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# UNIT 1 NUTRITION AND DIETETICS – PRINCIPLES AND DEFINITIONS

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## 1.0 OBJECTIVES

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After studying this unit, you should be able to:

- define nutrient, nutrition and dietetics;
- describe the interrelationship between food, nutrition and health; and
- identify diet as a form of therapy in the treatment of disease.

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## 1.1 INTRODUCTION

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As students of nursing and as health care practitioners you already know the essentials of nutrition. We would like to build on this foundation in order to give you more indepth knowledge that you will find useful in clinical settings and in your interactions with patients.

This unit focuses on this basic principles. It explores several interesting facets about the role of food in health and disease. Food is important as a soure of certain substances which are essential for our body. These substances, as you may know, are called nutrients. What are the functions of these nutrients? How does the body utilize them? This unit will give you a bird's eye view of these aspects as well as the clinical interrelationship between food and health. We hope it will convince you of the crucial importance of good food in promoting health.

You will also be introduced to the role of food and specific nutrients as a form of therapy. In other words, the treatment of certain diseases require the use of food and nutrients. This is an issue that you are often directly connected with when you give a patient vitamine pills or dispense intravenous glucose solution. Would'nt you like to know more about these aspects? This unit will introduce you to some underlying principles so that you can better appreciate the details that follow.

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## 1.2 FOOD AS A SOURCE OF NUTRIENTS

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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.

Why is food so important? Why is it that we cannot survive without food? The answer is that food contains substances which perform crucial functions in our body. These essential substances contributed by food are called nutrients. Now let us begin an interesting voyage into the world of food and nutrients. We will first look at nutrient categories.

### 1.2.1 Nutrient Categories

The nutrients that we need can be classified into six major categories (see Fig. 1.1):

- 1) Carbohydrates
- 2) Fats
- 3) Proteins
- 4) Vitamins
- 5) Minerals, and
- 6) Water

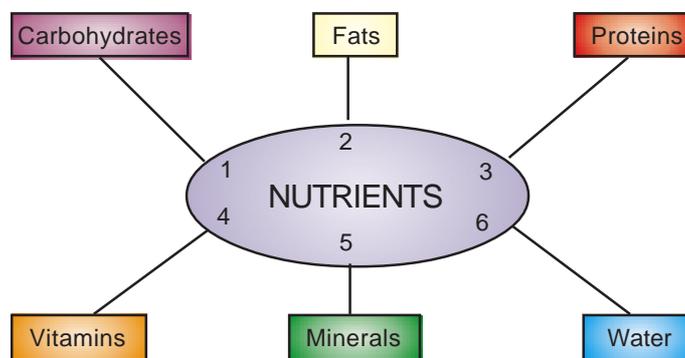


Fig. 1.1: Nutrient Categories

The nutrients included in each of these categories share a common general function. In addition each nutrient has one or more functions as well. We will talk about these functions in detail in the next section.

Let us now discuss the contributions of a variety of food items to our nutrient intake. You should look at the following table to familiarise yourself with the constituents of each nutrient.

Table 1.1: Examples of Nutrient Categories

Nutrient Categories	Examples
Carbohydrates	Glucose, galactose, fructose, sucrose, dextrans, starches
Fats	Triglycerides, fatty acids, cholesterol
Proteins	Casein (Milk protein), albumins (egg, gluten (wheat)
Vitamins	Water-soluble : Vitamin C or ascorbic acid, B <sub>1</sub> or B <sub>2</sub> or riboflavin, B <sub>12</sub> , niacin, folic acid, B <sub>6</sub> Fat soluble : Vitamin A (B Carotene, Retinol) Vitamin D (Calciferol), Vitamin E (Tocopherol), Vitamin K
Minerals	Sodium, Potassium, chloride, magnesium, iodine, calcium, phosphorus, iron
Water	Soft water, rain water
Fibres such as	Cellulose, hemicellulose, pectin, lignin are not <b>nutrients</b> but needed as roughage and consumed with nutrients

As we mentioned earlier, water is considered a nutrient. We must emphasize that we have included just a few examples here. There are several others. You would have encountered some of these nutrients in your study of metabolic processes in Block 1. You were also introduced to the chemical structure, nature and properties of these substances. Can you now recall these aspects? A quick look through the block would help you to refresh your memory. The nutrients we have mentioned may be further classified into two categories — **Macronutrients and Micronutrients** (Fig. 1.2).

**Macronutrients** are those which the body requires in relatively large amounts. Carbohydrates, fats and proteins are examples of macronutrients. We indicate the requirement of these nutrients in grams.

**Micronutrients**, on the other hand, are required in much smaller quantities by the body. Vitamins and minerals are examples of micronutrients. The requirement of some vitamins is measured in milligrams and micrograms.

One milligram is 1/1000 of a gram

One microgram is 1/10,00000 of a gram

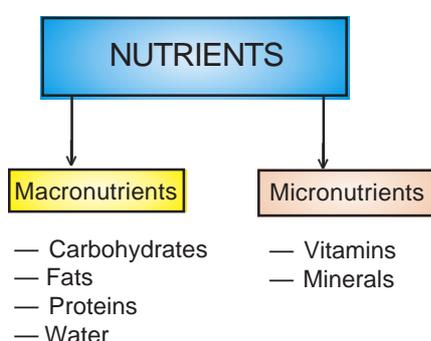


Fig. 1.2: Classification of Nutrients

## 1.2.2 Nutrient Contributions of Foods

Look at Table 1.2. You may be familiar with some of this information. It will however be useful to you as a ready reference.

Table 1.2: Nutrient Contribution of Foods

Food Group	Major Nutrient(s) Supplied	Nutrients Supplied
<b>Energy Sources</b> a) Cereals e.g. rice, wheat maize, bajra, ragi, jowar	Carbohydrate	Besides energy gives substantial amount of proteins due to large intakes. However, the protein provided is not a good quality protein but if combined with pulses the protein quality improves B vitamins e.g. niacin, thiamine Minerals e.g. iron (bajra), calcium (ragi)
b) Root vegetables and tubers e.g. tapioca, potato, sweet potato, yam, colocasia	Carbohydrate	Carotene (yellow yam) Vitamin C (potato, sweet potato, tapioca)
c) Sugar and jaggery	Carbohydrate (sugar is almost 100% carbohydrate)	Iron in jaggery
d) Fats and oils e.g. ghee, vanaspati, butter, vegetable oils (mustard, soyabean, groundnut etc.)	Fat	Retinol (Vitamin A) (butter, vanaspati) Vitamin D (butter, vanaspati)

Food Group	Major Nutrient(s) Supplied	Nutrients Supplied
<b>Protein Sources</b>		
e) Milk and milk products e.g. milk, curd, paneer & processed cheese & khoya	Proteins	Carbohydrate, fat, calcium, riboflavin
f) Pulses	Protein	Carbohydrate B Vitamins (thiamine, niacin) Vitamin C (in sprouted pulses)
g) Flesh foods e.g. fish, poultry, meat	Protein	B Vitamins Retinol (liver) Calcium
h) Eggs	Protein	Retinol (Vitamin A), Fat, Iron.
i) Nuts and Oilseeds e.g. groundnuts, almonds, cashewnuts, til and mustard seeds	Protein and fat	B complex vitamins, calcium and other minerals
<b>Vitamin and Mineral Sources</b>		
j) Green leafy vegetables e.g. spinach, amaranth, fenugreek, mustard and drumstick leaves	Carotene	Iron Calcium B Vitamins Vitamin C Fibre
k) Other vegetables e.g. brinjal, ladies finger, french beans		Supply some amount of vitamins, minerals and fibre
l) Fruits	Specific fruits are major sources of the following  Vitamin C (guava, amla citrus fruits)  Carotene (mango, apricot, orange, papaya)  Iron (dried fruits such as dates and raisins)	
m) Condiments and spices		Carotene (coriander leaves) Vitamin C (green chillies)

**Check Your Progress 1**

1) Identify the food categories which supply mainly:

a) Carbohydrate

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b) Fat

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c) Protein

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2) What are the two different types of vitamins ? Give two examples of each type.

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## 1.3 NUTRIENTS AND THEIR FUNCTIONS

We mentioned in the earlier section that each nutrient category is associated with a specific function. Broadly speaking there are three types of functions performed by nutrients. These are:

- Supplying energy
- Building body tissues
- Protecting the body from infection and regulating body processes

Which nutrients are associated with these functions? You might be able to answer this question on the basis of what you learnt in Block 1. Now let us try to match nutrients with their major functions.

Nutrients	Major functions
Carbohydrates	Supply Energy
Fats	Supply Energy
Proteins	Build new tissues and repair worn out tissues
Vitamins and Minerals	Protect the body from infection and regulate body processes

It is important to emphasize that the functions mentioned here are major functions. Each nutrient category is also associated with other functions. For example, the major role of proteins in our body is to build new tissues i.e. to promote growth. When we grow, new cells are added and existing cells increase in size. This process cannot take place without proteins. Similarly when tissues get worn out they cannot be replaced without proteins. However, proteins also have other functions such as protecting the body from infection and regulating body processes.

The following discussion indicates some specific functions of nutrients as well as other interesting details.

### Carbohydrates

Food contains three distinct types of **carbohydrates**— **sugars, starches and fibre**. Sugars and starches can be digested in the body and the end products of their digestion are absorbed by it. They can therefore be utilised and in this sense are “available” to the body. This is why they are called available carbohydrates. The chief function of available carbohydrate is to furnish energy for performing work and sustaining body processes. One gram of carbohydrate is to furnish energy for performing work and sustaining body processes. One gram of carbohydrate provides about 4 kilocalories (4 Kcal). Energy is measured in kilocalories. One kilocalorie is the amount of heat required to raise the temperature of one kilogram of water by one degree centigrade.

Carbohydrates have a protein-sparing action. If the diet contains sufficient carbohydrates, proteins will be spared for their body-building action. Otherwise, they will be broken down to release energy.

Carbohydrate is also essential for proper breakdown of fat, i.e. fat catabolism. In the absence of enough carbohydrate, excessive fat breakdown takes place resulting in accumulation of by-products of fat metabolism. These by-products are toxic.

On the other hand, insoluble fibre cannot be digested and is therefore “not available”. Cellulose and other complex carbohydrate molecules are forms of fibre. However, this does not mean that fibre serves no useful purpose. Fibre swells in the intestine by absorbing water. This helps the easy passage of stools and therefore prevents constipation. You may already be aware of this function. In fact recent research suggests that specific forms of fibre help in controlling blood, sugar and cholesterol levels. We also now know that lack of fibre

probably causes several diseases like diabetes mellitus, cardiovascular and obesity. You can turn to Section 1.3 for more information on this aspect.

### Fats

Fats provide more than double the energy supplied by carbohydrates, 9 Kcal per gram. This makes them concentrated sources of energy. Foods rich in fat provide satiety and are more palatable. Fat which is not used by the body is stored by a specific tissue called adipose tissue.

Adipose tissue is present under the skin and around vital organs such as the kidney and heart. The fat layers under the skin prevent excessive heat loss and keep the body warm.

On the other hand, the padding around the vital organs protects them from damage and injury.

One of the major functions of the fats aside from these is their role as sources of essential fatty acids. Fatty acids, as you know, are composed of a chain of carbon atoms with other elements such as hydrogen and oxygen. You have been introduced to the properties of fatty acids in Block 1. Fatty acids are of two types : saturated and unsaturated. The saturated fatty acids we mentioned earlier have to be provided by the diet. They cannot be synthesized by the body. This fact is the reason why they are called “essential”. The essential fatty acids called linoleic and linolenic acids are unsaturated in nature. Depending on the position of double bonds in their molecules, fatty acids can be classified as n-3 and n-6 fatty acids. Linoleic acid is an n-6 fatty acid whereas linolenic acid is an n-3 fatty acid.

Fats are also important as a vehicle for carrying fat-soluble vitamins and also aid in their absorption.

### Protein

Do you recall the fact that proteins are built of amino acids?

Some of the amino acids that constitute proteins cannot be synthesised by the body. These are also called **essential amino acids**. Here is a list of essential amino acids:

- Isoleucine
- Leucine
- Lysine
- Methionine
- Phenylalanine
- Theronine
- Tryptophan
- Valine
- Histidine (for infants only)

There is another group of amino acids which can be synthesised by the body. These are called **non-essential amino acids**. Actually the word is a bit of a misnomer. May be these amino acids are so important for the body that nothing is left to chance. Some examples of non-essential amino acids: alanine, aspartic acid, cystine, cysteine, glutamic acid, glutamine, glycine, hydroxyproline, hydroxylysine, proline, serine and tyrosine.

Proteins, as we mentioned earlier, have the chief function of sustaining growth and repair of body tissues. They are, however, remarkably versatile and the body uses them in several ways. As **digestive enzymes**, they help in the process of digestion. As **metabolic enzymes**, they regulate chemical reactions in the body. Further some of the **hormones** produced by the body are proteins. Proteins also play a protective role. **Antibodies** - a crucial link in our immune system - are proteins. In addition to all these functions, proteins serve as carriers in transporting certain substances from one part of the body to another usually through **blood**.

**BELIEVE IT OR NOT!**

**Proteins — The Wonder Substances!**

Proteins are large, complex chains of amino acids in our body.

Did you know that?

- Proteins are important constituents of enzymes
- Proteins are important in hormone synthesis
- Proteins transport many substances in the blood.
- Proteins are a vital element for the immune system in our body.

In the absence of the chief energy-givers (carbohydrates and fats) in the diet, proteins are forced to supply energy. In such circumstances the body breaks down proteins to yield 4 Kcal per gram of protein.

**Vitamins**

Unlike carbohydrates, fats and proteins, vitamins and minerals are required by the body in much smaller amounts. This is why vitamins and minerals are called micronutrients. In contrast, carbohydrates, fats and proteins are called macronutrients as we already mentioned earlier as they are needed in larger quantities.

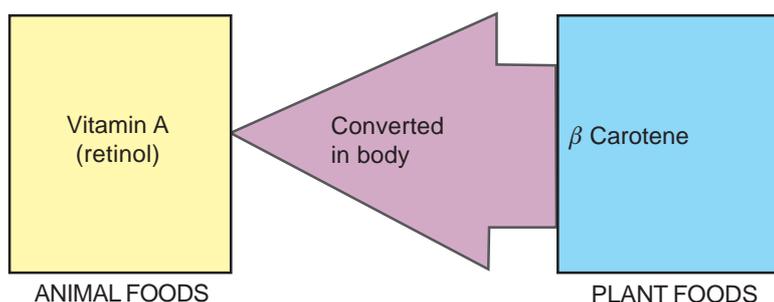
As you know vitamins belong to one of two categories. They are either fat-soluble or water-soluble.

The water soluble B-complex vitamins play a crucial role in the metabolism of carbohydrates, fats and proteins. Vitamins such as thiamin, riboflavin, niacin and folic acid are referred as coenzymes. These coenzymes act together with enzymes in helping metabolic reactions to proceed faster and more efficiently. Do you remember some of these coenzymes? They play a vital role in glycolysis and the TCA(tricarboxylic acid or citric acid cycle) as you discovered in Block 1. Folic acid and vitamin B<sub>12</sub> are indispensable in the formation of normal red blood cells in the bone marrow. The proper functioning of the digestive tract and nervous system also requires sufficient intake of vitamin B<sub>12</sub> and B<sub>6</sub>.

Vitamin C is another water-soluble vitamin. Its major functions include its role in collagen formation. Collagen is a protein and it forms a part of connective tissues. Proper synthesis of collagen helps wound healing. In addition to these, vitamin C helps in absorption of iron. Vitamin C is also believed to play a role in helping a person to deal with stressful situations. Ascorbic acid or in other words, vitamin C aids the release of the two stress hormones—epinephrine and norepinephrine. Do you know where they are synthesized? The adrenal glands, of course. These hormones, as you know, help the body to cope with stress.

This vitamin is a reducing agent. You may know that several substances in the body such as unsaturated fatty acids are destroyed by the process of oxidation. This process is halted or slowed down by vitamin C.

Now let us turn our attention to the fat-soluble vitamins. The body needs four distinct fat-soluble vitamins. These are Vitamin A, D, E and Vitamin K. Vitamin A as such is also called retinol. The suffix “ol” indicates that it is an alcohol. Retinol (Vitamin A) is found in animal foods and is not found in plant foods. Plants, however, do contain a fat-soluble carotenoid orange-yellow-green coloured pigment, called beta carotene ( $\beta$ -carotene). The interesting fact about the pigment is that the body can convert it into vitamin A or retinol (Fig. 1.3). Of course  $\beta$ -carotene is not the only carotene present in food. Other carotenes are also present which can be converted to vitamin A in the body but to a lesser extent.



**Fig. 1.3: Conversion of  $\beta$ -carotene to retinol**

**Why is Vitamin A** so important? This vitamin is essential for (i) maintenance of epithelial tissues in a healthy state, (ii) vision in dim light and (iii) growth of skeletal and soft tissues.

Vitamin D, on the other hand, has an amazing story. It is the only vitamin that can be synthesized in the body. To do this the body must be exposed to sunlight. The functions of vitamin D are chiefly related to effective utilization of the two minerals-calcium and phosphorus. Vitamin D aids in the absorption of both calcium and phosphorus. It is also essential for the deposition of calcium and phosphorus in bones. You may already be aware of the fact that the bones owe their strength and rigidity to the calcium and phosphorus compounds in their structure.

The function of Vitamin E is protective in nature. It is believed to help in maintaining the integrity of cell membranes by protecting them from oxidative and other degenerative processes. The vitamins help to protect unsaturated fatty acids, vitamin A and C from destruction. We mentioned earlier that vitamin C also has a protective effect. Now we know that Vitamin E helps to protect Vitamin C itself from destruction!

Let us now take a quick look at the functions of vitamin K. This vitamin is essential for synthesis of prothrombin. You may be aware that prothrombin is a protein which helps to clot blood. In other words, vitamin K is indispensable in the blood clotting process.

Table 1.3 summarises the functions of several minerals.

**Table 1.3: Functions of Minerals**

Minerals	Functions
Calcium	<ul style="list-style-type: none"> <li>● Development of bones and teeth in association with phosphorus.</li> <li>● Regulation of contraction and relaxation of muscles e.g. heart muscle.</li> <li>● Regulation of passage of substances across cell membranes</li> <li>● Facilitation of nerve impulses from one nerve cell or neuron to another.</li> <li>● Clotting of blood.</li> </ul>
Phosphorus	<ul style="list-style-type: none"> <li>● Development of bones and teeth (in association with calcium)</li> <li>● Also aids:                             <ul style="list-style-type: none"> <li>— Formation of phospholipids</li> <li>— Synthesis of certain coenzymes which play a crucial role in metabolism.</li> <li>— Formation of basic genetic material such as DNA and RNA.</li> <li>— Formation of ATP - the high energy currency of the body (ATP is the form in which the body stores energy)</li> </ul> </li> </ul>
Iron	<ul style="list-style-type: none"> <li>● Oxygen transport through the action of haemoglobin, an iron-containing compound.</li> <li>● Fuelling muscle contraction through the action of myoglobin which stores oxygen for the immediate needs of muscle cells.</li> <li>● Completing the oxidation of carbohydrates, fats and proteins in the electron transport chain resulting in synthesis of ATP. The electron transport chain operates inside the cell.</li> <li>● Maintenance of higher order brain functions including learning.</li> <li>● Metabolic reactions of various types as a part of enzymes or other substances Maintaining the functions of the body's immune system.</li> </ul>
Iodine	<ul style="list-style-type: none"> <li>● Synthesis of the hormone thyroxine secreted by the thyroid gland. Iodine, in fact, forms part of this hormone which plays an important role in the regulation of oxidation in cells.</li> </ul>
Sodium	<ul style="list-style-type: none"> <li>● Regulation of balance between extracellular and intracellular fluids.</li> <li>● Regulation of pH of body fluids</li> <li>● Facilitation of passage of nerve impulses from neuron to neuron</li> <li>● Regulation of muscle contraction</li> <li>● Regulation of movement of substances across cell membranes.</li> </ul>

Minerals	Functions
Potassium	<ul style="list-style-type: none"> <li>● Regulation of balance of intracellular and extracellular fluid</li> <li>● Regulation of pH of body fluids</li> <li>● Role in muscle contraction</li> <li>● Role in transmission of nerve impulses.</li> </ul>
Chloride	<ul style="list-style-type: none"> <li>● Regulation of pH of body fluids in association with sodium and potassium.</li> </ul>
Magnesium	<ul style="list-style-type: none"> <li>● Regulation of transport of substances across cell membranes.</li> <li>● Maintenance of enzyme activity as a coenzyme.</li> <li>● Role in bone mineralization (deposition of minerals in bones).</li> <li>● Maintenance of transmission of nerve impulses.</li> <li>● Synthesis of protein</li> <li>● Facilitation of smooth muscle action.</li> </ul>

### Minerals

We have already mentioned some of the minerals required by the body. Unlike vitamins which are compounds of a widely varying chemical nature, minerals are elements.

Some of the minerals such as iron and iodine mentioned in the table are required only in traces. This is why these minerals are also called **trace elements**. Zinc and copper are also considered members of this group.

### Check Your Progress 2

1) List the major functions of the nutrients indicated in the following chart.

Nutrients	Functions
Vitamin A	
Vitamin C	
Folic Acid and Vitamin B <sub>12</sub>	
Niacin	

2) Sarla is a college going adolescent girl who has recently started following a diet based on cereals and milk with minimal amounts of pulses, fruits and vegetables which she does not like.

a) Identify the nutrients which would be lacking in her diet.

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b) What points would you tell her to convince her to change to a more healthy eating pattern?

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## 1.4 DEFINING NUTRITION AND DIETETICS

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**Nutrition** is a scientific discipline with food as the major focus of interest. The discipline can be described thus:

- The processes by which organisms ingest, digest, absorb, transport and utilize nutrients and dispose of their end products;
- The science of food, the nutrients and other substances therein; their action, interaction and balance in relationship to health and disease;
- Social, economic, cultural and psychological implications of food and eating.

We must emphasise that these four aspects are integral to a definition of nutrition. The description of the discipline we have given here clearly illustrates its multidisciplinary nature. It draws from other disciplines such as chemistry, physiology, biochemistry, sociology, economics and psychology.

As students of nursing you may have come to recognize nutrition as a discipline intimately related with medicine. You may perhaps have become familiar with its relationship with physiology and biochemistry. But we must remember that nutritionists, like doctors, frequently interact with people and hence must realize the “**people-centred**” or “**community-centred**” approach to their work.

Let us now attempt to define dietetics. **Dietetics** is a study of using the principles of nutrition in planning suitable diets in health and disease. In other words, diet therapy and its application is in normal and **patient-related settings**. It is important to emphasise that dietetics cannot be studied without good knowledge of the basic principles and concepts of nutrition.

A few examples will help to make these distinctions clear.

**Example A:** Ramesh is 25 years old and works as an executive in a marketing firm. He has been advised to take antibiotics for an infection. Ramesh has been prescribed B-complex tablets.

**Example B:** Dental caries is common in school-going children. Ramani is showing signs of tooth decay and has been told to stop eating sweets and sticky foods and start brushing her teeth regularly. She was also told to eat more fruit and vegetables which would require more chewing.

**Example C:** Mr. Choudhary has diabetes. He has been prescribed oral sugar lowering (hypoglycemic) drugs. In addition he has been told to follow a diet prescription restricting use of refined carbohydrates (e.g., maida, sugar, jaggery) saturated fats (e.g. butter, ghee, vanaspati) and encouraging use of fibre-rich foods such as whole cereals, pulses and selected fruits and vegetables.

You would have noticed that the advice given to Ramesh and Ramani requires knowledge of some basic facts in nutrition which find applications in planning normal diets. Antibiotics kill beneficial bacteria in the intestine which synthesize valuable vitamins. Hence B-complex-tablets are recommended to make up for this deficit till the intestinal bacteria have a chance to grow again. Similarly Ramani has been advised dietary change in order to prevent a disease i.e. dental caries or cavities. Example C highlights a completely different case. Mr. Chaudhary is taking drugs to treat his diabetic condition. However, he has also been prescribed a diet. In other words, the diet is an integral part of therapy for diabetes. A diet cannot be planned for Mr. Chaudhary without understanding the influence of diabetes on body metabolism and utilization of food. His condition is also assessed in addition to listing other diseases he may suffer from or be predisposed to.

### Check Your Progress 3

Read the following section carefully and then answer the questions that follow.

Food, as you know, contains nutrients as well as substances which are non-nutrients. The body needs such nutrients in specific amounts. Some are needed in relatively larger amounts (the macronutrients) and some in small 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. To return to the earlier example, bones and teeth also contain the 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 require an interaction between these two nutrients. This is an example of a positive interaction. Nutrients can act against each other (as the following discussion points out) when the amounts of each are not appropriate in the diet.

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 and 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 amounts and proportions. This will, of course, ensure good health.

- 1) Which aspect of the definition of nutrition is the section highlighting?  
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- 2) In your own words give a general description of the following terms in the context of nutrients.
  - i) Action and interaction  
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  - ii) Balance  
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## 1.5 THE ROLE OF FOOD IN HEALTH AND DISEASE

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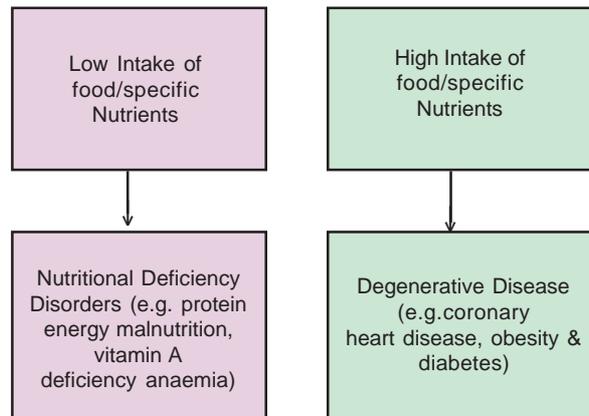
The definition of nutrition and dietetics and the examples we gave to illustrate them brought out the great importance of food in:

- Promoting health and preventing disease, and
- Treating and controlling disease conditions.

Let us consider each aspect one by one. Food for promoting health will be discussed in Unit 2.

### 1.5.1 Food in the Prevention of Disease

If a person eats the right kinds 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 (Fig. 1.4). These are both facets of malnutrition.



**Fig. 1.4: Effects of low and high intake of nutrients**

If we elaborate the same example further we would realize that mild forms of a nutrient deficiency would be treated and controlled by eating foods rich in that particular nutrient. In addition, tablets or capsules or syrups which contain the nutrient in concentrated form may be required especially in cases where the condition is moderate to severe.

These facets lead us to the realization that nutrients must be supplied to the body in the right amounts and proportions for a person to remain healthy. If the diet lacks or is deficient in a particular nutrient, the body will also become deficient in that nutrient. When this deficiency is prolonged or sufficiently severe, the person starts showing signs of a nutritional deficiency disorder.

Table 1.4 indicates how food can be used to prevent nutrient deficiencies.

**Table 1.4: Prevention of Nutrient Deficiencies**

Nutrient Lacking in the Diet	Foods to Include
1) Energy	Carbohydrates and fat-rich foods <b>Carbohydrate-rich foods</b> Cereals, roots and tubers, fruits such as banana, sapota, mango. Sugars are the most concentrated forms <b>Fat-rich foods</b> Nuts, oilseeds, fish and meat containing high amounts of fat; vegetable oil, ghee, vanaspati, butter are the most concentrated sources, whole milk and milk products and khoya.
2) Protein	Pulses, milk and milk products, eggs, meat, fish, nuts and oilseeds.
3) Vitamin A	<ul style="list-style-type: none"> <li>● <b>Retinol</b> Liver, egg yolk, Cream, butter, Ghee, whole milk, fish, liver, oils</li> <li>● <b>Beta Carotene</b> Yellow/orange and green vegetables and yellow fruits</li> </ul>
4) Vitamin D	<ul style="list-style-type: none"> <li>● Action of sunlight on skin Animal foods like eggs, butter, fish, liver oil</li> </ul>
5) Vitamin E	<ul style="list-style-type: none"> <li>● Vegetable oils, whole grain cereals, deep green leafy vegetables, pulses, nuts and oilseeds</li> </ul>
6) Vitamin K	<ul style="list-style-type: none"> <li>● Dark green leafy vegetables, egg yolk, liver</li> </ul>
7) Vitamin B <sub>1</sub> (Thiamine)	<ul style="list-style-type: none"> <li>● Whole grain cereals, pulses, nuts, egg yolk, liver, brewer’s yeast</li> </ul>
8) Vitamin B <sub>2</sub> (Riboflavin)	<ul style="list-style-type: none"> <li>● Green leafy vegetables, milk, eggs, organ meats like liver, kidney</li> </ul>
9) Niacin (Tryptophan precursor)	<ul style="list-style-type: none"> <li>● Cereals, pulses, milk, nuts and oilseeds, organ meats, fish</li> </ul>
10) Folic acid	<ul style="list-style-type: none"> <li>● Whole grain cereals, leafy vegetables, milk and eggs, organ meats like liver and kidney</li> </ul>

Nutrient Lacking in the Diet	Foods to Include
11) Vitamin B <sub>12</sub>	● Animal foods like eggs, organ meats
12) Vitamin C	● Citrus fruits, amla, guava, capsicum, green leafy vegetables, green chillies
13) Calcium	● Milk and milk products, some fish and sea foods, ragi, pulses, gingelly seeds, green leafy vegetables.
14) Phosphorus	● Eggs, milk and cheese, poultry, fish, cereals, nuts
15) Iron	● Liver, kidney, spleen, whole cereals, pulses, green leafy vegetables.
16) Iodine	● Sea foods, crops grown on soil rich in iodine. Iodized salt.
17) Sodium	● Table salt in adequate quantities, milk, egg white, meat, poultry, fish, green leafy vegetables, pulses, processed foods, pickle
18) Potassium	● Fruits, vegetables, meat, poultry, fish, pulses, whole grain cereals, oranges, bananas.
19) Chloride	● Table salt
20) Magnesium	● Nuts, oilseeds, pulses, whole grains, seafoods, dark green leafy vegetables, fish, meat.

This fairly long chart is, in fact, a ready reference for you and will help you to remember the sources of several nutrients. Though we have used the chart to illustrate the foods that can correct the lack of specific nutrients in the diet, remember that these foods also become important in controlling and tackling nutritional deficiency disorders.

In addition to the nutrients we have already mentioned, fibre also has a valuable role to play in the prevention of diseases such as constipation and cancer of the colon. Fibre is a general term for substances which cannot be digested by the body and hence are not available. We have talked about some types of fibre which are complex carbohydrate, e.g. cellulose. However, there are non-carbohydrate forms of fibre as well.

Research over the past decade has indicated the beneficial role of fibre in the prevention of disease and promotion of health. A summary of information is given below.

### Fibre in Health and Disease

Dietary fibre is now believed to play a vital role in preventing disease and promoting health. But what is fibre? You may be aware that the term 'fibre' refers to all those substances which cannot be digested by the digestive enzymes in the human body. Fibre includes polysaccharides such as cellulose, and is exclusively obtained from plants. It usually consists of the material forming the walls of the plant cell somewhat like a supportive skeleton. Some of the other polysaccharides classed as fibre include pectin, gums and mucilages. The latter are found in certain plant seeds and prevent the seed from drying out i.e. prevent dehydration. Certain complex carbohydrates (e.g. starch in fruits and vegetables, whole cereals and pulses) and fibre containing foods are helpful in controlling blood sugar levels in diabetic patients. These are **insoluble fibres**. On the other hand, gaur, gum, pectin and lignin present in fruits have a cholesterol lowering action and hence may be of benefit in treatment of hyperlipidaemia (excess levels of lipids or fats in blood). Those are **soluble fibre**.

Research has indicated that:

- Fibre rich foods protect the body from alimentary tract diseases such as diverticulosis, hiatus hernia, gall bladder disease, polyps and colon cancer
- Fibre prevents cardiovascular conditions such as ischemic heart disease, ocular disease, hemorrhoids etc.
- Fibre prevents metabolic conditions like obesity and diabetes.

\*However, there is also evidence to suggest that very high fibre intakes can be harmful. Under such conditions minerals such as calcium, zinc and magnesium are not available to the body. They appear to get bound to the fibre in the form of a complex.

**Check Your Progress 4**

Explain the role of food in preventing disease.

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**1.5.2 Food as Therapy**

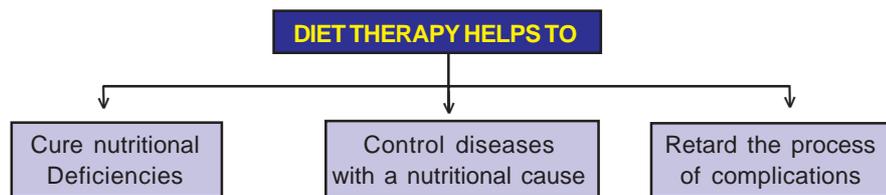
Food as well as nutrients in medicinal form (oils, syrups, capsules, tablets) are used in the treatment of diseases as we mentioned earlier.

It is useful to note that diseases can be of three types:

- 1) Diseases or disorders caused by nutrient deficiency.
- 2) Diseases which have several causes some of which are food and nutrient-related.
- 3) Diseases which have no direct food or nutrient-related cause.

Giving foods and nutrients in concentrated form is effective therapy for those diseases we have mentioned in the first type. Food and diet plays an important role in the case of these disorders.

Diseases in the second type include diabetes and coronary heart disease (CHD). Consumption of excessive amounts of sugar and refined carbohydrates can precipitate diabetes in individuals who are already genetically predisposed. Similarly, consumption of diets containing excessive amounts of fats (particularly) saturated fats and cholesterol) is believed to be a cause of deposition of fat in the blood vessels (arteries) leading to narrowing of the vessels also called atherosclerosis an important cause of cardiovascular and heart disease. In the case of these diseases diet cannot cure the disease. It can only help to check the progress of the disease process and also prevent complications. Diet therapy, therefore, helps patients to lead a full life. Without it, the disease can become uncontrollable, irrespective of whether the patient is also prescribed drugs or not. In fact mild cases can be controlled by diet alone (Fig. 1.5).



**Fig. 1.5: Diet therapy**

Infectious diseases are good examples of the third category. Some of these may be transmitted through food. However, food is not the direct cause. Treatment of these diseases usually do include a greater or lesser degree of diet therapy. For example, a febrile infectious disease (disease associated with fever, as you know) would require giving the patient additional energy and protein-rich foods in a suitable form. This would depend on whether the fever is chronic as in the case of tuberculosis or acute as in typhoids. You will study more details about these conditions later in this block (Units 3 and 4). Here, we will only emphasize that a suitable diet is very important in helping the person to recover from infectious diseases.

Some interesting findings about the history of diet therapy is given below.

### Can Food Cure Disease?

From ancient times we, in India, have endowed food with magical qualities. In the Vedic times, food was associated with divine attributes. This tradition was prevalent in other societies as well - ancient Egypt for example. Let's illustrate this point.

Inability to see in dim light is an early symptom of vitamin A deficiency. This is also called night blindness and was a well recognised disease in ancient Egypt. The cure suggested was to apply topically to the eyes juice squeezed from cooked liver! The ancient Greeks recommended that the patient eat cooked liver in addition to applying cooked liver oil or juice to the eye.

This is a good example of how man discovered the healing powers of food perhaps initially by accident. Later these patterns became well established and were described in medical texts. The astonishing fact is their proven value in treating disorders primarily caused by lack of food and nutrients.

Another dramatic episode in man's search for a cure is the story of scurvy. Scurvy is caused by vitamin C deficiency. It was found that fresh herbs, lemons, oranges and other citrus fruits were very effective in preventing and controlling scurvy.

These episodes in the history of man's battle against disease, clearly illustrate the fact that food can cure certain types of diseases. It is quite evident, however, that the diseases which can be cured by food or nutrient concentrates are caused by deficiency of particular nutrients. The disorders are cured by giving rich sources of these foods which otherwise are lacking in the diet.

This does not tell us, however, that food and the nutrients it contains can cure all diseases. There is no doubt that food can help to control several ailments.

Diabetes is a common example. Mild cases of diabetes seen in middle aged persons can usually be controlled by suitable modification of the diet itself. This can also minimise the complications of diabetes.

Phenylketonuria (PKU) is a genetic disease caused by inability of the body to utilize the amino acid phenylalanine. As you are aware, amino acids are the building blocks of proteins. Young children with PKU have to be given a diet which is almost free of phenylalanine. Otherwise they become mentally retarded. This shows us that PKU cannot be cured but dietary measures can keep it in check.

There are several other diseases which cannot be cured by food. Diseases caused by bacteria and viruses are obviously treated with antibiotics or sulpha preparations. Even in such cases good food is essential to prevent the patient from becoming weak. It also promotes quick recovery.

You will come across several other examples in this block to illustrate the role of food in the treatment of disease. Look out for them and make a checklist for yourself!

### Check Your Progress 5

- 1) You are invited to talk to a group of mothers. Which points would you emphasize in order to convince them of the importance of using the diet as a form of therapy in the treatment of disorders caused by nutritional deficiencies?

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- 2) "A proper diet can cure some diseases but not all. It is, however, important in all cases in helping the patient to maintain his or her lifestyle."

The above statement tries to summarize the role of the diet in the treatment and control of disease. Can you rewrite it to make the meaning more clear? You can write it in 3-4 sentences.

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Let us now discuss the definition, objectives and need of Community Nutrition programme in brief.

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## 1.6 COMMUNITY NUTRITION

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Community Nutrition assesses the nutrition needs of populations and develops health promotion strategies and nutrition education programmes. The role of the community nutrition, as a discipline, is to determine the nutrition needs of specific target populations. In this, special attention is given to the factors that influence eating behaviour and the processes available for planning, delivering and evaluating community nutrition services.

In simple terms, community nutrition is the study of:

- assessing food and nutrition situation in terms of estimating the number of individuals in a population who are either suffering from inadequate nutrition in term of type and degree,
- identifying the reasons for any malnutrition, which may be discovered, and which individuals in a community are most vulnerable to its effects, and
- determining the corrective and preventive measures and implementing suitable action plans.

The objectives of community nutrition include to:

- understand the present and future **scope and role of nutrition** within the community and public health systems.
- gain an understanding of the **significance of the community-based planning and evaluation processes** in the development of effective nutrition programming.
- understand the **meaning and determinants of food choice behaviours** and strategies used to help people modify their behaviours to improve nutritional health.
- promote **awareness of social determinants of health**.
- provide an understanding of the role of nutrition in **maintaining the health status of the body**.
- provide an **understanding of the problems associated with nutritional deficiencies**.
- foster an **appreciation of the role of nutrition education in maintaining the health status** of the community.
- enable the **designing, implementation and evaluation of community health nutrition programmes**.
- **identify the most common nutritional problems** of pregnant women, infants, children, adults, the elderly and the hungry.
- apply principles of community assessment and nutrition education to **plan the assessment, implementation, monitoring, and evaluation of a targeted community nutrition intervention**.
- describe trends of the health care policy and administration, as related to nutrition needs and services in the community.
- apply basic theories of nutrition behaviour change.
- develop a nutrition education intervention that will include goals, objectives, learning activities, nutrition messages and evaluation for a target population.
- critique nutrition education materials.

Community nutrition focuses on eating behaviours and how these behaviours influence health status, morbidity and mortality. It also involves community programmes and individual guidance on how to make healthy food choices. Community nutrition programmes

have in common nutrition or nutrition-related objectives, be it the broad objectives of reducing the prevalence of malnutrition or improving household food security, or more specific objectives related to a single micronutrient or a single nutrition activity such as the promotion of breastfeeding.

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## 1.7 LET US SUM UP

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The main points we covered in this unit are explaining the definition of Nutrition and Dietetics. **Nutrition** is defined as 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 social, economic, cultural and psychological implications of food and eating are also important.

**Dietetics** is defined as study of diet therapy deals with how to plan diets for individuals who are normal or who suffer from disease conditions. Dietetics is an application of basic principles and concepts which form a part of the study of nutrition. Further the role of food and nutrients in health and disease is also emphasised.

Food and the nutrients have a very important role in promoting health and preventing disease, treating and controlling disease conditions. The unit also gave information about specific sources and functions of several nutrients.

As nursing students you would have found that this unit offered a basic rationale for using food as a means of preventing as well treating and controlling disease. It also highlights information on diet in normal conditions. The principle to be followed is inclusion of

- Foods supplying energy
- Foods which are body-building and
- Foods which are protective/regulatory in the diet. The next unit will give more details on how to use these foods to plan balanced diets for normal people.

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## 1.8 KEY WORDS

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<b>Atherosclerosis</b>	:	The process whereby fatty substances accumulate on the walls of arteries. Gradually this narrows the lumen of the artery till it gets completely blocked.
<b>Cholesterol</b>	:	A particular type of lipid/fatty substance which is essential for the body. Eating too much cholesterol predisposes to atherosclerosis and CHD.
<b>Coenzyme</b>	:	A compound or element that is essential for the action of an enzyme.
<b>Enzyme</b>	:	A protein regulating a chemical reaction
<b>Facilitate</b>	:	Help or aid; to make it easier for a process or event to take place.
<b>Metabolic process</b>	:	A process whereby complex substances are broken down into simpler ones (catabolism) or simpler substances join to form complex substances (anabolism).
<b>Reducing agent</b>	:	A substance that removes oxygen or adds hydrogen to another compound or element.
<b>Saturated fatty acid</b>	:	A fatty acid with no double bonds in its structure. All valencies of carbon are filled by hydrogen atoms
<b>Unsaturated fatty acid</b>	:	A fatty acid with one or more double bonds in its structure; that is all valencies of carbon are not filled.

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## 1.9 ANSWERS TO CHECK YOUR PROGRESS

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### Check Your Progress 1

- 1)
  - a) **Carbohydrate:** Cereals, roots and tubers, sugar, jaggery.
  - b) **Fat:** Fats oils (vegetable oils, ghee, butter), nuts and oilseeds.
  - c) **Protein:** Milk, eggs, poultry, meat, fish, pulses, nuts and oilseeds.
- 2)
  - a) Water-soluble vitamins e.g. vitamin C, folic acid or any other B complex vitamin
  - b) Fat-soluble vitamins e.g. vitamin A, D, E or K.

### Check Your Progress 2

- 1) **Vitamin A:** Maintenance of epithelial tissues in a healthy state, vision in dim light, growth of skeletal and soft tissues.

**Vitamin C:** Role in collagen formation (facilitates wound healing), promotes release of stress hormones — epinephrine and norepinephrine, protects substances such as unsaturated fatty acids from being destroyed by oxidation.

**Folic Acid and Vitamin B:** The role common to both is formation of red blood cells in the bone marrow.

**Niacin:** Part of coenzymes which act together with enzymes to ensure normal metabolic reactions in the body.

- 2)
  - a) Sarla's diet is likely to be deficient in iron, vitamin C. If Sarla does not drink milk in large amounts the diet will also not supply B complex vitamins and minerals such as calcium in adequate amounts. Even protein would not be supplied in adequate quantities.
  - b) It is necessary to convince Sarla to change her meal pattern including pulses, fruits and vegetables. You could tell her that these foods, supply valuable amounts of protein (pulses) and vitamins and minerals (fruits and vegetables, pulses also contribute). It is quite possible that this information would not be enough. You must emphasize the fact that these nutrients are indispensable and perform vital functions such as aiding in maintenance of body tissues i.e. body - building. These nutrients protect the body against disease and regulate the body processes.

### Check Your Progress 3

- 1) Nutrients, Action, Interaction and Balance
- 2)
  - a) Nutrients have specific functions in the body. Each nutrient usually has a major function and several others. The word 'action' is used to refer to the way in which nutrients 'act' in the body. It is also a fact that nutrients interact with each other. Two nutrients might act better together. On the other hand, nutrients can also act against each other particularly when the diet does not supply them in appropriate amounts.
  - b) An ideal balance of nutrients is necessary for proper functioning of the body. The diet must supply nutrients in adequate amounts. However, a certain proportion has also to be maintained. If one nutrient is present in excess it can interfere with proper utilization of one or more other nutrients. This itself can endanger health.

### Check Your Progress 4

Food prevents disease by providing essential nutrients. If these nutrients are not supplied in adequate amounts, the body begins to suffer from deficiency.

Eating nourishing food therefore prevents nutritional deficiency disorders. It is also a fact that eating such food reduces the risk of suffering from infection and other acute as well as chronic ailments.

**Check Your Progress 5**

- 1)
  - a) Food contains nutrients which are essential for health.
  - b) These nutrients perform vital functions in the body.
  - c) Deficiency/or excess of nutrients in the diet can lead to nutritional diseases.
  - d) An adequate diet and sometimes additional supplements of nutrients in the diet is the only way to treat these diseases.
  
- 2) A proper diet can cure diseases caused by the deficiency of nutrients. However, if the cause of a disease is not directly due to a nutrient deficiency, the role of the diet may be to prevent further complications or to aid in the process of recovery. Treatment by drugs along with a nourishing diet can be a common form of treatment of some diseases.