla's diet.

We must add that Sarla is a sedentary woman.

Meal/Menu	Ingredients	Amount (g)	Exchange	No. of exchanges	Energy (Kcal)	Pr
Breakfast						
Tea	Milk	25 ml	Milk	1/10	17	0.
	Sugar	5	Sugar	1	20	
Buttered toast	Bread	40	Cereal	2	140	
	Butter	5	Fat	1	45	
Fried egg	Egg	One	Meat/fish/ poultry/egg	1	70	7.
	Oil	5				
Lunch						
Poories	Atta	60	Cereal	3		
	Oil	10	Fat	2		
Chana Dal	Chana dal	30	Pulse	1		
	Tomato	50	Other vegetables	1/2		
	Oil	5	Fat	1		
Capsicum potato vegetable	Capsicum	100	Other vegetables	1		
	Potato	60	Roots & tubers	1		
	Oil	-	Fat	1		
Tomato, onion cucumber salad	Tomato	100	Other veg.	1		
	Onion		Cucumber can be considered similar to green leafy vegetables	1/2		
	Cucumber	50				
Tea						
Tea	Milk	25 ml	Milk	1/10	17	0.8
Murmura chikki	Jaggery		Sugar	4		
	Puffed rice		Cereal	1/2		
Samosa	Maida		Cereal	1		
	Potato		Roots & tubers	3/4		
	Oil		Fat	2		
Dinner						
Pulao	Rice		Cereal	2		
	Oil		Fat	2		
Parantha	Atta		Cereal	1½		
	Oil		Fat	1½		
Rajmah curry	Rajmah		Pulse	1		
	Onion, tomato		Other veg.	1/2		
	Oil			1½		
Kheer	Rice	10	Cereal	1/2		
	Milk	250	Milk	1		
	Sugar	15	Sugar	3		

Comparison of Sarla's diet contribution with RDIs for a sedentary woman

	RDI	Contribution of Day's Diet
Energy (Kcal)	1875	
Protein (g)	50	

DISCUSSION 10 : Now what do you conclude about Sarla's diet ? Is it adequate or inadequate ? How would you improve it ? You must also think of the amounts of fruits and vegetables included in addition to including other good sources of vitamins and minerals.

APPENDIX 1

MODEL ANSWERS

SECTION 2

ACTIVITY 1

a) Egg, b) Egg, Spinach, c) Jaggery, Butter

ACTIVITY 2

Foodstuff	Amount g	Energy Kcal	Protein g	Carotene µg	Iron mg
Rice	30	105	2.5	0	1
Jaggery (cane)	25	96	0	0	0.1
Egg (hen)	50	87	6.6	300*	0.9
Groundnut	120	113	5	7.0	0.6
Butter	80	533	0	0**	0

* also contains 180 µg retinol
** contains 960 µg retinol

ACTIVITY 3

1) Besan-spinach cheela is suitable for her as it will provide 272 Kcal energy and 17 g protein.

2) Bread roll is not suitable for her. It is rich in energy (306.0 Kcal) not in protein (5.5 g).

3) Bread pakora is suitable for her. It will provide 286 Kcal energy and 8.8 g protein.

SECTION 3

ACTIVITY 1

b) One possible practice that could be changed is the washing of rice. It is important to wash the minimum number of times to conserve nutrients like thiamine.

ACTIVITY 3

Boiling	:	Vitamins	C, B_1, B_2
Frying	:	Vitamins	C, A, B_1, B_2
Grilling	:	Vitamins	A, B_2, B_1

ACTIVITY 4

Most essential information is summarized in Sub-section 3.5.

SECTION 5

ACTIVITY 1

a) **Cereal:** Amount = 160 g; energy = 560 Kcal
Milk: Protein = 16 g
Pulses: No. of exchanges = 3; Protein = 21 g

b) cereal: energy = 980 Kcal; protein = 28 g
roots and tubers: energy = 120 Kcal; protein = 4 g
sugar/jaggery: energy = 140 Kcal; protein = 0
fats & oils: energy = 360 Kcal; protein = 0

ACTIVITY 2

In this case a dash is made to indicate negligible quantities or absence of a particular nutrient. Fill in dashes for energy and protein in the case of meat/fish/poultry/egg since we are not giving them. Also fill in a dash for protein contribution of fruits.

The energy value for (sugar/jaggery) is 100 Kcal and for fats and oils is 315 Kcal (45 Kcal × 7). For pulses, the energy and protein contributions are 200 Kcal and 14 g respectively.

SECTION 6

ACTIVITY 2

Changes with sex: The exchanges related to the body-building group and the energy-giving group are more for men rather than women. Look at the changes in the following exchanges: Cereals, sugar/jaggery, fats and oils, pulses or addition of egg etc.

Changes in pregnancy and lactation: Energy and protein needs go up in both pregnancy and lactation. The food plans reflect this and therefore, more of the energy-giving and body-building exchanges are included. Lactation pushes up energy and protein needs more than pregnancy so a greater amount of energy-giving and body-building foods are included in food plans for lactation.

Changes with age in children: The number of the following exchanges increases in the 4–6 years group: Cereals, sugar/jaggery, fats and oils, green leafy vegetables, other vegetables.

Changes with age in adults: Compare the food plan of the old man with that of the adult sedentary young man. There are changes in the following exchanges: Sugar, cereal, fats and oils. Animal protein is included in higher amounts. Skim milk and meat are given to the older person.

APPENDIX 2

SELECTED LIST OF TERMS AND THEIR DEFINITIONS

Batter: Liquidy mixture of a cereal/pulse flour with water or milk.

Edible portion: The portions of foodstuff which are really consumed or eaten like leaves of spinach (inedible stalks are thrown away) or seeds of peapods (inedible pod are thrown away).

Evaporation: The process whereby water in the liquid form gets converted to the gas form (i.e. steam).

Exchange: A group of similar food items in specified amounts so that each supplies constant amount of a particular nutrient (carbohydrate or protein or fat) e.g. members of cereal exchange : wheat, rice ; one cereal exchange as wheat = 22 g, supplying 15 g carbohydrate ; One cereal exchange as rice = 19 g, supplying 15 g carbohydrate.

Cooking methods: Methods usually involving application of heat in order to bring about desirable changes in the texture, flavour and appearance of food.

Food composition tables: Tables which provide information regarding the composition or nutrient content of foods i.e. moisture, energy, protein, minerals (calcium, phosphorus) and vitamins (vitamin A, thiamine, riboflavin, niacin, folic acid, vitamin C).

Food plan: A list of exchanges to be included in a day's diet with their number and contribution to total energy and protein content of the diet.

Standard measure: Any measure which has accurate markings/calibrations on it indicating volume.

Oxidation: A chemical reaction whereby oxygen combines with a compound. This compound is therefore oxidized to form a new compound. Elements are also oxidized to form compounds.

Measuring equipment: Any device/equipment which helps in measuring the quantity/volume of foodstuffs.

Pre-preparation methods: Methods used to prepare foods for further cooking.

Volume: The amount of space taken up by an object.

Weighing equipment: Any equipment which is used for determining weight.

Weight: The total pull or attraction of the earth on an object.

APPENDIX 3
NAMES OF FOODSTUFFS IN INDIAN LANGUAGES

The following abbreviations have been used in this Appendix: B.— Bengali; G.—Gujarati; H.—Hindi; Kan.—Kannada; Kash.—Kashmiri; Mal.—Malayalam; Mar.—Marathi; O.—Oriya; P.—Punjabi; Tam.—Tamil; Tel.—Telugu.

CEREAL GRAINS AND PRODUCTS

1. **Bajra: Pennisetum typhoideum**
   B., H., O. *Bajra*; G., Mar. *Bajri*; Kan. *Sajje*; Kash. *Bajr'u*; Mal., Tam. *Cambu*; Tel. *Sazzalu*. Other names: Spiked millet, Pearl millet.

2. **Bamboo seeds: Bambusa arundi nacea**
   B. *Banser dhana*; H. *Bans ke beej*; Mal. *Mulaari*; Tam. *Moongil arisi*; Tel. *Veduru biyyam*.

3. **Banti: Echinochloa stagnina**
   B. *Dul*; Kan. *Kadu debhat hullu*; Mar. *Banti*

4. **Barley: Hordeum vulgare**
   B. *Job*; G., H., Mar. *Jau*; Kan. *Jave godhi*; Kash. *Wushku*, Mal. *Yavam*; O. Jaba *dhana*; Tam. *Barli arisi*; Tel. *Barli biyyam*.

5. **Buchwheat: Fagopyrum esculentum**
   B. *Titaphapur*; H., Mal., Mar., Tam. *Kootu*.

6. **Italian millet: Setaria italica**
   B. *Syama dhan*; G. *Rai kang*; H. *Kangni*; Kan. *Thene*; Kash. *Shol*; Mal. *Thina*; Mar. *Rala*; P. *Kaon*; Tam. *Thenai*; Tel. *Korralu*; Other names: Foxtail millet; Moha millet; *Kakan kora*.

7. **Job's tears: Coix lachryma**
   B. *Gurgur*; H. *Sankru*; Mar. *Ran makka*; Tam. *Netpavalam*.

8. **Jowar: Sorghum vulgare**
   B., G., H. *Juar*; Kan. *Jola*; Mal., Tam. *Cholam*; Mar. *Jwari*; O. *Janha*; Tel. *Jonnalu*; Other names: Milo, *Chari*.

9, 10. **Maize: Zea mays**
   B. *Bhutta*; G. *Makai*; H., Mar., O. *Maka*; Kan. *Musikinu jola*; Kash. *Makaa'y*; Mal. *Cholam*; Tam. *Makka cholam*; Tel. *Mokka jonnalu*.

11. **Oat meal: Avena byzantina**
   B. *Jai*; G., H., Mar. *Jav*; Tel. *Yavalu*.

12. **Panivaragu: Panicum milliaceum**
   B., H. *Chinna*; Kan. *Baragu*; Kash. *Pingu*; Mal., Tam. *Panivaragu*; Mar. *Vari*; Tel. *Varagalu*; Other names: French millet.

13. **Ragi: Eleusine coracana**
   B., H. *Madua*; G. *Bhav*; Kan. *Ragi*; Mal. *Moothari*; Mar. *Nachni*; O. *Mandia*; Tam. *Kezhvaragu*; Tel. *Ragulu*; Other names: Finger millet; *Korakan*.

14. **Rice, parboiled: Oryza sativa**

15. B. *Siddha chowl*; G. *Ukadello chokha*; H. *Usna chawal*; Kan. *Kusubalakki*; Mal *Puzhungal ari*; Mar. *Ukda tandool*; O. *Usuna chaula*; Tam. *Puzhungal arisi*; Tel. *Uppudu biyyam*.

16. **Rice, raw: Oryza sativa**

17. B. *Chowl*; G. *Chokha*; H. *Chawal*; Kan. *Akki*; Kash. *Tomul*; Mal. *Ari*; Mar. *Tandool*; O. *Chaula*; Tam. *Arisi*; Tel. *Biyyam*.

18. **Rice bran: Oryza sativa**
   B. *Goora*; Kan., Mal., Tam., Tel. *Thavudu*; Mar. *Konda*.

19. **Rice flakes: Oryza sativa**
   B. *Chira*; G., Mar. *Pohe*; H. *Chowra*; Kan. *Avalakki*; Mal., Tam. *Avol*; O. *Chuda*; Tel. *Atukulu*.

20. **Rice, puffed: Oryza sativa**
   B. *Mudi*; G., H., Mar. *Murmura*; Kan., Mal., Tam. *Pori*; O. *Mudhi*; Tel. *Murmuralu*.

21. **Samai: Panioma miliage**
   B. *Kangul*; H. *Mutki*; Kan., Tam. *Samai*; Kash. *Ganukaar*; Mal. *Chana*; Mar. *Sava*; O. *Sun*; Other names: *Goudli, Gondola*.

22. **Sanwa millet: Echinochloa frumantacea**
   B. *China*; G. *Sama*; H. *Shama*; Mar. *Shamul*; Tam. *Kudiroi valu*; Tel. *Chamelu*; Other names: *Sawank*.

23. **Semolina: Triticum aestivum**
   B., H. *Sooji*; Kan., Mal., Mar., Tel. *Rawa*; Tam. *Ravai*. Other names: Broken wheat, Cream of wheat.

24. **Varagu: Paspalum scrobiculatum**
   B. *Kodoadhan*; G., H. *Kodra*; Mal. Tam. *Varagu*; Mar. *Harik*; Tel. *Varlaga*; Other names: *Pakodi, Monakodra*.

25. **Vermicelli: Triticum aestivum**
   B. *Semai*; H. *Siwain*; Kan. *Shevige*; Mal., Tam., Tel. *Semiya*; Mar. *Shevaya*; O. *Simai*.

26. **Wheat, Bulgar: Triticum aestivum**

27. **Wheat: Triticum aestivum**
   B. *Com*; G. *Ghau*; H. *Gehun*; Kan. *Godhi*; Kash. *Ku'nu'kh*; Mal. *Gothambu*; Mar. *Gahu*; O. *Gahama*; P. *Kamak*; Tam. *Godumai*; Tel. *Godhumalu*.

28. **Wheat flour, whole: Triticum aestivum**
   B., H., O. *Atta*; G. *Ato*; Kan. *Godhi Hittu*; Mal. *Gothambu mavu*; Mar. *Kaneek*; Tam. *Godumai mavu*; Tel. *Godhuma pindi*.

29. **Wheat flour, refined: Triticum aestivum**
   B., H., Kan., Mar., O. *Maida*; Mal., Tam. *Maida mavu*; Tel. *Maida pindi*; Other names: *American mavu*.

30. **Wheat germ: Triticum aestivum**
   Tam. *Godumai mulai*.

PULSES AND LEGUMES

31. **Bengal gram (whole): Cicer arietinum**
   B. *Chola*; G., H. *Chana*; Kan. *Kadale*; Kash. *Chanu*; Mal. *Kodala*; Mar. *Harbara*; O. *Buta*; P. *Chole*; Tam. *Kothukadalai*; Tel. *Sangagalu*; Other names: Chick pea, Garbanzo.

32. **Bengal gram dhal: Cicer arietinum**
   B. *Cholar dal*; H. *Chane-ki-dal*, Kan. *Kadale bele*; Kash. *Chola dal*; Mal.

Kadala parippu; Mar. *Harbara dal*; Tam. *Kadalai paruppu*; Tel. *Sanaga pappu*.

33. Bengal gram, roasted : **Cicer arietinum**
B. *Chola bhaja*; G. Mar. *Phutana*; H. *Bhuna chana*; Kan. *Huri-kadale*; Mal. *Varutha kadala*; O. *Bhajabuta*; Tam. *Pottukadalai*; Tel. *Putnalu pappu*.

34. Black gram dhal : **Phaseolus mungo Roxb.**
B. *Mashkalair dal*; G. *Aalad*; H. *Urd dal*; Kan. *Uddina bele*; Kash. *Maha*; Mal. *Uzhunnu parippu*; Mar. *Uddachi dal*; O. *Biri*; P. *Mah-di-dal*; Tam. *Ulutham paruppu*; Tel. *Minapa pappu*.

35. Cow pea : **Vigna catjang**
B. *Barbati*; H. *Lobia*; Kan. *Alasande*; Mal. *Payar*; Mar. *Chavli*; O. *Chani*; Tam. *Karamani*; Tel. *Bobbarlu*.

36. Field bean : **Dolichos lablab**
B. *Sim*; G. Mar. *Valpapdi*; H. *Val*; Kan. *Avare*; Kash. *Moang*; Mal. *Avara*; O. *Baragudi*; Tam. *Mochai*; Tel. *Chikkudu*; Other names : *Kadumal*, Hyacinth bean.

37. Green gram (whole) : **Phaseolus aureus Roxb.**
B. G. *Mug*; H. Mar. *Mung*; Kan. *Hesare kalu*; Kash. *Muang*; Mal. *Cheru*; O. *Muga*; P. *Moongi*; Tam. *Pasipayir*; Tel. *Pesalu*.

38. Green gram dhal : **Phaseolus aureus Roxb.**
B. Mar. *Mug dal*; H. *Mung dal*; Kan. *Hesara bele*; Mal. *Cherupayarparippu*; P. *Mungi-di-dal*; Tam. *Payatham-paruppu*; Tel. *Pesara-pappu*.

39. Horse gram : **Dolichos biflorus**
B. *Kulthi-kalai*; G. Mar. *Kuleeth*; H. *Kulthi*; Kan. *Hurule*; Mal. *Muthira*; O. *Kolatha*; Tam. *Koll*; Tel. *Ulavalu*.

40. Khesari dhal : **Lathyrus sativus**
B. H. O. *Khesari dal*; G. Mar. *Lakh dal*; Mal. *Vattu parippu*; Tam. *Khesari paruppu*; Tel. *Lamka pappu*.

41. Lentil : **Lens esculenta**
B. *Masoor*; G. H. Mar. *Masur dal*; Kan. *Masur bele*; Kash. *Musur*; Mal. *Masur parippu*; O. *Masura*; Tam. *Mysore paruppu*; Tel. *Misur pappu*.

42. Moth beans : **Phaseolus aconitifolius, Jacq.**
H. *Moth*; Mar. *Matki*; Tam. *Narippayir*; Other names : Dew gram, Aconite bean, *Kheri*.

43. Peas : **Pisum sativum**

44. B. H. *Matar*; G. Mar. *Vatana*; Kan. Tam. *Batani*; Kash. *Kara*; Mal. Tam. *Pattani*; O. *Matara*.

45. Rajmah : **Phaseolus vulgaris**
B. *Barbati*; G. *Phanasi*; H. *Rajmah*; Kash. *Raazmaha*; Mar. *Shravang-hevda*; Other names : French bean (dry).

46. Red gram dhal : **Cajanus cajan**
B. H. Kash. *Arhar dal*; G. *Tuver*; Kan. *Thugare bele*; Mal. *Tuvara parippu*; Mar. *Tur dal*; O. *Harada*; Tam. *Tuvaram paruppu*; Tel. *Kandi pappu*; Other names : Pigeon pea.

47. Soya bean : **Glycine max Merr.**
B. *Garikalai*; H. *Bhatmas*; Kash. *Muth*

48. Sutari : **Phaseolus calcaratus**
Other name : Rice bean.

LEAFY VEGETABLES

49. Agathi : **Sesbania grandiflora**
B. *Bak*; G. *Agathio*; H. Mar. O. *Agasti*; Kan. *Agase*; Mal. Tam. *Agathi*; Tel. *Avise*; Other names : *Basna*.

50. Amaranth, spined : **Amaranthus spinosus**
B. *Kanta-notya*; G. *Kantalo dabho*; H. *Kantewali chaulai*; Kan. *Mullu dantu*; Mal. *Mullancheru-cheera*; Mar. *Kante-math*; O. *Kanta neutia saga*; Tam. *Mullu keerai*; Tel. *Mulla thotakoora*; Other names : *Gendari sag*.

51. Amaranth, tender : **Amaranthus gangeticus**
B. *Notya*; H. *Chaulai sag*; Kash. *Bustar*; Mal. *Cheera*; Mar. *Math*; Tam. *Thandukeerai*; Tel. *Thotakoora*. Other names : *Gogta sag*.

52. Ambat chuka : **Rumex vesicarius**
B. *Chuka palang*; H. *Chuka*; Kash. *O'bej*; Mar. *Ambat chuka*; Tam. *Chukka keerai*; Tel. *Chukka koora*; Other names : *Khatti palak*.

53. Araikeerai : **Amaranthus tristis**
Tam. *Araikeerai*.

54. Bamboo, tender shoots : **Bambusa arundinacea**
B. *Bansher-ankur*; G. *Vansnal kupal*; H. *Bans*; Mal. *Mulan [illegible]*; Mar. *Kalkipan*; O. *[illegible]*; Tam. *Moongil kuruthu*; Tel. *[illegible]*; Other names : *Chakrat*.

55. Bathua leaves : **Chenopodium album**
B. *Beto sag*; G. *Chilni bhaji*; H., P. *Bathua sag*; Kan. *Sakothina soppu*; Mar. *Chandan bathua*; O. *Bathua saga*.

56. Beet greens : **Beta vulgaris**
H. *Chukandar-ka-sag*.

57. Bengal gram leaves : *Cicer arietinum*
B. *Chola sag*; G. *Chanana pan*; H. *Chana sag*; Kan. *Kadale soppu*; Mal. *Kadala ilagal*; Mar. *Harbara pan*; O. *Chana saga*; P. *Chholianda sag*; Tam. *Kadalai ilaigal*; Tel. *Sanaga aku*.

58. Bottle gourd leaves : **Lagenaria vulgaris**
B. *Lau sag*; H. *Lauki-ka-sag*; Kan. *Sorakayyele*; Mal. *Cheranga ilagal*; P. *Ghia da sag*; Tam. *Surai ilaigal*; Tel. *Anapa aku*; Other names : Calabash cucumber leaves.

59. Broad bean leaves : **Vicia faba**
H. *Bakala*.

60. Brussels sprouts : **Brassica oleracea, var. gemmifera**
B. *Bilati-bandhakopi*; H. *Chotee gobee*; Kan. *Mara kosu*; Kash. *Hoa'kh*; O. *Chota bandha kobi*; Tam. *Kalakose*.

61. Cabbage : **Brassica oleracea var. capitata.**
B. O. *Bandha kopee*; G. Mar. *Kobi*; H. Kash. *Band gobee*; Kan. *Kosu*; Mal. *Mutta gose*; Tam. *Muttaikose*; Tel. *Gos koora*; Other name : *Pat gobee*.

62. Carrot leaves : **Daucus carota**
B. H. *Gajar sag*; G. Mar. *Gajar pan*; Kan. *Gajri soppu*; *soppu*; Mal. *Carrot*

ilagal; O. *Gajara patra*; Tam. *Carrot keerai*; Tel. *Gajjara akulu*; P. *Gajar di sag.*

63. Cauliflower greens: Brassica oleracea var. botrytis
B. *Phool-kopi sag*; H. Mar. *Phoolgobee sag*; Kan. *Hukosina yele.*

64. Celery leaves: Apium graveolens var. dulce
B. *Randhuni sag*; G. *Ajmana pan*; H. *Ajwan-ka-patta*; O. *Jwani patra.*

65. Ceylon pasali: Talinum triangulare
Tam. *Ceylon pasali.*

66. Chakravarthi keerai: Amaranthus sp.
Tam. *Chakravarthi keerai.*

67. Chekkur manis: Sauropus androgynans

68. Chimti sag: Polygonum plebijum

69. Chozhi keerai
Tam. *Chozhi keerai.*

70. Colombo keerai
Tam. *Kozhambu keerai.*

71-73. Colocasia leaves: Colocasia antiquorum
B. *Kochu sag*; H. *Arvi-ka-sag*; Kan. *Shamagadde yele*; Mal. *Chembu ilagal*; Mar. *Alu pan*; O. *Sarue*; Tam. *Seppam ilaigal*; Tel. *Chama akulu*; Other names: *Guan-ka-sag, Alti.*

4. Coriander leaves: Coriandrum sativum
B. *Dhane sag*; G. *Kothmer*; H. *Hara dhania*; Kan. *Kothambari soppu*; Kash. *Daaniwal*; Mal. Tam. *Kothamalli*; Mar. *Kothimbir*; O. *Dhania*; Tel. *Kothimiri.*

75. Cowpea leaves: Vigna catjang
Mal. *Payar ilagal*; Mar. *Chavli pan*; Other name: *Rawanda sag.*

76. Curry leaves: Murraya koenigii
B. O. *Bursunga*; G. *Mitha limbdo*; H. *Gandhela*; Kan. *Karibe'u*; Mal. Tam. *Karivepplai*; Mar. *Kadhi limb*; Tel. *Karivepaku.*

77. Drumstick leaves: Moringa oleifera
B. O. *Sajna sag*; G. *Saragavo*; H. *Saijan patta*; Kan. *Nugge yele*; Mal. *Muringa ela*; Mar. *Shevaga pan*; Tam. *Murungai keerai*; Tel. *Mulanga akulu*; Other names: Horse radish leaves, *Suha najna.*

78. Fenugreek leaves: Trigonella foenum-graecum
B, H., O., *Methi sag*; G. *Kash*, Mar. *Methi*; Kan. *Menthli na soppu*; Mal. *Uluva ila*; Tam. *Venthiya keerai*; Tel. *Menthkoora.*

79. Fetid cassia: Cassia tora
B. H. *Chakunda*; G. *Kovaiya*; Mar. *Takla*; Tam. *Tagarai*; Tel. *Tantemu*; Other names: *Chakwar.*

81. Garden cress: Lepidium sativum
B., H., P., *Halim*; G. *Asalio*; Kan. *Allibija*; Mar. *Ahliva*; Tam. *Alivirai*; Tel. *Adityalu.*

82. Garden sorrel, sepals

83. Giria sag: Suaeda nudiflora
H. *Giria sag*; Mar. *Moras.*

84. Goru: Hibiscus cannabinus
B. *Mestapat*; G. Mar. *Ambadi*; H. *Pitwa*; Kan. *Pundi*; O. *Nalita saga*; Tam. *Pulichai keerai*; Tel. *Gongura.*

85. Gulcharni: Calonyction muricatum
B., H. *Michai*; G. *Garayo*; Mar. *Bhonvari*; Tam. *Kathutali.*

86. Ipomoea leaves: Ipomoea reptans
B., H. *Kalmi sag*, Mar. *Nadishaka Nalani bhaji*; O. *Kandamula saga*; P. *Ganthian*; Tel. *Tutikoora.*

87. Kasini keerai: Raphanus sp.
Tam. *Kasini keerai.*

88. Kalavan keerai
Tam. *Kalavan keerai.*

89. Karslanganni keerai

90. Mal. *Kannunni cheera*; Tam. *Karslanganni keerai.*

91. Katha sag: Dentella repens
H. *Katha sag*; Other names: Water fern.

92. Kena sag: Commelina benghalensis
B. *Dolopata*; H. *Kena sag*; Tel. *Vennadevi koora.*

93. Khesari leaves: Lathyrus sativus
B., H., O. *Khesari sag*; Other names: *Lakkodi, Charal.*

94. Knol-khol greens: Brassica oleracea var. caulorapa
B. *Col sag*; H. *Ganth gobi-ka-sag*; Kash. *Monj hak*; P. *Gadh-gobee-da-sag.*

95. Kolla karha sag: Astercantha longifolia
B. *Kulliakhara*; H. Mar. *Talmakhana*; Tam. *Nirmulli*; Tel. *Neerugubbi.*

96. Konar sag: Bauhinia purpurea
B., Mar. *Devakancham*; H. *Khairwal*; Tam. *Mandari*; Tel. *Kanchanam.*

97. Koria leaves: Bauhinia malabarica
Mar. *Koria.*

98. Koya keerai: Amaranthus sp.
Tam. *Koya keerai.*

99. Kuppa keerai: Amaranthus viridis
Tam. *Kuppa keerai.*

100. Kuppameni: Acalypha indica
B. *Mukthajhuri*; G. *Dadano*; H., Mar. *Kuppi khokli*; Kan. *Kuppigida*; Mal. Tam. *Kuppameni*; Tel. *Kuppichettu.*

101. Lettuce: Lactuca sativa
B. *Salad pata*; G. *Salat*; H. *Salad*; Kash. *Salaa'd*; Mal. *Uvar cheera.*

102. Lettuce tree leaves: Pisonia alba

103. Other names: *Chinai salit.*

104. Love-lies-bleeding: Amaranthus caudatus
B. *Nate sag*; G. *Chuko*; H. *Gendhri sag*; Tam. *Pungi keerai.*

105. Manal keerai: Mullugo sp.
Tam. *Manal keerai.*

106. Manathakkali leaves: Solanum nigrum
B. *Kakmachi*; G. *Piludi*; H. *Mukoy*; Kan. *Ganika*; Mal., Tam. *Manathakkali*; Tel. *Kamanchi*; Other name: *Gurkhi.*

107. Mata sag: Antidesma diandrum

108. Mayalu: Baselia rubra
B., H., Mar. *Poi*; Kan. *Basale*; Mal. *Basala*; Tam. *Sivappu salakkeerai*; Tel. *Erra bachchali*; Other name: Indian red spinach.

109. **Minmini keeral**
Tam. *Minmini kerrai.*

110. Mint : **Mentha spicata**
B., H., Kan., Mal., Mar., P., Tam., Tel. *Pudina ;* G. *Fudina ;* Kash. *Pudynu ;* O. *Podana patra.*

111. Modakathan keerai : **Cardiospermum helicacabum**
B. *Sibjhul ;* G. *Karolis ;* H. *Kanphuti ;* Mar. *Kapat phodi ;* Tam. *Modakathan keerai ;* Tel. *Budda kakara.*

112. Mukarrate keerai : **Boerhaavia repens**
B., Tel. *Punarnava ;* G. *Vakhakhapro ;* H. *Sani ;* Mar. *Tambadi vasu ;* Tam. *Mukarrate keerai.*

113. Mustard leaves : **Brassica campestris var. sarason**
B. *Sorisa sag ;* H. *Sarson-ka-sag ;* Kan. *Sasuve yele ;* Mal. *Kadugu ila ;* Mar. *Mohari-chi pan,* P. *Sarson-da-sag ;* Tam. *Kadugu ilai ;* Tel. *Ava akulu.*
Other name : *Sharisha*

114. **Nachukottai keeral**
Tam. *Nachukottai keerai.*

115. Neem leaves : **Azadirachta indica**
116. B. *Neem pata ;* G. *Limdo limba ;* H. *Neem-ka-patte ;* Kan. *Bevu ;* Mal. *Arya veppila ;* Mar. *Kadu limb ;* O. *Nima patra ;* P. *Nim ;* Tam. *Veppilai ;* Tel. *Vepa akulu.*

117. Nerringi : **Tribulus terrestris**
B. H. *Gokhru ;* Kan. *Negalu ;* Mal. *Neringil ;* Tam. *Nerringi ;* Tel. *Palleru ;*
Other name : *Bhakra.*

118. Pacharisi keeral : **Euphorbia hirta**
H. *Dudhi ;* Mal. *Nelapalai ;* Tam. *Pacharisi keerai.*

119. Panna keerai : **Celosia sp.**
Tam. *Panna keerai.*

120. Parsley : **Petroselinum crispum**

121. Paruppu keerai : **Portulaca oleracea**
B. *Bara loniya ;* H. P. *Kulfa ;* Mar. *Ghol ;* Tam. *Paruppu keerai ;* Tel. *Pappu koora ;* Other name : *Khursa.*

122. Parwar sag : **Trichosanthes dioica**
B. *Potol sag ;* G. *Parwalne pan ;* H. *Parwar sag ;* Mar. *Paduwal ;* Tam. *Kombuppodalai ;* Tel. *Kommupotla.*

123. Pasarai keerai : **Portulaca sp.**
Tam. *Pasarai keerai.*

124. Patua sag : **Corchorus capsularis**

125. Ponnanganni : **Alternanthera sessilis**
B. *Khanchari ;* H. *Saranti sag ;* Kan. *Honagone soppu ;* Mal. Tam. *Ponnangani ;* O. *Madarang ;* Tel. *Ponnaganti koora ;* Other name : *Khane hari.*

126. Potato leaves : **Solanum tuberosum**
B., H. *Alu sag ;* Kan. *Alu yele ;* Mal., Tam. *Urula langu ilagal ;* P. *Alu-de-patte ;* Tam. *Alugadda akulu.*

127. **Pullara keeral**
Tam. *Puliara keerai.*

128. Pumpkin leaves : **Cucurbita maxima**
B., H. *Kumhra sag ;* Kan. *Kumbale soppu ;* Mal. *Mathan elakal ;* Mar. *Bhopla-chi-pan ;* P. *Sitaphal-de-patte ;* Tam. *Parangi ilai ;* Tel. *Gummadi akulu ;* Other name : *Kaddu-da-sag.*

129. Punnaku keerai : **Corchorus acutangulus**
Tam. *Punnaku keerai.*

130. Radish leaves : **Raphanus sativus**
B., H. *Mooli ka sag ;* Kash. *Muji Lak ;* Mal., Tam. *Mullangi ; ilaigal ;* Tel. *Mullangi akulu.*

131. Rajagira leaves : **Amaranthus paniculatus**
Tam. *Rajakeerai.*

132. Rape leaves : **Brassica napus**
133. B., O. *Sorisa sag ;* G. *Sarsiya ;* H. *Sag sarsoon.*

134. Safflower leaves : **Carthamus tinctorius**
B., H. *Kusum sag ;* G. *Kusumba pan ;* Kan. *Kusume yele ;* Mal. *Kusumba ilagal ;* Mar. *Kardi pan ;* Tam. *Sendurkarkami ;* Tel. *Kusuma akulu*

135. Saravallai keerai : **Trianthema monogyna**
B. *Lovet sabuni ;* H. *Khapra sag ;* [illegible] *Muchchugoni ;* Mar. *Pundhari ghenti ;* Tam. *Saravallai keerai ;* Tel. *Galijeru ;*
Other name : Horse purslane.

136. Sarli sag : **Vanguería spinosa.**
137. B., H. *Muyuna ;* Kan. *Mullakare ;* Tam. *Munakkarai ;* Tel. *Virikilinta ;*
Other name : *Atu.*

138. Seemai ponnanganni : **Alternanthera sp**
Tam. *Seemai ponnanganni.*

139. Shepu : **Peucedanum graveolens.**
B., H. *Sowa ;* G. *Suvani bhaji ;* [illegible] *Sabsige ;* Mar. *Shepu ;* Tam. *Sathakuppai ;* Other name : *Surva.*

140. Sinduar sag : **Celosia argentia.**
B. *Swet murga ;* H. *Safaid murga.*

141. Sinduar sag (wild) : **Allmania polygonoides.**

142. Sirukeerai : **Amaranthus polygonoides**
Tam. *Sirukeerai.*

143. Sonchal sag : **Malva parviflora**
H. *Panirak ;* Other name : *Supra.*

144. Spinach : **Spinacia oleracea**
B., O. *Palang sag ;* G., H., Kash., Mar., P. *Palak ;* Mal. *Basala cheera ;* Tam. *Pasalai keerai ;* Tel. *Basheball koora.*

145. Soya leaves : **Glycine max**
B. *Goarikalai sag ;* H. *Soya-ka-sag ;* Mal. *Soya ilagal ;* O. *Soya patra.*

146. Susni sag : **Marsilea minuta**
B. *Susni sag ;* Kan. *Chitgina soppu ;* Kash. *Paf Araikeerai ;* Tel. *Chikilinth*

147. Sweet potato green : **Ipomoea batatas**
B. *Rangalu sag ;* H., P. *Shakarkand sag ;* Kan. *Gotasina yele ;* Mal. *Madhura kizhangu ilagal ;* Tam. *Vallikizhangu ilai ;* Tel. *Chilagodadumpa akulu.*

148. Table radish leaves : **Raphanus sativus**
See No. 130.

149. Tamarind leaves : **Tamarindus indicus**
150. B. *Tetul pata ;* H., P. *Imli patte ;* Kan. *Hunise chiguru ;* Mal., Tam. *Puli ilaigal ;* Mar. *Chinchecha pala ;* Tel. *Chinta chiguru.*

151. Thooduvalai keeral : **Solanum sp.**
Tam. *Thooduvalai keerai.*

152. **Thuthi keerai**
Tam. *Thuthi keerai.*

153. **Turnip greens : Brassica rapa**
H. *Shalgam-ka-sag.*

154. **Utarba :**

155. **Vadhanarayanan keerai :**
Tam. *Vadhanarayananan keerai.*

156. **Veethi keerai : Cadalia indica**
Tam. *Veethi keerai.*

157. **Velai keerai : Hydrolea sp.**
Tam. *Velai keerai.*

158. **Vella keerai : Cleome viscosa**
B. *Hurhuria ;* G. *Talvani ;* H. *Belaigoir sag ;* Kan. *Nayibela ;* Mar. *Kamphuti ;* Tam. *Vella keerai ;* Tel. *Gominta.*

159. **Vellari keerai :**
Tam. *Vellari keerai.*

160. **Water cress : Nasturtium officinale**
G. *Asalia ;* H. *Chandrasur ;* Kan. *Alvi ;* Mar. *Ahliv ;* O. *Brahmi sag ;* Tam. *Alli ilai.*

ROOTS AND TUBERS AND OTHER VEGETABLES

161. **Arwa gadda.**

162. **Banana rhizome : Musa paradisicum**
Mal., Tam. *Vazhai kizhangu ;* Tel. *Arati dumpa.*

163. **Beet root : Beta vulgaris**
B., G., Kan., Mal., Mar., Tam., Tel. *Beet ;* H., P. *chukandar ;* O. *Bita.*

164. **Bokwa : Dioscorea pentaphylla**
B. *Suar alu ;* H. *Kanta alu ;* Mar. *Ulassi ;* Tam. *Kathu kizhangu ;* Tel. *Dookapendalamu ;* Other names : *Kulu, Tigo.*

165. **Budhia : Malothria heterophylla**
B. *Kudari ;* H. *Anantmul ;* Mal. *Njerinagan puli ;* Mar. *Gometia ;* O. *Karakla ;* Tam. *Pulivanji ;* Tel. *Thiyya donda.*

166. **Canna, edible : Canna edulis**

167. **Carrot : Daucus carota**
B., G., H., Mar., P. *Gajar ;* Kan. *Gajjare ;* Kash. *Gaazur ;* O. *Gajara ;* Tel. *Gajjara gadda.*

168. **Chumbia : Dioscorea hamiltonii**

169. **Churkia : Dioscorea glabra**
Other name : Baiyang.

170. **Colocasia : Colocasia antiquorum**
B. Kochu ; G. *Alvi ;* H., P. *Arwi ;* Kan. *Sama gadde ;* Mal. *Chembu ;* Mar. *Alu kanda ;* O. *Saru ;* Tam. *Seppam kizhangu ;* Tel. *Chama dumpa ;* Other name : *Kachalu Taro.*

171. **Epadong sanga : Peucedanum nagpurense**

172. **Garmar : Coleus barbatus**

173. **Gotigadde :**
Kan. *Gotigadde.*

174. **Jipoo sanga : Habenaria cammelinifolia**

175. **Khamealu : Dioscorea alata**
B., H. *Chupri alu ;* Kan. *Onthalai gasu ;* Mal. *Kachil kizhangu ;* Tam. *Perunvalli kizhangu ;* Tel. *Pendalamu*

176. **Lotus root : Nelumbium nelumbo**
H. *Kamal-ki-jadh ;* Kan. *Kamla dambu ;* Kash. *Nadur ;* Mal., Tam. *Thamara kizhangu ;* Tel. *Thamara dumpa.*

177. **Mango ginger : Curcuma amada**
B. *Amada ;* H. *Am haldi ;* Kan. *Mavina hasisunthi ;* Mal. *Manga inji ;* Mar. *Amba haldi ;* Tam. *Ma inji ;* Tel. *Mamidi allam.*

178. **Moor sanga : Butea frondosa**

179. **Murum sanga : Dioscorea spinosa**

180. **Nulu gadda**

181. **Ochen sanga : Momordica cochinchinensis**

182. **Onion : Allium cepa**

183. **B., H. *Pyaz ;* G. *Kando ;* Kan. *Eerulli ;* Kash. *Gandall ;* Mal. *Ulli,* Mar. *Kanda ;* O. *Piaja ;* P. *Ganda ;* Tam. *Vengayam ;* Tel. *Neerulli.***

184. **Parsnip : Pastinaca sativa**

185. **Potato : Solanum tuberosum**
B. *Gol alu ;* G., Mar. *Batata ;* H., O., P. *Alu ;* Kan. *Alu gadda ;* Kash. *Oole ;* Mal., Tam. *Urula kizhangu ;* Tam. *Alu gaddalu*

186. **Radish : Raphanus sauvus**

189. B., G., Mar., O. *Mula ;* H., P. *Muli ;* Kan. Mal., Tam. Tel. *Mullangi ;* Kash. *Muj ;* Other name: *Wuazu*

190. **Song : Dioscorea anguiera**

191. **Sweet potato : Ipomoea batatas**
B. *Ranga alu ;* G. *Sakkaria ;* H. *Shakarkand ;* Kan. *Genasu ;* Mal., Tam. *Sakkaravalli kizhangu ;* Mar. *Ratalu ;* O. *Kandamula ;* P. *Sakkarkamali ;* Tel. *Chilagada dumpa.*

192. **Tapioca : Manihot esculenta**

193. **B. H. *Simla alu ;* Kan. *Mara genrsu ;* Mal. *Marachini ;* O. *Kathakanda ;* Tam. *Maravalli kizhangu ;* Tel. *Karrapendalamu ;* Other names : Cassava, *Kappa.***

194. **Turnip : Brassica rapa**
H. *Shalgam ;* Kash. *Guagu'j.*

195. **Turum sanga : Curculigo orchioides**
B. *Talamuli ;* H. *Kalimushli ;* Tam. *Nilappanai kizhangu ;* Tel. *Nelatlati gadda.*

196. **Usingid**

197. **Yam, elephant : Amorphophallus campanulatus**
B., O., G., Mar. *Suran ;* H., P. *Zimi kand ;* Kan. *Suvarna gadde (dodda) ;* Mal. *Chena (valuthu) ;* O. *Hathikhojia alu ;* Tam. *Senai kizhangu ;* Tel. *Kanda dumpa.*

198. **Yam, ordinary : Typhonium trilobatum**
Kan. *Suvarna gadde ;* Mal. *Cheena (sadharana) ;* Mar. *Goradu ;* O. *Khamba alu ;* Tam. *Karunai kizhangu*

199. **Yam, wild : Dioscorea versicolor**
B. *Banalu ;* H. *Sucr alu ;* Kan. *Heggenasu ;* Mal. *Kattuchena ;* Tam. *Kodikizhangu ;* Tel. *Chedu paddu dumpa.*

200. **Water lily : Nymphea nouchali**

201. Tam. *Alli kizhangu*

201. **Agathi flowers : Seshania aegyptiaca**
H. *Agasti-ka-phool.*

203. Amaranth stem : **Amaranthus gangeticus**
B. *Nate danta* ; H. *Cholai-ki-danai* ; Kan. *Dantu* ; Mal. *Cherucheera thandu* ; Mar. *Matha-che-deth* ; O. *Khada* ; Tam. *Keera thandu* ; Tel. *Thotakoora kadai*

204. Artichoke : **Cynara scolymus**
B., H. *Hathichak*

205. Ash gourd : **Benincasa hispida**
B. *Chalkumra* ; H., P. *Petha* ; Kan. *Budagumbala* ; Kash. *Mashaa'ly al* ; Mal. *Kumbalanga* ; Mar. *Kohala* ; O. *Panikakharu* ; Tam. *Poosini kai* ; Tel. *Boodida gummadi*.

206. Bagnaha : **Capparis horrida**
B. *Kalokera* ; H. *Ardanda* ; Kan. *Tottulla* ; Mar. *Govindi* ; P. *Karvilla* ; Tam. *Adondai* ; Tel. *Adonda* Other name : *Wag*.

207. Beans, scarlet runner : **Phaseolus coccineus**
H. *Sem* ; *Other names : Sim, Uri*.

208. 209. Bitter gourd : **Momordica charantia**
B., G., H., Kash., P. *Karela* ; Kan. *Hagal kai* ; Mal. *Kaippakka* ; Mar. *Karle* ; O. *Kalara* ; Tam. *Pavakkai* ; Tel. *Kakara kayi*

210. Borocee, raw : **Gardenia gummifera**

211. Bottle gourd : **Lagenaria vulgaris**
B., O. *Lau* ; G. *Dudhi* ; H. *Lowki* ; Kan. *Sorekai* ; Kash. *Zeeth* ; Mal. *Charanga* ; Mar. *Pandhara bhopla* ; P. *Ghia* ; Tam. *Surai kai* ; Tel. *Anapakaya* ; Other names : Calabash cucumber, *Kaddu*.

212. Brinjal : **Solanum melongena**
B. *Begun* ; G. *Ringna* ; H. *Baingan* ; Kan. *Badane* ; Kash. *Waangum* ; Mal. *Vazhuthininga* ; Mar. *Vange* ; O. *Baigan* ; P. *Bataun* ; Tam. *Kathiri* ; Tel. *Vankaya* ; Other name : Egg plant.

213. Broad beans : **Vicia faba**
B. *Makhan sim* ; G. *Fafda papdi* ; H. *Bakla* ; Kan. *Chapparadavare* ; Mal. *Avarakka* ; O. *Simba* ; Tam. *Avarai* ; Tel. *Pedda chikkudu*.

214. Cauliflower : **Brassica oleracea, var. botrytis**
B., G., H., Kash., Mar., O., P. *Phulgobi* ; Kan. *Hukosu* ; Tam. *Kovippu* ; Other name : *Olkapi*.

215. Celery stalks : **Apium graveolens, var. dulce**
B. *Randhuni* ; H. *Ajmud*.

216. Chaitha : **Dillenia indica**
G., Mar. *Karambel* ; Other name : *Uva*.

217. Cho-cho-marrow : **Sechium edule**
Kan. *Seeme badane* ; O. *Phuti kakudi* ; Tam. *Seemai kathirikai* ; Tel. *Seema vankayi*.

218. Cluster beans : **Cyamopsis tetragonoloba**
B. *Jhar sim* ; G. *Govar* ; H. *Guar-ki-phalli* ; Kan. *Gori kayi* ; *Guar-ki-phalli* ; Mal., Tam. *Kothavara* ; Mar. *Govari* ; O. *Guanra chhuin* ; P. *Guara-di-phalli* ; Tel. *Goruchikkudu*.

219. Colocasia stem : **Colocasia antiquorum**
B. *Kochu danta* ; H. *Arwi-ki-dandi* ; Kan. *Kesu dantu* ; Mal. *Chembin thandu* ; Mar. *Alu-che-deth* ; O. *Sarunada* ; Tam. *Seppanthandu* ; Tel. *Chama kada*.

220. Cow pea pods : **Vigna catjang**
See No. 35

221. Cucumber : **Cucumis sativus**
B. Sasha ; G. *Kakdi* ; H., P. *Khira* ; Kan. *Souche kayi* ; Kash. *Laa'r* ; Mal. *Vellarika* ; Mar. *Kakadi* ; O. *Kakudi* ; Tam. *Kakkarikkai* ; Tel. *Dosa kayi*.

222. Double beans : **Faba vulgaris**
G. *Papdi* ; H. *Chastang* ; Mal. *Avara*.

223. Drumstick : **Moringa oleifera**
B. *Sajna danta* ; G. *Saragavo* ; H. *Saijan-ki-phalli* ; Kan. *Nugge kayi* ; Mal., Tam. *Muringakkai* ; Mar. *Shevaga sheng* ; O. *Sajina chhuin* ; Tel. *Mulaga kadu* ; Other name : Horse radish.

224. Drumstick flowers : **Moringa oleifera**

225. Field beans, tender : **Dolichos lablab**
See No. 36.

226. Figs : **Ficus sunia**
B. *Dumur* ; H., Mar. *Anjeer, Mal., Tam.* Tel. *Athikai*.

227. French beans : **Phaseolus vulgaris**
G. *Fansi* ; H. *Bakla* ; Kan. *Huruli kayi* ; Kash. *Fraa'sh bean* ; Mar. *Pharasbee* ; P. *Fras bean*.

228. Ghosala : **Luffa cylindrica**
Mar. *Gohosala* ; P. *Ghia tori* ; Tel. *timbi beera*.

229. Giant chillies (Capsicum) : **Capsicum annuum var. grossa**
B. *Lanka (bilathi)* ; H. *Sagiya mirchi* ; Kash. *Marchawangum* ; Mal. *Unda mulagu* ; Mar. *Bhopli mirch* ; P. *Simla-di-mirch* ; Tam. *Koda milagai*.

230. Ipomoea stems : **Ipomoea reptans**
B. *Kolmi danta* ; Mar. *Nalichi bhaji* ; O. *Kandamula danka*.

231. Jack tender : **Artocarpus heterophyllus**
B. *Aanchar* ; G. *Kawla phanas* ; H. *Kathal* ; Kan. *Halasu (yela)* ; Mal. *Idichakka* ; Mar. *Phanas* ; O. *Panasa katha* ; Tam. *Pila pinju* ; Tel. *Panasa*.

232. Kanthau kathiri : **Solanum xanthocarpum**
G. *Bhony ringni* ; H. *Kateli* ; Mal., Tam. *Kandan Kathiri* ; O. *Bhaji baigana* ; Tel. *Vakudu mulaga*.

233. Kankoda : **Momordica dioica**
H. *Golkandra* ; Mal. *Erimapasal* ; Tam. *Paluppakkai*, Tel. *Akakara* ; Other name : *Karantoil*.

234, Karonda : **Carissa carandas**
235. H. *Karonda*.

236. Kheksa : **Momordica cochinchinensis**
G. *Karapata* ; H. *Kheksa* ; Other names : *Kakrol, Bhat karela*.

237. Kovai : **Coccinia cordifolia**
B. *Telakuchu* ; G. *Ghole giuru* ; H. *Konduri* ; Kan. *Tondekayi* ; Mal., Tam. *Kova kai* ; Mar. *Tondale* ; O. *Kunduru* ; Tel. *Donda kayi*.

238. Knol-khol : **Brassica oleracea, var. caulorapa**
B. Olkopi, G., Mar. *Nol-kol* ; H. *Kohl-rabi* ; Kash. *Mo'nd* ; O. *Ulkobi* ; P. *Ganth gobi*.

239. Ladies fingers : **Abelmoschus esculentus**
B. *Dherash* ; G. *Bhinda* ; H, P. *Bhindi* ; Kan. *Bende* ; Kash. *Bindu* ; Mal., Tam. *Vendakkai* ; Mar., O. *Bhendi* ; Tel. *Benda kayi* ; Other name : *Okra*

240. Lakooch, raw : **Artocarpus lakoocha**
H. *Barhar (kacha)* ; Kan. *Vatchuli* ; Mar. *Wotomba* ; Tel. *Kamma regu.*

241. Leeks : **Allium porrum**
B. *Piyaj (bilati)* ; H. *Lasson (vilayiti)* ; Kash. *Praan* ; Mar. *Khorat* ; O. *Rasuna (bilati).*

242. Lotus stem : **Nelumbium nelumbo**
H. *Kamal gatta* ; Mal., Tam. *Thamara thandu* ; Tel. *Thamara kada.*

243. Mango green : **Mangifera indica**
B. *Am (kancha)* ; G., *Ambo* ; H. *Am* ; Kan. *Mavinakayi* ; Mal., Tam. *Manga* ; Mar. *Amba* ; O. *Ambu (kancha)* ; P. *Am (hare)* ; Tel. *Mamidi kayi.*

244, 245. Mogra

246. Nisorha flowers : **Cardia dichotoma**
B. *Bahubara* ; H. *Lasora* ; Kan. *Chikka challe* ; Mal. *Cheruviri* ; Tam. *Naluvili* ; Tel. *Chinna nakkeru.*

247. Onion stalks : **Allium cepa**
B. *Piyaz kali* ; G. *Dunglina dakkadi* ; H. *Pyaz* ; Kan. *Eerulli soppu* ; Mal. *Ulli thandu* ; Mar. *Pati* ; O. *Piaja sandha* ; Tam. *Vengaya thandu* ; Tel. *Ulli kadalu.*

248. Papaya, green : **Carica papaya**
B. *Pempe (kancha)* ; G. *Papayi* ; H. *Papita* ; Mar. *Papaya* ; Kan. *Parangi* ; Mal. *Omakaya* ; P. *Kaicha pepita* ; Tam. *Pappali kai* ; Tel. *Boppayi kayi.*

249. Parwar : **Trichosanthes dioica**
B. *Patol* ; G. *Padval* ; H. *Parwal* ; Mal. *Potalam* ; Mar. *Parwar* ; O. *Potala* ; Tel. *Kommu potla.*

250. Peas : **Pisum sativum**
B, H, Kash, P. *Matar* ; G., Mar. *Vatana* ; Kan., Tel. *Batani* ; Mal., Tam. *Pattani* ; O. *Matara.*

251. Pink beans : **Phaseolus** sp.
B. *Lal sim* ; G. *Valore* ; H. *Babri* ; Kan. *Kempu huruli* ; Mal. *Chuvana avara* ; O. *Nali simba.*

252. Plantain flower : **Musa saplentum**
B. *Mocha* ; G, Mar. *Kel phool* ; H. *Kele-ka-phool* ; Kan. *Bale motho* ; Mal, Tam. *Vazhapoo* ; O. *Kadali bhanda* ; P. *Kele-da-phool* ; Tel. *Arati puvvu.*

253. Plantain, green : **Musa saplentum**
B. *Kela (kanch)* ; G. *Kela* ; H., P. *Kela (hara)* ; Kan. *Bale kayi*, Mal., Tam. *Vazhakkai* ; Mar. *Kele* ; O. *Bantala kadali* ; Tel. *Arati kayi.*

254. Plantain stem : **Musa saplentum**
B. *Thor* ; G. *Kelanu thed* ; H. *Kele-ka-tana* ; Kan. *Dindu* ; Mal. *Unnipindi* ; Mar. *Kelicha khunt* ; O. *Kadali manja* ; Tam. *Vazhai thandu* ; Tel. *Arati doota.*

255. Pumpkin : **Cucurbita maxima**
B. *Kumra* ; G. *Kohlu* ; H. *Kaddu* ; Kan. *Kumbala* ; Kan. *Paarimal* ; Mal. *Mathan* ; Mar. *Lal bhopla* ; O. *Kakharu* ; P. *Sitaphal* ; Tam. *Parangikkai* ; Tel. *Gummadi kayi.*

256. Pumpkin flowers : **Cucurbita maxima**

257. Rape plant stem : **Brassica napus**
B. *Sorisa danta* ; G. *Rainu zad* ; H. *Sarson-ki-dandi* ; O. *Sorisa nada.*

258. Red gram, tender : **Cajanus cajan**

259. Rhubarb stalks : **Rheum emodi**
B. *Reuchini danta* ; H. *Revand chini* ; Mal. *Variyath thandu.*

260. Ridge gourd : **Luffa acutangula**
B. *Jhinga* ; G. *Turia* ; H. *Toral* ; Kan. *Heeraikai* ; Kash. *Turrel* ; Mal. *Peechinga* ; Mar. *Dodka* ; O. *Janchi* ; P. *Kali tori* ; Mal. *Pirkkankti* ; Tel. *Beera kayi.*

261. Sanga-ka-phal : **Dioscorea puber**

262. Sannhemp flowers : **Crotalaria juncea**
B. *Shon* ; H. *Sanai-ka-phool* ; Kan. *Sanalu* ; Mal. *Wucka poo* ; Mar. *Tag* ; Tam. *Sannappu sanal* ; Tel. *Janumu puvvu.*

263. Silk-cotton flowers : **Bombax malabaricum**
H. *Semal-ka-phool* ; Kan. *Reshme-hattine huvu* ; Mal. *Poola poo* ; Tam. *Ilavam puvu* ; Tel. *Boorugu puvvulu.*

264. Snake gourd : **Trichosanthes anguina**
B. *Chichinga* ; G. *Pandola* ; H, O. *Chachinda* ; Kan. *Padavala* ; Mal. *Padavalanga* ; Mar. *Padwal* ; Tam. *Podalangai* ; Tel. *Potla kayi.*

265. Spinach stalks : **Spinacia oleracea**
B. *Palong danta* ; H, P. *Palak-ki-dandi* ; Mal. *Vasalicheera thandu* ; Mar. *Palak deth* ; O. *Palanga nada* ; Tam. *Pasalai thandu* ; Tel. *Bacchalu kada.*

266. Sundakai : **Solanum torvum**
B. *Titbaigum* ; Kan. *Sondekai* ; Mal. *Sundakka* ; Tam. *Sundakkai* ; Tel. *Usthi kayi.*

267. Sword beans : **Canavalia gladiata**
B. *Kath sim* ; G. *Taravardini vel* ; H. *Bara sem* ; Kan. *Tumbekai* ; Mal. *Val avana* ; Mar. *Abaichi sheng* ; O. *Maharda* ; Tam. *Kathu thambattam* ; Tel. *Adavi thamma* ; Other name : *Makhan sim.*

268. Tetrolobar bean : **Lotus tetragonolobus**
H. *Hatna-sirmi* ; Other name : Winged pea.

269. Tinda : **Citrullus vulgaris**
G. *Tadabuch* ; H. *Tinda* ; Other name : Round gourd.

270. Tomato, green : **Lycopersicon esculentum**
B. *Bilathi begun* ; Kash. *Ruwangan* ; Mal, Tam. *Thakkali* ; Other names : Love apple.

271. Vegetable marrow : **Cucurbita pepo**
B. *Dhudul* ; H. *Safed kaddu* ; Kan. *Dilpasand* ; Kash. *Kaoshir al* ; Mar. *Kashi bhopla* ; O. *Golu phuli kakuri* ; Other name : Field pumpkin.

272. Water chestnut : **Trapa bispinosa**
273. B. *Pani phal* ; G. *Shingoda* ; H, Mar. *Shingara* ; O. *Pani singhara* ; Te.. *Kubyakam.*

274. Water lily flowers : **Nymphaea nouchali**
G. *Nilopal* ; H. *Bhent-ka-phool* ; Mal. *Vellambalpoo* ; Tam. *Allithamaru* ; Tel. *Tella kaluva.*

NUTS & OILSEEDS

275. Almond : **Prunus amygdalus**
B., G. Kan., Kash. Mal., Mar., O., P., Tam., Tel. *Badam.*

276. Cashew nut : **Anacardium occidentale**
B. *Hijli badam*; G., H. Kash, Mar., P. *Kaju*; Kan. *Geru beeja*; Mal. *Kasu andi*; O. *Lar ka ambu manji*; Tam. *Mundiri pan.ppu*; Tel. *Jeedi pappu.*

277. Chilgoza : **Pinus gerardiana**
H. *Chilgoza*; P. *Rhi.*

278- Coconut : **Cocos nucifera**
279. B. *Narkel*; G., H. *Nariyal*; Kan. *Thengini kai*; Kash. *Narjeel*; Mal., Tam. *Thenga*; Mar. *Narel*; O. *Nadia*; P. *Gola*; Tel. *Kobbari.*

280. Garden cress seeds : **Lepidium sativum**
See No. 81.

281. Gingelly seeds : **Sesamum indicum**
B., H., Mar., P. *Til*; G., *Tal*; Kan. *Acchellu*; Mal., Tam., *Ellu*; O. *Rasi*; Tel. *Nuvvulu*; Other name : Sesame seeds.

282- Groundnut : **Arachis hypogaea**
283. B., O. *China badam*; G. *Bhoising*; H., Kash., P. *Moong phali*; Kan. *Kadale kayi*; Mal., Tam. *Nilakkadalai*; Mar. *Bhui mug*; Tel. *Verusanaga.*

284. Jungli badam : **Sterculia foetida**
Tel. *Yenuga badam.*

285. Linseed seeds : **Linum usitatissimum**
B. *Tishi*; G., H., P. *Alsi*; Kash. *A'lish*; Mal. *Cheruchana vithu*; Mar. *Jawas*; O. *Pesi*; Tam. *Ali vidoi*; Tel. *Avise ginzalu.*

286. Mustard seeds : **Brassica nigra**
B. *Sorse*; G., H., P. *Rai*; Kan. *Sasuve*; Kash. *Aasur*; Mal., Tam. *Kadugu*; Mar. *Mohori*; O. *Sorisa*; Tel. *Avalu.*

287. Niger seeds : **Guizotia abyssinica**
B. *Ram til*; H. *Kala til*; Kan. *Gurellu*; Mar. *Karale*; Tam. *Kattalu*; Tel. *Valasulu*; Other name : *Surguja.*

288. Oyster nut : **Telfairea pedata**

289. Pistachio nut : **Pistacia vera**
B. *Pesta*; G., H., Kan., Mal., Mar., O., P., Tam., Tel. *Pista*; Kash. *Jalguza.*

290. Piyal seeds : **Buchanania latifolia**
G., Mar. *Charoli*; H., B. *Piyal*; Kan. *Narkal*; Tam. *Sarai paruppu*; Tel. *Sarapappu*; Other name : *Chironji.*

291. Safflower seeds : **Carthamus tinctorius**
H. *Kardi*; Tel. *Kusuma ginzalu*; Other name : Kusumbh seeds.

292. Sunflower seeds : **Helianthus annuus**
B., P. *Suraj mukhi*; H., Mar. *Surya mukhi*; Mal., Tam. *Suryakanthi*; Tel. *Poddutthirugudu puvvu ginzalu.*

293 Walnut : **Juglans regia**
B., G., H., P. *Akhrot*; Mar. *Akhrod*; O. *Akhoot.*

CONDIMENTS AND SPICES

294. Arisithippili :
B. *Pipul*; H. *Peepal*; Mal., Tam. *Arisithippili*; O. *Sarupipali.*

295. Asafoetida : **Ferula foetida**
B., G., H., Mar., P. *Hing*; Kan., O. *Hingu*; Kash. *Yangu*'; Mal., Tam. *Perungayam*; Tel. *Inguva.*

296. Cardamom : **Elettaria cardamomum**
B. *Elachi*; G., H., P. *Elaychi*; Kan. *Yelakki*; Kash. *Aa'l Budu'a an'l*; Mal. *Elathari*; Mar. *Veldoda*; O. *Alaichi*; Tam., Tel. *Elakkai.*

297- Chillies : **Capsicum annuum**
298. B., O. *Lanka*; G. *Marcha*; H. *Mirch*; Kan. *Menasina kayi*; Kash. *March wangun*; Mar. *Mirchi*; Mal. *Mulaku*; P. *Mirchan*; Tam. *Milagai*; Tel. *Mirapakayi.*

299, Cloves : **Syzygium aromaticum**
300. B., O. *Labang*; G., H., Mar. *Lavang*; Kan. *Lavanga*; Kash. *Ruang*; Mal., Tam. *Krambu*; P. *Long*; Tel. *Lavangalu.*

301. Coriander : **Coriandrum sativum**
B., G., H., O., P. *Dhania*; Kan. *Kothambari*; Kash. *Daantwal*; Mal. *Kothambalari*; Mar. *Dhana*; Tam. *Kothamalli vidai*; Tel. *Dhaniyalu.*

302. Cumin seeds : **Cuminum cyminum**
B., H., Mar., O., P. *Jira*; G. *Jiru*; Kan. *Jeerage*; Kash. *Zyur*; Mal., Tam. *Jeerakam*; Tel. *Jeelakarra.*

303. Fenugreek seeds : **Trigonella foenum graecum**
B., G., H., Mar., O. *Methi*; Kan. *Mentha*; Kash. *Meeth*; Mal. *Uluva*; P. *Meth*; Tam. *Venthayam*; Tel. *Menthulu.*

304. Garlic : **Allium sativum**
B. *Rashun*; G., P. *Lasan*; H. *Lahsun*; Kan. *Bellulli*; Kash. *Ruhan*; Mal., Tel. *Vellulli*; Mar. *Lasoon*; O. *Rasuna*; Tam. *Ullipoondu.*

305. Ginger, fresh : **Zingiber officinale**
B., O. *Ada*; G. *Adu*; H., P. *Adrak*; Kan. *Shunti*; Mal., Tam. *Inji*; Mar. *Ale*; Tel. *Allam.*

306. Kandanthippili : **Piper longum**
Mal., Tam. *Kandanthippili*; O. *Pipali.*

307. Lime peel : **Citrus medica var. acida**
B. *Lebur khosa*; G. *Limbuni chal*; H. *Neebu ka chilka*; Kan. *Numbe sippe*; Mal. *Cherunaranga tholu*; Mar. *Limbsal*; O. *Lembri chopa*; Tam. *Elumichan thol*; Tel. *Nimma thokku.*

308. Mace : **Myristica fragrans**
B., O. *Jaytri*; G., Mar. *Jaypatri*; H. *Javithri*; Kash. *Jalwatur*'; Mal., Tam. *Jathipatri*; Tel. *Japathri.*

309. Nutmeg : **Myristica fragrans**
B., G., H., Mar., O. *Jaiphal*; Kan., Tel. *Jaji kayi*; Kash. *Zaaphal*; Mal., Tam. *Jathikkai.*

310. Nutmeg rind : **Myristica fragrans**

311. Omum : **Trachyspermum ammi**
B. *Joan*; H., P. *Ajwan*; Kan. *Omu*; Kash. *Jaawen*; Mal. *Ayamothakam*; Mar. *Onva*; O. *Juani*; Mal. *Omum*; Tel. *Vamu*; Other name : *Jiwan.*

312, Pepper : **Piper nigrum**
313. B., O. *Golmarich*; G. *Mari*; H., P. *Kalimirch*; Kan. *Kari menasu*; Kash. *Marutus*; Mal. *Kurumulaku*; Mar. *Mire*; Tam. *Milagu*; Tel. *Mirlyalu.*

314. Tamarind pulp : **Tamarindus indica**

B. *Tetul*; G. *Amli*; H, P. *Imli*; Kan. *Hunise hannu*; Kash. *Tamber*; Mal, Tam. *Puli*; Mar. *Chinch*; O. *Tentuli*; Tel. *Chintha pandu.*

315. Turmeric: **Curcuma domestica**
B. *Holud*; G. *Haldhar*; H, P. *Haldi*; Kan. *Anashina*; Kash. *Lader*; Mal, Tam. *Manjal*; Mar. *Halad*; O. *Haladi*; Tel. *Pasupu.*

FRUITS

316. Ambada: **Spondias mangifera**
B, H. *Amra*; Kan. *Ambate*; Mal. *Mampuli*; Tam. *Mambulichi*; Tel. *Amratakamu*; Other name: Indian hog plum.

317. Amla: **Emblica officinalis**
B. *Amlaki*; G, H. *Amla*; Kan, Mal, Tam. *Nellikai*; Mar. *Anvla*; O. *Anla*; Tel. *Usirikayi*; Other name: Indian gooseberry.

318. Apple: **Malus sylvestris**
G. *Safarjan*; H, O. *Sev*; Kan. *Sebu*; Kash. *Tsoonth*; Mar. *Safar chand*; Other name: *Tarel.*

319, Apricot: **Prunus armeniaca**
320. H. *Khoomani*; Kash. *Tser*; Other name: *Khubani.*

321. Avacado pear: **Persea americana**
B. *Kulunashpati*; Kash. *Goshtub tang*; Other name: Butter fruit.

322. Bael fruit: **Aegle marmelos**
B., H, Mar., *Bel*; G. *Bil*; Tam. *Bilwa pazham*; Tel. *Maredu pandu.*

323. Bainchs: **Flacourtia indica**
B. *Bincha*; H. *Bilangra*; Mar. *Kaker*; Tam. *Sottai kala*; Tel. *Putikatada*; Other names: *Baichi*, Batoko plum.

324. Bamboo fruit: **Bambusa arundinacea**
B. *Banser phal.*

325. Banana, ripe: **Musa paradisiaca**
B. *Kala (paka)*; G, H, Kash. *Kela*; Kan. *Bale hannu*; Mal, Tam. *Vazha pazham*; Kan. *Kele*; O. *Champa kadali*; P. *Kella*; Tel. *Arati pandu.*

326. Banyan tree figs: **Ficus bengalensis**
H. *Bargad-ka-phal*; Mal, Tam. *Alam pazham*; Tel. *Marri pandu.*

327. Bilimbi: **Averrhoa bilimbi**
B. *Kamranga*; Kan. *Kamaleku*; O. *Karamanga.*

328. Blackberry: **Rubus fruticosus**
H. *Vilaiti-anchu*; P. *Alish*; Other name: Bramble.

329. Borooee: **Gardenia gummifera**
H. *Dikamli*; Tam. *Dikka malli*; Tel. *Karingua.*

330. Bread fruit: **Artocarpus altilis**
B, H. *Madar*; Mal. *Kadachakka.*

331. Bullock's heart: **Annona reticulata.**
B. *Nona*; G, Mar. *Ramphal*; H. *Nona atwa*; Kan, Tel. *Ramaphala*; Mal, *Athachakka*; O. *Raja amba*; Tam. *Ramsita pazham.*

332. Cape gooseberry: **Physalis peruviana**
B. *Tepari*; G. *Popta*; H, P. *Rasbari*; Mal. *Kodinellikkai*; Mar. *Tipari*

333. Carambola: **Averrhoa carambola**
H. *Kamrakh*

334. Cashew fruit: **Anacardium occidentale**
B. *Hijli badam*; G, H, Mar., P. *Kaju phal*; Kan. *Geru hanhu*; Mal. *Kasu manga*; O. *Lanka amba*; Tam. *Mundiri pazham*; Tel. *Jeedi pandu.*

335. Cherries, red: **Prunus cerasus**
H, Kash, P. *Gilas.*

336. Cherimoyer: **Annona cherimolia**
H. *Hanuman phal*

337. Currants, black
H. *Munakka.*

338, Dates: **Phoenix dactylifera**
339. B. *Khejur*, G, H, Mar, P. *Khajur*; Kan. *Kharjoora*; Kash. *Kha'zur*; Mal. *Eethapazham*; O. *Khajuri*; Tam. *Perichem pazham*; Tel. *Kharjoora pandu.*

340. Durian: **Durio zibethinus**
Mal. *Durian pazham*

341. Figr: **Ficus carica**
B. *Dumoor*; G, H, Kash, Mar., P. *Anjeer*; Kan. *Anjura*; Mal, Tam. *Atti pazham*; O. *Dimiri*; Tel. *Athi pallu*; Other name: *Gullar.*

342. Gab: **Diospyros embryopteris**
B, H. *Gab*; Mal. *Panichi*; Tam. *Tumbi*; Tel. *Tinduki.*

343, Grape: **Vitis vinifera.**
344. B, H, P, O. *Angoor*, G, Kan., Mar., Tam., Tel. *Draksha*; Kash. *Da'ch*; Mal. *Mundiringa.*

345. Grapefruit: **Citrus paradisi**
346. B. *Bilati batabi Jambura*; G, H. *Chakotra*; Kash, Mar., *Be'daana*; Mal. *Mundri pazham*; O. *Bada angur.*

347. Guava, country: **Psidium guajava**
B. *Payra (deshi)*; G. *Jam phal*; H, P. *Amrud*; Kan. *Seebe*; Mal. *Perakka (nattu)*; Mar. *Peru*; O. *Pijuli (deshi)*; Tam. *Koya pazham*; Tel. *Jami pandu.*

348. Guava, hill: **Psidium cattleyanum**

349. Harfarowrie: **Phyllanthus distichus**
B. *Hari phal*; Kan, Mal., Tam. *Aranelli*; Mar. *Rai avala*; Tel. *Racha usiri kayi*; Other name: Star gooseberry.

350. Hoormad: **Erioybe paniculata**

351. Jack fruit: **Artocarpus heterophyllus**
B. *Kanthal*; G, Mar. *Phanas*; H, P. *Kathal*; Kan. *Halasu*; Mal. *Chakka*; O, Tel. *Panasa*; Tam. *Pala pazham.*

352, Jam, safed: **Eugenia malaccensis**
353. Jambu fruit: **Syzgium cuminl**
B. *Kalojam*; G. *Jambu*; H, P. *Jamun*; Kan. *Neralai*; Mal, Tam. *Naga pazham*; Mar. *Jambhool*; O. *Jamukoli*; Tel. *Neredu pandu.*

354. Jurmata: **Canthium didyamum**

355. Kesaur: **Pachyrrhizus angulatus**
H. *Sakalu.*

356. Kila pazham: **Vaccinium leschenaultii**
H. *Karaunda*, Mal, Tam., *Kila Pazham*; Tel. *Wakkai.*

357. Korukkapalli: **Pithecellobium dulce**
B. *Tetul (bilati)*; G. *Amli goras*; H. *Singhri*; Kan. *Seema hunise*; Mal. Tam. *Korukkapalli*; Mar. *Chinch (vilaythi)*; Tel. *Seema chinta* Other name: Manila imli.

358. Kusum fruits : **Schleichera trijuga**
H. *Kusum-ka-phal.*

359. Lakuch : **Artocarpus lakoocha**
B. *Dephal-dahua* ; H. *Barhar* ; Kan. *Vote huli* ; Mar. *Wotombe* ; Tam. *Ilagusam* ; Tel. *Kamma regu.*

360. Langsat : **Lansium domesticum**

361. Lemon : **Citrus limon**
B. *Pati lebu* ; G. *Motu limbu* ; H. *Bara numbu* ; Kash. *Nyomb* ; Mal. *Poo naranga* ; Mar. *Limbu* ; O. *Kagaji lembu.*

362. Lemon, sweet : **Citrus limetta**
B. *Mitha lebu* ; G. *Mitha limbu* ; H. *Mitha neebu* ; Kan. *Gaja numbe* ; Tam. *Kolinchi pazham* ; Tel. *Gaja nimma pandu.*

363. Lichi : **Nephelium litchi**
H. *Lichi*

364. Lichi, bastard : **Nephelium longana**
H. *Ansfal.*

365. Lime : **Citrus aurantifolia**
B. *Lebu* ; G. *Kadgi limbu* ; H. *Neembu* ; Kan. *Numbe* ; Kash. *Nyomb* ; Mal. *Cherunaranga* ; Mar. *Musumbe* ; O. *Gangakulia lembu* ; P. *Nimbha* ; Tam. *Elumichai* ; Tel. *Nimma pandu.*

366. Lime, sweet, Malta.

367. Lime, sweet, Musammi : **Citrus sinensis**
H. *Musambi.*

368. Loquat : **Eriobotrya japonica**
H., Kash., Tel. *Lokat* ; Kan. *Laquot* ; Mal., Tam. *Lakot pazham* ; Mar. *Lukat* ; Other name : Japan plum.

369. Mahua, ripe : **Bassia longifolia**
B., G., H., Mar. *Mahua* ; Kan. *Hippe* ; Mal. *Poonamilupa* ; O. *Mahula* ; Tam. *Iluppai* ; Tel. *Ippa.*

370. Mango, ripe : **Mangifera indica**
B., H. *Aam (paka)* ; G. *Keri* ; Kan. *Mavina hannu* ; Kash., P. *Amb* ; Mal., Tam. *Mam pazham* ; Mar. *Amba (piklela)* ; O. *Amba (pachila)* ; Tel. *Mamidi pandu.*

371. Mangosteen : **Garcinia mangostana**
Kan., Tam. *Mangusthan.*

372. Matasura : **Antidesma ghesaembilla**

373.

374. Melon, musk : **Cucumis melo**
B. *Kharmuj* ; G., H., Mar., P., Tel. *Kharbooja* Kash. *Kherbuz* ; Tam. *Mulam pazham* ; Other name : Cantaloup.

375. Melon, water : **Citrullus vulgaris**
B. *Tarmuj* ; G., H. *Tarbuj* ; Kan. *Kallangadi* ; Kash. *He'nd wend* ; Mal. *Thannir mathan* ; Mar. *Kalingad* ; O. *Tarvuja* ; P. *Tarbuja* ; Tam. *Darbusini* ; Tel. *Puchakayi.*

376. Mulberry : **Morus sp.**
H. *Shahtoot* ; Kash. *Tul* ; Tam. *Musukkottai pazham.*

377. Mulchari : **Mimusops elengi**
H. *Bakul* ; Tam. *Magilam* ; Tel. *Vakulamu.*

378. Neem fruit : **Malia azadirachta**
B. *Neem phal* ; Mal., Tam. *Veppam pazham* ; Tel. *Vapa pandu.*

379. Nisorha : **Cordia dichotoma**
B. *Bahubara* ; H. *Lasora* ; Kan. *Ch...* *chalk* ; Mal. *Cheruviri* ; Mar. *Sheh...* Tam. *Narvalli* ; Tel. *Chinna nakk...*

380. Orange : **Citrus aurantium**

381. B. *Kamala lebu* ; G., P. *Santra* ; ... *Narangi* ; Kan. *Kithilai* ; Kash. *Sangtar* ; Mar. *Madhura naranga* ... Mar. *Madhura naranga* ; ... O. *Kamala* ; Tam. *Kichili pazham* ... *Kamala pandu.*

382. Palmyra fruit : **Borassus flabellifer**

383. B. *Tal shash* ; G. *Tal* ; H. *Tar* ; ... *Thati nungu* ; Mal. *Panam nungu* ... *Shindi shiren* ; O. *Tala* ; Tam. ... *nungu* ; Tel. *Thati pandu.*

384. Paniyala : **Flacourtia ...**
B. *Paniyala* ; H. *Talis-...*

385. Papa : **Gardenia latifolia** ...

386. Papaya, ripe : **Carica papaya**
B. *Pepe (paka)* ; G. *Papaya* ; ... *Papita* ; Kan. *Pharangi* ; Mal. ... Mar. *Popai* ; O. *Amrut bhanda* ... *(pachila)* ; Tam. *Pappali* ; Tel. ... *pandu.*

387. Passion fruit : **Passiflora edulis**

388. G. *Krishna kamal* ; Mal. ... *poochad pazham.*

389. Peaches : **Amygdalis persica**
H., P. *Aarhoo* ; Kan. ... *Tsun'un* ; O. *Piceuu* ; Other name ... *Satalu.*

390. Pears : **Prunus persica**
B., G., H., Mar., O., P. *Nashpati* ; ... Tam., Tel. *Berikai* ; Kash. ... *Sabarjil* ; Other name : *Goshbub.*

391. Perar : **Randia uliginosa**

392. Persimmon : **Diospyros kaki**
B. *Gav* ; Other name : *Kaki.*

393. Phalsa : **Grewia asiatica.**
H., P. *Falsa.*

394. Pine apple : **Ananas comosus** ...
B. *Anarash* ; G., H., Kan., Mar., P. ... *Ananas* ; Mal. *Kaythia chakka* ; O. ... *Sapuri Anasiahas* ; Tam. *Anasi pazham* ; Tel. *Anasa pandu.*

395. Pipal tree figs : **Ficus religiosa**
H. *Pipar-ka-pakua* ; Tam. *Arasam pazham* ; Tel. *Ravi Pandu.*

396. Piyal : **Buchanania latifolia**

397. Plum : **Prunus domestica**
H. *Alubokhara* ; Kash. *Laar* ; P. *Alu...* Tam., Tel. *Alpagoda.*

398. Pomegranate : **Punica granatum**
B. *Dalim* ; G. *Dalamb* ; H., P. *Anar* ... Kan. *Dalimbari* ; Kash. *Daan'n* ; ... Tam. *Mathalam pazham* ; Mar. *Dalimb* ; O. *Dalimba* ; Tel. *Danimma pandu.*

399. Prunes : **Prunus salicina**

400. Pummelo : **Citrus maxima**
B. *Batabi lebu* ; G., Mar. *Papnus* ; ... *Chakotra* ; Kan. *Chakkota* ; Mal. ... *Bombilimas* ; O. *Batapi lembu* ; Tel. ... *Pampara nanasa* ; Other name : Shaddock.

401. Quince : **Cydonia oblonga**
B. *Bael (bilati)* ; H. *Bihi* ; Kan. *Sema dalimbe* ; Kash. *Bamt soonth* ; Tam. *Seemai madalai* ; Tel. *Seemadanimma...*

iii

402. **Raisins : Vitis vinifera**
B, G, H, Kash, O, P, Tel. *Kishmish* ; Kan. *Drakshi* ; Mal. *Mundiringa (unakku)* ; Mar. *Manuka* ; Tam. *Drakshai.*

403. **Raspberry**
H. *Rushbhary.*

404. **Rayan : Mimusops hexandra**
B. *Khukhajur* ; H. *Khirni.*

405. **Rose apple : Syzygium jambos**
B. *Jamrul* ; G. *Gulab jambu* ; Kan. *Panneeralai hannu* ; Mal. *Jambakka* ; Mar. *Jambhool* ; O. *Chota pijuli* ; Tam. *Pannirkoyya* ; Tel. *Gulab jamun.*

406. **Sapota : Achras sapota**
H. *Sapatu* ; Mar., P. *Chiku* ; Mal., Tam., Tel. *Sapota.*

407. **Seethaphal : Annona squamosa**
B, O. *Ata* ; G., Mar. *Sitaphal* ; H., P. *Sharifa* ; Kan., Tel. *Seethaphalam* ; Mal, Tam.. *Seetha pazham* ; Other names : Custard apple, Sugar apple.

408. **Sirka : Zizyphus rugosa**

409. **Star apple : Eugenia javanica**
H. *Jambrool.*

Strawberry : Fragaria vesca
...ash. *Istabari.*

..avittu pazham : Rhodomyrtus ...mentosa
..al, Tam. *Thavittu pazham* ; O. *Jangli pijuli.*

412. **Tirkol-ka-phal**

413. **Tomato, ripe : Lycopersicon esculentum**
Kash. *Ruwangum* ; Mal., Tam. *Takkali pazham.*

414. **Tomatillo : Physalis ixocarpa**
Other names : Maxican husk tomato, Jamberry.

415. **Tree tomato : Cyphomandra betacea**

416. **Tuki**

416. **Tuki : Diospyros melanoxylon**
Other name : *Kend.*

417. **Vikki pazham : Elaeocarpus oblongus**
B. *Jalpai* ; Mal., Tam. *Vikki pazham* ; Other name : Wild olive.

418. **Wood apple : Limonia acidissima**
B. *Kathbel* ; G. *Kothu* ; H. *Kaith* ; Kan. *Bela* ; Mal., Tam. *Vilam pazham* ; Mar. *Kavath* ; O. *Kaitha* ; Tel. *Velega pandu* ; Other name : *Kapith.*

419. **Zizyphus : Zizyphus jujuba**
G., Mar. *Bor* ; H. *Ber* ; Kan. *Yelachi* ; Kash. *Bre'y* ; Mal., Tam. *Elantha-pazham* ; O. *Barakoli* ; Tel. *Regu pandu* ; Other names : Jujube, Indian plum.

FISHES AND OTHER SEA FOODS

420. **Air : Mystus seenghala**
B. *Air* ; H. *Ari* ; Kan. *Shede* ; Mal. *Karatta* ; Mar. *Singala* ; O. *Alli* ; P. *Challa* ; Tam. *Cumboo kelutti* ; Tel. *Mulli jella.*

421. **Amlet**

422. **Anchovy : Engraulis mystax**
Kan. *Engalu* ; Mal. *Nedumanangu* ; Tam. *Poruva* ; Tel. *Poracalu.*

423. **Bacha : Eutropiichthys vacha**
B. *Bacha* ; H., O. *Bachuwa* ; P. *Jhalli.*

424. **Bali kankda**
B. *Kankda.*

425. **Bam : Mastocembelus armatus**
B. *Bam* ; O. *Bummi* ; Tam. *Kularal* ; Tel. *Mudibommiday* ; Other name : *Samp machli.*

426. **Baspata machli : Ailia coilia**
B. *Kajoli* ; O. *Bunsputta* ; Tel. *Vella kalada.*

427. **Bata**
B. *Bata.*

428. **Bele : Glossogobius giuris**
B. *Bele* ; Kan. *Abbrony* ; Mal. *Wantee-poolah* ; O. *Gulathi* ; Tam. *Nullatan* ; Tel. *Bulli-koka* ; Other name : *Gooloowah.*

429. **Bhangar : Mugil tade**

430. B. *Bhangon* ; Other name : *Dhoka.*

431. **Bhangan bata : Labeo bata**
B. *Bhangan bata* ; H. *Gootellah* ; O. *Dunguduporah* ; Tel. *Mosu.*

432. **Bhetki : Lates calcarifer**

433. B. *Bhetki* ; Kan. *Koliji* ; Mal. *Chembolli* ; Mar. *Khajura* ; O. *Durrah* ; Tam. *Painnee meen* ; Tel. *Pandu chapa.*

434. **Bhole**

435. **Big-jawed jumper : Lactarius lactarius**
Kan. *Adai meenu* ; Mal. *Adavu* ; Tam. *Guthipu* ; Tel. *Suduma.*

436. **Blue mussel : Mytilus viridis**

437. **Boal : Wallago attu**
B. *Boal* ; H. *Boalee* ; Kan. *Bahle* ; Mal. *Attuvalai* ; Mar. *Shivda* ; Tam. *Valai* ; Tel. *Valuga.*

438. **Bombay duck : Harpadon nehereus**
B. *Nehare* ; Kan., Mar. *Bombli* ; Mal. *Bummili* ; Tam. *Vangaravasi* ; Tel. *Vanamathlu.*

439. **Bugda chingri**

440. **Cat fish : Arius sona**
Kan. *Shede* ; Mal. *Valla etta* ; Mar. *Shingala* ; Tam. *Keluthi* ; Tel. *Jellalu.*

441. **Chela : Chela phulo**

442. B. *Chela* ; H. *Dunnahru.*

443. **Chiki.**

444. **Chingru**

445. **Chingri, goda**
B. *Goda chingri*

446. **Chital : Notopterus chitala**
B, O. *Chital* ; Tam. *Ambattan*

447. **Crab : Paratephusa spinigera**

448. B. *Kankra* ; G. *Karachlo* ; H. *Kenkra* ; Kan. *Aedi* ; Mal., Tam. *Nandu* ; Mar. *Khekra* ; O. *Kankada* ; Tel. *Peetha.*

449. **Dhain : Solonia silondia**
B. *Dhain* ; H. *Baikar* ; O. *Jil-lung* ; Tam. *Pala katuthi* ; Tel. *Pedda chelwa.* Other name : Silond.

450. **Fesha**

451. B. *Fesha.*

452. **Fish meal**
Other name : Fish flour.

453. **Folui : Notopterus notopterus**
B. *Folui* ; H. *Pholi* ; Kan. *Pappasi* ; O.

Pulli; Tam. *Chotta valai*; Tel. *Mangali kathi.*

454. Ghol: **Sciaena miles**
H. *Dhoma*; Tam. *Vella-kattéelee.*

455. Goggler: **Caranx crumenophthalmus**
Kan. *Banguda hedday*; Mal. *Chamban*; Mar. *Labi.*

456. Golavindalu:
Tel. *Golavindalu*

457. Golim.

458. Herring, Indian: **Pellona brachy-soma**
Mal. *Kannan mathi*; O. *Paunla puiee.*

459. Herring, ox-eyed: **Megalops cyprinoides**
Kan. *Selakku*; Mal. *Valathan*; O. *Punni kowu*; Mal. *Morancundai*, Tel. *Kannangi.*

460. Hilsa: **Clupea ilisha**
B., H. *Hilsa*; Kan. *Paliya*; Mal. *Paluva*; Mar. *Pala*; Tam. *Oolum*; Tel. *Palasa.*

461. Horse mackerel: **Caranx melampygus**
Mal. *Ovupara*; Tel. *Kuvvogooparal*

462. Indian whiting: **Sillago sihama**
Kan. ; Mal. *Poozhan*; Mar. *Murdi*; Tam. *Kellakkan*; Tel. *Shorangi.*

463. Jew fish (kora): **Pseudosciaena coibor**
Mal. *Kora*; Tam. *Vella kattelee.*

464. Jew fish (pallikora): **Otolithes ruber.**
Mal. *Pallikora*

465. Joyali magur.
B. *Joyali magur.*

466. Kalabasu: **Labeo calbasu**
B. *Kalvus*; H., O. *Kala-bainse*; Kan. *Kaghi*; Mal. *Karthamin*; Mar. *Kanoshi*; Tam. *Kakkameen*; Tel. *Kaki bontha*; Other name: Khursha.

467. Katla: **Catla catla**
B., H. *Katla*; Mal. *Karakatla*; Mar. *Tambra*; O. *Barkur*; Tam. *Theppu meenu*; Tel. *Botchee.*

468. Kholshe.
B. *Kholshe.*

469. Khorsula: **Mugil corsula**
B. *Khorsula*; H. *Answari*; Mal. *Thiruta*; O. *Kakunda.*

470. Khoyra: **Gonialosa manmina**
471. B. *Khoyra.*

472. Koi: **Anabas testudineus**
B., O. *Koi*, Mal. *Undee-collee*; Tam. *Sennal.*

473. Koocha machli: **Amphipnous cuchia**
B. *Kucha*; Other name: *Andha samp.*

474. Kucha vetki.
B. *Kucha vetki.*

475. Lady vendi.

476. Lata: **Ophiocephalus punctatus**
B. *Lata*; H. *Phooldhok*; Kan. *Karava*; Mal. *Kayichal*; O. *Gorissa*; Tam. *Korava*; Tel. *Mitta.*

477. Laukhoia.
B. *Lankhoia.*

478. Lobster: **Palaemon sp.**
B. *Mocha chengdi.*

479. Mackerel; **Rastrelliger kanagurta**
Kan. *Bangadei*; Mal. *Ayila*; Mar. *Kaula-gedar*; Tam. *Kanan-keluthi.*

480. Magur: **Clarias batrachus**
B. *Magur*; H. *Mangri*; Mal. *Yarivahlay*; O. *Magurah*; Tam. *Masarai*; Tel. *Marpoo.*

481. Mahasole: **Barbus tor.**
B. *Mahasole*; H. *Naharm*; Kan. *Peruval*; Mal. *Meruval*; Mar. *Khadchi*; O. *Kajra*; Tam. *Kuli*; Tel. *Pédda-polika.*

482. Mandeli.

483. Mangalore fish

484. Modal machh

485. Modki

486. Mowrala: **Amblypharyn godonmola**

487. Mrigal: **Cirrhinus mrigala**
B. *Mrigal*; H. *Nalm*; O. *Mirgah*; Tel. *Yerra mosu.*

488. Mullet: **Mugil cear**
B. *Ain*; Kan. *Mala*; Mal. *Elameen*; O. *Khoiriga*; Tam. *Madaval*; Tel. *Kathi peraga.*

489. Mushi.

490. Mussel, fresh water

491. Muti

492. Oil sardine: **Sardinella longiceps**
Mal. *Nallamathi*; Mar. *Torli*; Tam. *Paichalai*; Tel. *Noonekavallu.*

493. Pabda: **Callichorus pabo**
B. *Pabda.*

494. Paksi

495. Palmplate
B. *Palmplate*

496. Pangas: **Pangasius pangasius**
B. *Pangas*; H. *Pangsa*; O. *Jellum*; Tam. *Kovalloola-keluthi*; Tel. *Choluva jella.*

497. Parsey: **Mugil parsia**
498. B. *Parsey*; Mal. *Malan*; Tam. *Chirayakandai.*

499. Pata machh.

500. Poliana.

501. Pomfret, black: **Formio niger**
Kan. *Chandraiya*; Mal. *Karuppu avoli*; Mar. *Halva*; O. *Bahal*; Tam. *Karuppuvawal*; Tel. *Nalla sandewah.*

502. Pomfret, white: **Stromateus sinensis**
B. *Chanda*; Kan. *Thondrotte*; Mal. *Vella awoli*; Mar. *Chandava*; O. *Bahal*; Tam. *Mogang vavval*; Tel. *Chanduva.*

503. Prawn: **Penaeus sp.**
B. *Chingri*; Kan. *Segedi*; Mal. *Chemmeen*; Tam. *Yera*; Tel. *Royya.*

504. Puti: **Barbus sp.**

505. Rangoli.

506. Ravas: **Polynemus tetradactylus**
B. *Gurjowli*; Kan. *Vahmeenu*; Mal. *Bahmeen*; Mar. *Ravas*; Tam. *Puzhakkala*; Tel. *Budathamaga*; Other name: *Guchhal.*

507. Ray: **Rhinoptera sewelli**
Mal. *Nelthirandi.*

508. Ribbon fish: **Trichiurus sp.**
509. B. *Rupa patia*; Kan. *Pambole*; Mal. *Vellithalayan*; Mar. *Pithurti*; O. *Puttiah*; Tam. *Savalai*; Tel. *Savala.*

510. Rohu: **Labeo rohita**
B. *Ruee*, H., O. *Rohu*; Mar.*Tambada-massa.*

511. Royna

512. Rupapatar

513. Sakchi: Dasyatis sp.

514. Sardine: **Sardinella fimbriata**
B. *Khaira*; Kan. *Pedi*; Mal. *Chala-mathi*; Mar.*Pedwa*; Tam. *Seedai*; Tel. *Kavallu.*

515. Sarputi: **Barbus sarana**
B. *Sarputi*; H. *Giddi-kaoli*; Kan. *Gid pakka*; Mal. *Pullan*; O. *Sarana*; Tam. *Kendai-meen*; Tel. *Paraga.*

516. Shankachur.

517. Shark: **Carcharias sp.**
B. *Hangoor*; Tam. *Soorah*; Tel. *Sora chapa.*

518. Shengti.

519. Shrimp

520. Seer: **Cybium guttatum**
B. *Bijram*; Kan. *Khulkul*; Mar.*Towar*; Tam., Tel. *Vanjram*; Other name: *Ayakora.*

521. **Silver belly: Lelognathus insidiator**
Mal. *Chakra mullan.*

522. Singhala: **Arius dussumieri.**
Kan. *Mongam shede*; Mal. *Valia atta*; Mar.*Singhala*; Tam. *Mandai valoi*; Tel. *Jadi-jella.*

523. Singhi: **Saccobranchus fossilis**
B., H., O. *Singhi*; Kan. *Chelu meenu*; Mal. *Kahree mee* Mar.*Bitchuka machi*; Tam. *Thelimeen thayi-lee*; Tel. *Mapu jella.*

525. Sode: **Ophiocephalus striatus**
B. *Shol*; H. *Morrul*; Kan. *Poolikuchi*; Mal. *Kannan*; Mar.*Sohr*; O. *Sola*; Tam. *Virahl*; Tel. *Korrameenu.*

526. Sole (Malabar): **Cynoglossus semi-fasciatus**
B. *Kukurjibli*; Kan. *Nangu*; Mal. *Manthal*; Mar.*Rhepti*; Tam. *Aral*; Tel. *Jerripothu.*

527. Surmai: **Cybium commersoni**

528. B. *Champa*; Kan *Arkalai*; Mal. *Chum bum*, Mar. *Tuvar anjari*; Tam. *Mah-wu-laachi*, Tel. *Koneme.*

529. Talpatra

530. Tapra

531. Tapsi: **Polynemus paradiseus**
B. *Tapsi*; Other name: Mango fish.

532. Tartoor: **Opisthopterus tardoore**
Mal. *Ambatta*; Tel. *Tartoor.*

533. Tendli

534.

535. Tengra: **Mystus vittatus**

536. B. *Tengra*; Mal. *Kalian-Cooree*; O. *Kuntiah*; Tam. *Auppan keluthi*; Tel. *Yerra jellu.*

537. Tunny: **Thynnus macropterus**

538. Vajra

539. White bait: **Anchovielia sp.**

OTHER FLESH FOODS

340. Beef: **Bos taurus**

541. B. *Go-mangso*; G. *Go-mas*; H. *Gai-ka-goshi*; Kan. *Danda mamsa*; Mal., Tel. *Go-mamsam*; Mar.*Go-mans*; O. *Go-mansa*; Tam. *Mattu eraichi.*

542. Boordood:
Other name: Winged white ants.

543. Buffalo meat: **Bulbus bubalis**
H. *Bhains-ka-ghoshi*; Mal. *Pothiraichi*; Tam. *Erumai iraichi*; Tel. *Barre mamsam.*

544. Dhauns: **Rana tigrina**
Other name: Indian bull frog.

545. Duck: **Anas platyrhyncha**
B. *Hans*; H. *Bathak*; Mar.*Tharavu*; Mar.*Badak*; Tam. *Vathu*; Tel. *Bathu.*

546. Egg, duck
B. *Hansher dim*; G. *Batak nu indu*; H. *Bathak-ka-anda*; Kan. *Bathu motte*; Kash. *Batakh thul*; Mal. *Tharavu mutta*; Mar.*Badak ande*; O. *Bataka dimba*; P. *Bathak da-anda*; Tam. *Vathu muttai*; Tel. *Bathu guddu.*

547. Egg, hen:
B. *Dim (murgi)*; G. *Murgi nu indu*; H. *Murgi-ka-anda*; Kan. *Koli motte*, Kash. *Kokar thul*; Mal., Tam. *Kozhi mutta*; Mar.*Kombdi ande*, O. *Kukkuda dimba*; P. *Kukdi da anda*; Tel. *Kodi guddu.*

548. Egg, turtle:
B. *Jagol dim*; H. *Katchua ka anda*; Mal. *Ama mutta.*

549. Field rat's meat:
H. *Harna chuka-ka-gost.*

550. Finch: **Fringillidae**
H. *Bageri.*

551. Fowl: **Gallus bankiva murghi**
B. *Murgi*; H., P. *Murga*; Kash. *Kuakur*; Mal., Tam. *Kozhi*; Mar. *Kombdi*; Tel. *Kodi*; Other name: Chicken.

552. Goat meat: **Capra hyrchusb**
B. *Pantar mangso*; H. *Khasi-ka-ghoshi*; Mal., Tam. *Attiraichi*; P. *Bakri da mas*; Tel. *Meka mamsamu.*

553. Grey quail: **Coturnic coturnix**
H. *Batair.*

554. Liver, goat: **Capra hyrchusb**
B. *Pantar mettle*; H. *Khasi ka jigar*; Mal., Tam. *Attu eeral*; P. *Bakri da kaley*, Tel. *Meka kariamu.*

555. Liver, sheep:
B. *Mete (vera)*; G. *Kaleju*; H. *Kaleji (bher)*; Kash. *Kre'hnu maaz*; Mal., Tam. *Semmari attin eeral*; Mar.*Kaleej*; O. *Mendha kalija*. P. *Bhed-di-kaleji*; Tel. *Gorre karjamu.*

556. Mutton
B. *Vera mangso*; G. *Ghetanu gos*; H. *Bakri ka gosht*; Kan. *Mamsa*; Kash. *Maaz*; Mal., Tam. *Attiraichi*; Mar. *Mans, sheli*; O. *Manai sa, chheli*; P. *Mas*; Tel. *Mamsamu.*

557. Meat of narrow snouted crocodile: **Gavialis gangeticus**, Gmelin
H. *Gharial-ka-gosht.*

558. Pigeon: **Columba livia intermedia**
B. *Pyara*; H., P., Mar. *Kabutar*; Kash. *Katar maaz*; Mal. *Pravu*; Tam. *Pura*; Tel. *Pavuramu.*

559. Pork : **Sus cristatus Wagner**
B. *Sukar mangso* ; G. *Suvarnu mas* ; H. *Suar ka gosht* ; Kan. *Handi mamsa* : Mal, Tam. *Panni iraichi* ; Mar. *Mans (dukar)* ; O. *Ghusuri mansa* ; P. *Soor da mas* ; Tel. *Pandi mamsamu.*

560. Red ants (with eggs) : **Aecophylla smaragdina Fab.**
H. *Hau or mata.*

561. Ruff and Reeve : **Philomachus pugnax Linn**
H. *Chaha (bara).*

562. Snail, small : **Viviparus bengalensis f. typica (Lamarck)**
B. *Samuk* ; H. *Changhi* ; Mal. *Ochu (Cherutharam)* ; Mar. *Soap.*

563. Snail, big : **Pila globosa**
B. *Samuk* ; H. *Ghongha* ; Mal. *Ochu (Valiatharam).*

564. Turtle's meat
B. *Jagol mangse* ; H. *Kachua-ka gosht* ; Mal, Tam. *Amai iraichi.*

565. Venison : **Antilope cervicapra Linn**
H. *Haran-ka-gosht* ; Mal, Tam. *Man iraichi* ; Tel. *Ledi mamsamu.*

566. Wood sand piper : **Tringa galareola**
H. *Chahee.*

MILK AND MILK PRODUCTS

567. Milk, buffalo's
B. *Doodh (mosher)* ; G. *Bhesnu doodh* ; H. *Bhains ka doodh* ; Kan. *Yemme halu* ; Kash. *Maa'shi duad* ; Mal, Tam. *Erumai pal* ; Mar. *Doodh (maaish)* ; O. *Mainsi dudha* ; P. *Mahin-da-doodh* ; Tel. *Barre palu.*

568. Milk, cow's
B. *Doodh (garu)* ; G. *Gaynu doodh* ; H. *Gai-ka-doodh* ; Kan. *Hasuvina halu* ; Kash. *Gaav duad* ; Mal, Tam. *Pasum pal* ; Mar. *Doodh (gay)* ; O. *Gai dudha* ; P. *Gau-da-doodh* ; Tel. *Avu palu.*

569. Milk, goat's
B. *Doodh (Chagal)* ; G. *Bakrinu doodh* ; H. *Bakri-ka-doodh* ; Kan. *Adina halu* ; Kash. *Tshaavgi chir* ; Mal, Tam. *Attu pal* ; Mar. *Doodh (sheli)* ; P. *Bakri-ka-doodh* ; Tel. *Meka palu.*

570. Milk, human
B. *Doodh (Manush)* ; G. *Strinu doodh* ; H. *Aurat ka doodh* ; Kan. *Yede halu* ; Mal. *Mula pal* ; Mar. *Doodh (Stri)* ; O. *Maa dudha* ; P. *Janani-da-doodh* ; Tam. *Thai pal* ; Tel. *Chanu palu.*

571. Milk ass's :
H. *Gadhe ka doodh* ; Mal, Tam. *Kazhutha pal* ; P. *Khothi-da-doodh* ; Tel. *Gadida palu.*

572. Curds :
B. *Doyi* ; G., H., Mar., O., P. *Dahi* ; Kan. *Mosaru* ; Kash. *Zaamut duad* ; Mal., Tam. *Thayir* ; Tel. *Perugu* ; Other names : Yoghourt, Sour cream.

573. Butter milk
B. *Ghol* ; G. *Chhas* ; H., P. *Lassi* ; Kan. *Majjige* ; Kash. *Chuaku duad* ; Mal, Tam. *Moru* ; Mar. *Tak* ; O. *Ghola dahi* ; Tel. *Majjiga.*

574, Channa
575. B. *Chana.*

576. Cheese
B., G., H., P. *Paneer* ; Kan. *Ginnu* ; Kash. *Tsaama* ; Mal, Tam. *Pal katti* ; O. *Chhena* ; Tel. *Junnu.*

577. Kheer
B., H., P. *Kheer.*

578- Khoa
580. B., H., Kan., Mal., P., Tel. *Khoa* ; O. *Kua* ; Tam. *Thirattu pal.*

581, Skimmed milk
582. B. *Makhantana dooda* ; Kash. *Gurus* ; Mal. *Padakalanya pal* ; O. *Sarakadha dudha* ; Tam. *Kadaintha pal* ; Tel. *Venna theesina palu.*

583. Whole milk powder
B. *Goora doodh* ; Mal., Tam. *Pa : thool* ; O. *Dudha gunda* ; Tel. *Pala podi.*

FATS AND EDIBLE OILS

584. Butter
B., H., P. *Makhan* ; Kan. *Benne* ; Kash. *Thany* ; Mal., Tel. *Venna* ; Mar. *Loni* ; Tam. *Vennai.*

585, Ghee
586. B., H., P. *Ghee* ; Kan. *Thuppa* ; Mal., Tam. *Ney* ; Mar. *Thup* ; Tel. *Neyyi.*

587. Hydrogenated oil
B. *Banaspati* ; Other names : Vanaspati, Vegetable ghee.

588. Vegetable cooking oil
B., H., Mar., Tel., Kan., Mal., *Enne* ; Tam. *Ennai* ; Tel. *Noone.*

MISCELLANEOUS FOODS

589. Adda : **Bauhinia vahlii**
Tel. *Adda* ; Other name : *Lama-ke-biya-ka-gudda.*

590. Amaranth seeds : **Amaranthus sp.**
Mal. *Cheera vithu* ; Tam. *Keerai vidai* ; Tel. *Thotakoora ginjalu.*

591. Areca nut : **Areca catechu**
B., H., Mal., P. *Supari* ; G. *Sopari* ; Kan. *Adike* ; Mal. *Adakka* ; O. *Gua* ; Tam. *Pakku* ; Tel. *Vakka* ; *Other name : Betel nut.*

592. Arrowroot flour : **Maranta arundinacea**
B. *Tavkeel* ; Mal. *Koova podi* ; Mar. *Toukil* ; O., P. *Araroot* ; Tam. *Kuva mavu* ; Tel. *Pala gunda.*

593. Avocado pear nut : **Persea drymifolia**

594. Bajjar bhang

595. Barai dal

596. Betel leaves : **Piper betle**
B. *Pan* ; G. *Nagarvelna pan* ; H. *Pan-ka-pata* ; Kan. *Vilaid yele* ; Mal., Tam. *Vettilai* ; O. *Pana* ; P. *Pan da patta* ; Tel. *Thamalapaku.*

597. Bhangari

598. Bhangri-ka-atta

599. Bhilisa of Elo

600. Bhoose-ka-atta

601. Bhorra chattoo

602. Bid root : **Scirpus grossus**
B., H. *Kasuru* ;

603, Biscuit
604.

605, Bread

606. B, H. *Roti*; *Other name : Double roti.*

607. **Cane sugar : Saccharum officinarum**
B, H, P. *Chini*; Kan. *Sakkare*; Kash. *Madrar*; Mal. *Panchasara*; Tam. *Sarkarai*; Tel. *Pancha dara* ; *Other name : Sakkar.*

608. Cholai

609. Chookri-ka-atta

610. Chookri-ka-patta

611. Chota karhani chatto
Other name : *Langra chattoo.*

612. Chukary

613. Coconut, tender : **Cocos nucifera**
B, *Dab*; Kan. *Yelnee*; Mal. *Karikku*; Mar. *Shahale*; O. *Paida*; Tam. *Elani*; Tel. *Letha kobbari.*

614. Coconut milk : **Cocos nucifera**
B. *Narikel doodh*; H. *Nariyal-ka-doodh*; Kan. *Kobbare halu*; Mal., Tam. *Thenga pal*; P. *Gola-da-doodh*; Tel. *Kobbari palu.*

615. Coconut water : **Cocos nucifera**
B. *Daber jal*; G. *Pani nariyal*; H. *Nariyal-ka-pani*; Kan. *Thenga neeru*; Mal. *Thenga vellam*; Mar. *Naral pani*; O. *Paida pani*; P. *Gola da pani*; Tam. *Ilanir*; Tel. *Kobbari neeru.*

616. Coconut meal, deoiled : **Cocos nucifera**
Mal., Tam. *Thenga punnakku*; Tel. *Kobbari pindi.*

617. Cowage seed flour : **Mucuna capitata**
H. *Kabach sattoo.*

618. Daincha seeds

619. Dingli chhattoo : **Collybica sp.**
Other name : *Baskhukhri chattoo.*

620. Elo

621. Fish liver oil
B. *Matsha tel*; G. *Machhiline tel*; H. *Machli-ka-tel*; Kan. *Meen yenne*; Mal. *Meen enna*; O. *Machha tela*; Tam. *Meen ennai*; Tel. *Chapa noone.*

622. Groundnut cake : **Arachis hypogaea**
B. *Badamer khol*; H. *Chinia badam-ka-khali*; Mal., Tam. *Kadalai punnakku*; Mar. *Pend*; Tel. *Verusanaga pindi.*

623. Honey
B. *Mou*; H. *Shaid*; Kan. *Ten thuppa*; Kash. *Maanch*; Mal., Tam. *Then*; Mar. *Madh*; Tel. *Thene.*

624. Jack fruit seeds : **Artocarpus heterophyllus**

625, Jaggery
629. B., H., P. *Gud*; G. *Gol*; Kan. *Bella*; Kash. *Gor*; Mal., Tam. *Vellam*; Mar. *Gul*; O. *Guda*; Tel. *Bellum.*

630. Kalipakku
B. *Khoir*; Mal. *Kali adakka*; O. *Kanchagua sijha*; Tam. *Kalipakku.*

631. Kirul flour : **Caryota urens**
G. *Shiva jata*; H. *Mari*; Kan. *Bagani*; Mal. *Kudappan mavu*; Mar. *Berli*; Tam. *Coondapanai*; Tel. *Jilugu chettu*; *Other name : Talipot flour.*

632. Laintra

633, Lotus seeds : **Nelumbium nelumbo**
634. Mal. *Thamara vithu*; Tel. *Thamara ginjalu.*

635. Madapu ginja
O. *Ganjei.*

636. Mahua flowers : **Bassia latifolia**
Tam. *Iluppai poo*; Tel. *Ippa puvvulu.*

637. Makhana : **Eurvale ferox**
G, H. *Makhana.*

638. Malted palmyra root
Mal., Tam. *Panam kizhangu*; O. *Tala kanda*; Tel. *Thegalu.*

639. Mango seed kernel : **Mangifera indica**
H. *Am-ka-guthli-ka atta*; Mal. *Manga andi parippu*; P. *Am-di guttak*; Tel. *Mamidi jeedi.*

640. Mango powder : **Mangifera indica**
H. *Am choor.*

641. Marking nut : **Semecarpus anacardium**
Tel. *Nalla jeedi ginjalu*; *Other name : Velwa-ka-topi.*

642. Mushroom
H. *Tila chhattoo*; Mal. *Koon*; Tam. *Kalan*; Tel. *Kukka godugu.*

643. Neera

644. Pachwai (Assam)

645. Papad
B., H. *Papar*; G., Mar., P. *Papad*; Kan. *Happala*; Mal., Tam. *Pappadam*; O. *Pappada*; Tel. *Appadam.*

646. Perandai : **Vitis quadrangularis**
B. *Hor*; H. *Hadjora*; Kan. *Perundai*; Mal., Tam. *Perandai*; O. *Siju*; Tel. *Nalleru.*

647. Phutka chattoo (Rugroo) : **Lycoperdon sp.**
Other name : Puff ball mushroom.

648. Poppy seeds : **Papaver somniferum**
B. *Posto*; H. *Post dana*; Mar. *Khaskhas*; Tam. *Khasakhasa*; Tel. *Gasagasalu.*

649. Pumpkin seeds : **Cucurbita maxima**
B. *Kumdar dana*; Mal. *Mathan vithugal*; P. *Sitaphal-di-bee*; Tel. *Gummadi ginjalu.*

650. Rajakeera seeds : **Amaranthus paniculatus**

651. Red palm oil : **Elaies guineensis**

652. Roselle seeds

653. Sal-ka phal : **Shorea robusta**

654. **Sago**
B. *Saboo*; G., Mar. *Sabu dana*; H., Mal. *Sago*; Kan. *Sabba akki*; Kash. *Saboo dana*; O. *Sagu dana*; Tam. *Javvarisi*; Tel. *Saggu biyyam.*

655- Sea weeds
656. Mal. *Kadal chandi*; Tam. *Kadal pasi*

657. Sugar cane juice
B. *Ikkhu raush*; G. *Sherdina ras*; H. *Ganne-ka-ras*; Kan. *Kabbina halu*; Mal. *Karumbin neeru*; Mar. *Usacha rasa*; O. *Akhju doruo*; P. *Ganne-da-ras*; Tam. *Karuppan charu*; Tel. *Cheraku rasam.*

658. Tamarind seed kernel : **Tamarindus indicus**
H. *Imli-ka-biya-ka-gudda*; Mal. *Pulin kuru*; Tam. *Puliyam kottai*; Tel. *Chinta ginjalu.*

659. Toddy

660. B. *Tari*; H. *Tarail*; Kan. *Henda*, Mal., Tam., Tel. *Kallu*; Mar., O. *Tadi*.

661. Water lily seeds : **Nymphaea nouchali**

662. Water melon seeds : **Citrullus vulgaris**

663. Yeast

664. G., Mar. *Khamir*; Tam. *Ithadi*.

Source : Nutritive Value of Indian Foods by C. Gopalan, B. V. Rama Sastri and S. C. Balasubramanian, NIN, ICMR (1985)

APPENDIX 4
RECOMMENDED DIETARY INTAKES FOR INDIANS

Group	Particulars	Body wt kg	Net energy Kcal	Protein g	Fat g	Calcium mg	Iron mg	Vit A. Retinol µg/d	Vit A. B-carotene µg/d	Thiamine mg	Riboflavin mg	Niacin mg	Ascorbic acid mg	Folic acid µg	Vit. B-12 µg
Man	Sedentary work	60	2425	60	20	400	28	600	2400	1.2	1.4	16	40	100	1
	Moderate work		2875							1.4	1.6	18			
	Heavy work		3800							1.6	1.9	21			
Woman	Sedentary work	50	1875	50	20	400	30	600	2400	0.9	1.1	12	40	100	1
	Moderate work		2225							1.1	1.3	14			
	Heavy work		2925							1.2	1.5	16			
	Pregnant woman	50	+300	+15	30	1000	38	600	2400	+0.2	+0.2	+2	40	400	1
	Lactation 0–6 months	50	+550	+25	45	1000	30	950	3800	+0.3	+0.3	+4			
	6–12 months		+400	+18						+0.2	+0.2	+3	80	150	1.5
Infants	0–6 months	5.4	108/kg	2.05/kg		500		350	1200	55µg/kg	65µg/kg	710µg/kg	25	25	0.2
	6–12 months	8.6	98/kg	1.65/kg						50µg/kg	60µg/kg	650µg/kg			
Children	1–3 years	12.2	1240	22	25	400	12	400	1600	0.6	0.7	8	40	30	0.2-1
	4–6 years	10.0	1690	30			18	400		0.9	1.0	11		40	
	7–9 years	26.9	1950	41			26	600	2400	1.0	1.2	13		60	
Boys	10–12 years	35.4	2190	54	22	600	34	600	2400	1.1	1.3	15	40	70	0.2–1.0
Girls	10–12 years	31.5	1970	57			19			1.0	1.2	13			
Boys	13–15 years	47.8	2450	70			41			1.2	1.5	16			
Girls	13–15 years	46.7	2060	65	22	600	28	600	2400	1.0	1.2	14	40	100	0.2-1.0
Boys	16–18 years	57.1	2640	78			50			1.3	1.6	17			
Girls	16–18 years	49.9	2060	63	22	500	30	600	2400	1.0	1.2	14	40	100	0.2-1.0

Source : Nutrient R

NOTES