

Food and Nutrition

Why do we have food? We have food because we feel hungry. Isn't it? Being hungry is the body's way of saying that it needs more fuel to keep going. The food we eat provides energy for all body functions and is also used to form new cells for the body. We eat a variety of food according to our taste, body requirement and availability. Some of us may prefer to eat rice to bread or chapattis. Others may like to have dosas, idlis, burgers, noodles, etc. We may be a vegetarian or a non-vegetarian. All living beings, both plants and animals need food for growth, repair and maintenance.

OBJECTIVES

After completing this lesson, you will be able to:

- describe various modes of nutrition in organisms;
- define the term photosynthesis, and list its raw materials and products;
- explain the importance of photosynthesis as a source of food for all life on earth;
- list and describe the factors affecting photosynthesis;
- list the components of a balanced diet and state the functions of each of them;
- draw the parts of the alimentary canal and describe the functions of each;
- describe some nutritional disorders, their causes and prevention;
- define food adulteration, and list some common food adulterants.

25.1 FOOD

Food provides the essential raw material our body needs to grow and stay healthy.

25.1.1 The need for Food

How do you feel if you do not have food for a day or two? You may feel exhausted and weak. Think of a young child who is deprived of food for a few days. Will the child survive and grow? The answer is 'No'. All living beings need food to survive. Food serves the following purposes:

- provides energy for various metabolic activities (bio-chemical reactions taking place in the body), such as respiration and digestion.
 - helps in growth of the body and repair of worn-out tissues.
 - protects us from deficiency diseases.
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25.1.2 Nutrition

Your food may include a number of items, if it meets your entire body's requirement and is utilized by the body, it is called nutrition (nutrine : to nourish).

The process by which, organisms obtain and utilise food for their growth and development (from their environment) is called nutrition.

25.1.3 Types of nutrition

Depending upon the mode of food uptake, nutrition could be of two broad types – autotrophic nutrition and heterotrophic nutrition.

a) Autotrophic nutrition (autos: self; trophos: food)

You must have noticed a gardener watering the plants or occasionally providing them with fertilizers. Are water and fertilizers food for them? Is it all that all plants need?

Green plants synthesize their food from water and carbon dioxide, in the presence of sunlight. This process is called photosynthesis. The green plants and certain bacteria which can manufacture their own food within themselves, are called autotrophs, and their mode of nutrition is called autotrophic nutrition (Fig. 25.1).

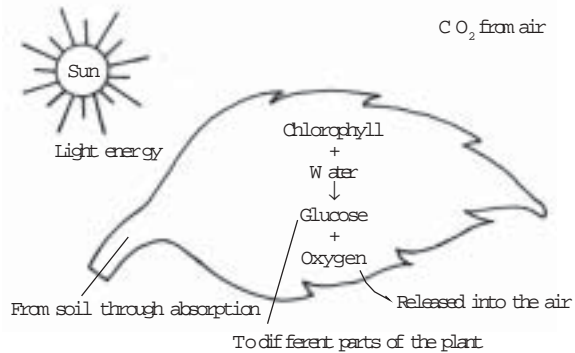


Fig. 25.1 Green plants synthesise their own food

b) Heterotrophic nutrition (heteros: different; trophos: food)

We cannot make food inside our own body. All animals including man and non-green plants cannot make their food and depend on green plants. The organisms, which depend on other organisms for their food, are called heterotrophs and their mode of nutrition is called heterotrophic nutrition.

On the basis of their feeding habits heterotrophs may be classified as – saprotrophs and parasites.

i) Saprotrophic nutrition: You must have seen a white cottony growth developing on your wet leather shoes or belts especially when they get wet during rainy days. This is a fungal growth. The fungus grows and feeds on substances, which were once part of the living organisms, such as stored food, wood, leather and rotten plant products. Some common examples are bacteria, mushrooms, yeast, bread mould, etc. Organisms that derive their food from dead and rotten organisms are called saprotrophs (Fig. 25.2). Saprotrophs help in cleaning the environment by decomposing the dead and recycling the nutrients.

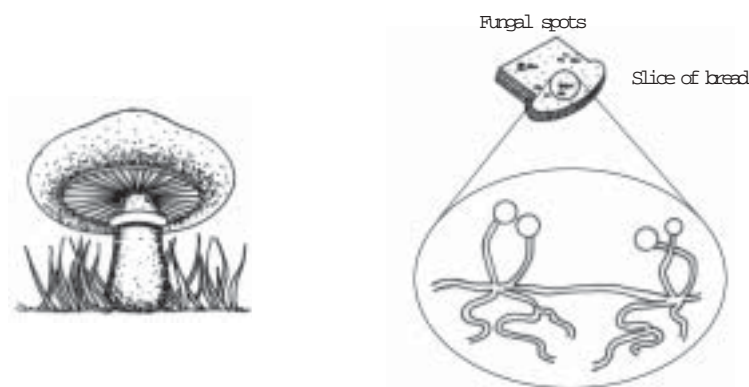


Fig. 25.2 Some saprotrophs

- ii) **Parasitic nutrition:** Have you ever been bitten by a head louse or a bed bug? Have you heard of some children having worms inside their body? These organisms that live on or inside other living organisms, to derive their food are called **parasites**. Such a mode of nutrition is known as **parasitic nutrition**. Bed bug, head louse and leech remain outside the body. Some bacteria, and worms, such as tapeworm and roundworm, live inside the body (Fig. 25.3). Dodder plant (Amar bel) is a parasite on green plants.

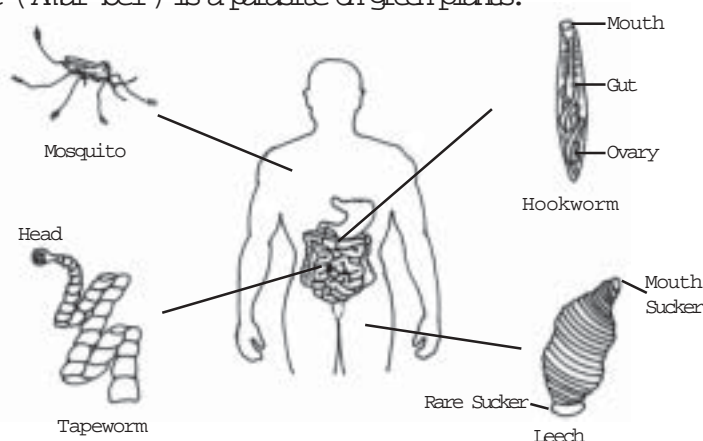


Fig. 25.3 Some parasites on human body

CHECK YOUR PROGRESS 25.1

1. Which are the two major groups of organisms on the basis of nutrition?
2. Give two examples of saprotrophs.
3. Which group of organisms is capable of preparing its own food as well as nourishing others?
4. Differentiate between parasitic and saprotrophic mode of nutrition.
5. Classify the following as saprotrophs or parasites:
leech, yeast, head louse, mushroom
6. Name one parasitic plant.

25.2 NUTRITION IN PLANTS

You must have seen animals, such as cows, horses, sheep, etc grazing in the fields for food. How do plants get their food? You have already studied that autotrophs,

such as green plants, can synthesize their own food. Green plants utilize energy from sunlight to prepare food. The food that humans and animals eat, consists of plant products, or products of animals that eat plants.

The process by which green plants manufacture food from carbon dioxide and water in the presence of sunlight is called photosynthesis (photos : light; synthesis : to combine).

25.2.1 Where does photosynthesis occur?

It occurs in the cells of green leaves and other green parts of the plant that are exposed to light. These cells possess tiny structures called chloroplasts. These structures remain packed with chlorophyll, a green pigment, about which you have already studied in lesson 24. Plants require energy for photosynthesis. Let us see how plants harvest (gather) this energy for the process of making food.

25.2.2 How does photosynthesis occur?

In this process, plants use carbon dioxide and water as raw materials to build energy containing chemical compounds. Glucose is one such compound. Such compounds are needed by all living beings for energy production.

The process of photosynthesis is completed in two steps – light reaction and dark reaction.

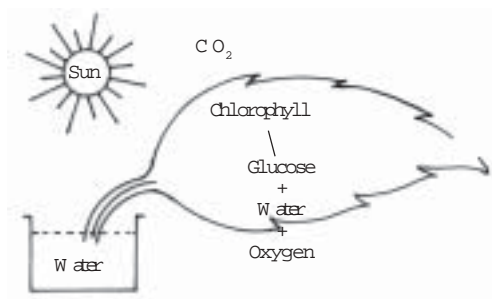


Fig. 25.4 The process of photosynthesis in a leaf

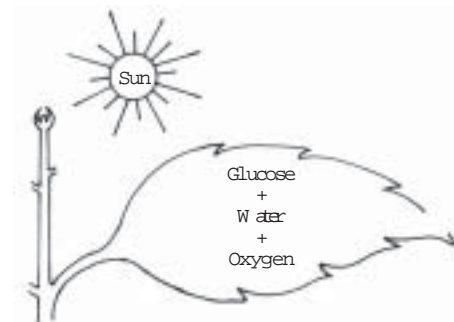


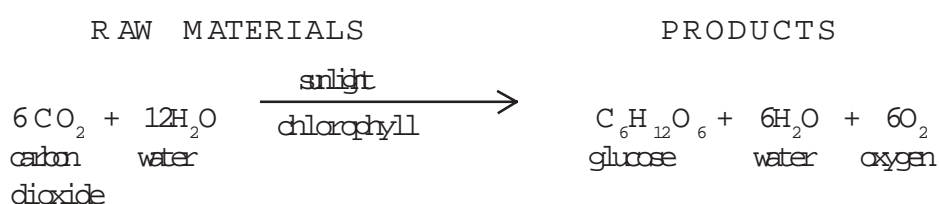
Fig. 25.5 The products of photosynthesis

- i) Light reaction: The first step of photosynthesis occurs in the presence of light. During this step, chlorophyll contained in the chloroplast of plant cells absorbs light energy. This energy is converted into another form, which can be supplied for the completion of the dark reaction.
 - ii) Dark reaction: This second step of photosynthesis does not require light, and is called dark reaction. It can also carry on in the presence of light. During this step, energy generated during light reaction is used to combine carbon dioxide and water molecules to form energy rich compounds, such as glucose. Oxygen is also released in this process.
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Green plants – The green lungs

Green plants constantly absorb carbon dioxide from the environment and return enough oxygen into it. Is it not worth appreciating that we do not have to buy oxygen filled cylinders for our survival! Oxygen is naturally added to the environment by the plants. They are sometimes called the green lungs as they help in keeping the environment clean by maintaining low levels of carbon dioxide.

The following equation summarizes the raw materials and products of photosynthetic process:



(Water and carbon dioxide are used in equal proportions in the synthesis of organic compounds.)

25.2.3 Factors that influence photosynthesis

The rate of photosynthesis is influenced by external and internal factors.

a) External factors

These include light, carbon dioxide, water and temperature.

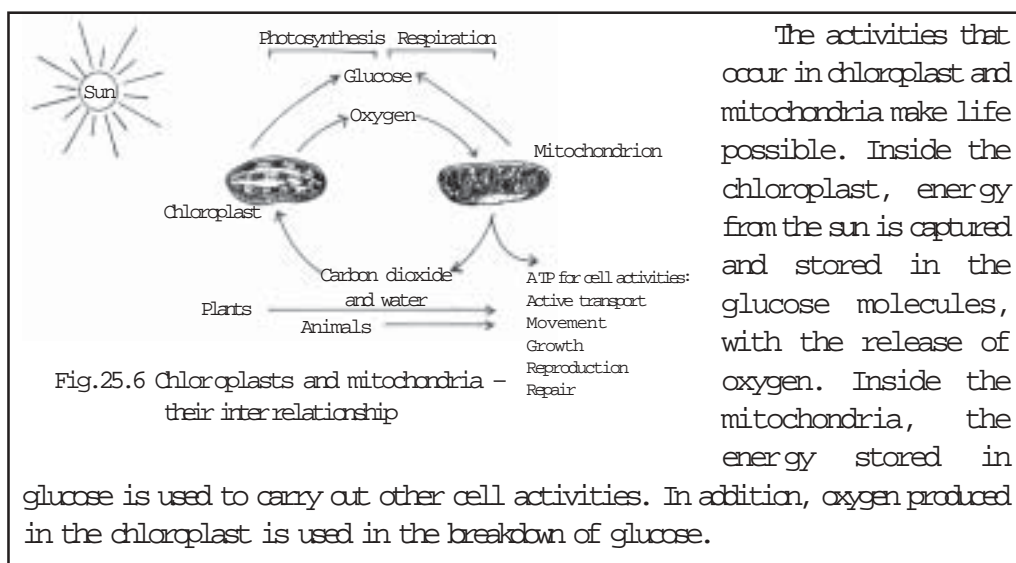
- **Light:** The rate of photosynthesis depends directly on the intensity of light. Glucose is not formed in the absence of light.
- **Carbon dioxide:** High carbon dioxide concentration increases the rate of photosynthesis up to a certain extent. Glucose cannot be synthesized in its absence.
- **Water:** It is an essential raw material, its low availability reduces the rate of photosynthesis, whereas the excess present is removed by transpiration.
- **Temperature:** Most of the plants work best at an optimum temperature of 25°C. A rise above 35°C leads to a decrease in the rate of photosynthesis. Plants that grow in the tropics can efficiently produce starch even at a higher temperature.

b) Internal factors

These include chlorophyll content, number of stomata, and the shape, structure and age of the leaf. Chlorophyll is the most important internal factor. The rate of photosynthesis decreases with an increase in the age of leaf.

The cycle of life

Look at the Figure 25.6. You have already studied the structure and functions of mitochondria and chloroplasts. Let us study the way they are functionally interrelated.



25.2.4 Materials synthesized by plants as a source of food

You may have seen farmers caring for their crops. Young plants of wheat, maize and paddy grow to yield grains. This production of food grains or growth of fruits and vegetables is a result of photosynthesis. Products of photosynthesis are important for the nourishment and survival of all life forms on the earth.

Glucose formed during photosynthesis is converted into starch and a number of other useful forms by undergoing chemical changes or combining with other molecules. Following table indicates materials synthesized by green plants and their use as a source of food.

Table 25.1 : Nutrients synthesized by plants that are used as food

Type of nutrient	Food source (some examples)
Carbohydrates	
1 Glucose	Grapes
1 Fructose	All fruits that taste sweet
1 Sucrose	Sugarcane and beet root, common sugar
1 Cellulose	Peels of fruits and vegetables, whole grains (bran – good source of roughage)
1 Starch	Cereals (wheat, rice, maize, barley), and vegetables (potato, sweet potato, tapioca, onion, banana, water chestnut or singhara)
Proteins	Pulses (soyabean, beans, peas, lentils, gram), nuts
Oil and fats	Groundnut, mustard seeds, coconut

CHECK YOUR PROGRESS 25.2

- Where does photosynthesis take place in the plant cell?
- During which step of photosynthesis are carbohydrates synthesized – light or dark reaction?

- 3 Name any two plants that are a rich source of starch?
- 4 Which form of sugar is present in sugarcane and beetroot?
- 5 Give the overall chemical reaction involved during photosynthesis.

25.3 OUR DIET

The food that we have on regular basis forms our diet. You may have different types of food in your diet. You may prefer to take more of one and less of another. Does your diet fulfill your body's requirements? Should it satisfy your taste buds or body needs?

For healthy growth and development of the body, you need to eat foods that provide enough of the essential nutrients. What does the term nutrient mean? Nutrients are the chemical constituents present in our food that are required for the nourishment of our body.

25.3.1 Components of diet and their functions

From the wide variety of food items that we consume, we get mainly six types of nutrients. Most foods provide, at least, small amounts of each kind of nutrient. These nutrients are carbohydrates, fats, proteins, vitamins, minerals and water.

a) Carbohydrates

Carbohydrates are compounds made up of three elements – carbon, hydrogen and oxygen. These are the main source of energy in our diet. One gram of carbohydrates on complete oxidation yields 17 kJ (4 kilocalories) of energy. Carbohydrates may be in the form of sugars, starch or cellulose.

- Sugars are available in the following forms: glucose, fructose (fruit sugar), lactose (natural sweetness in milk) and sucrose (common sugar made from sugarcane juice). Glucose provides almost instant energy. It is also given to the patients who cannot digest food.
- Starch can be easily digested in our body. It forms the bulk of our diet. Potato, wheat, rice, sweet potato and banana are few good sources of starch.
- Cellulose cannot be digested in our body yet, it is important to have some cellulose (in the form of roughage) in the diet. Roughage helps in easy movement of food through the food canal prevents constipation and helps in digestion. Whole grains, peels of most fruits and vegetables are good sources of roughage.

b) Fats

Much like carbohydrates, fats are composed of carbon, hydrogen, and oxygen but in different proportions. A fat molecule consists of two parts: glycerol and fatty acids. On complete oxidation each gram of fat provides around 37 kJ (9 kilocalories) of energy to the body. Fats perform the following functions:

- Keep body warm by providing extra energy
 - Fat deposits in the body prevent loss of body heat
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- Act as shock absorber and protect internal organs against injury
- Help in the transport of fat-soluble vitamins

Some common sources of fats are edible oil, ghee, butter, meat and nuts like groundnuts.

c) Proteins

You must have often heard your mother insisting on having a glass of milk or a bowl of cooked pulses (dals) or even an egg. All these are rich in proteins. Proteins are made up of molecules of carbon, hydrogen, oxygen, and nitrogen, and sometimes sulphur also. Growth of body tissues is the main function of proteins. During starvation proteins also serve as a source of energy. On the basis of function performed proteins may be of following six types:

- Structural proteins help build up tissues and replace worn out cells, for example collagen and elastin.
- Enzymes regulate the chemical reactions going on inside our body like digestion and respiration, for example pepsin and trypsin.
- Protective proteins provide protection to body against infections with the help of antibodies, for example gamma globulins.
- Contractile proteins help in movement and locomotion of body parts, for example actin and myosin.
- Transport proteins carry different substances in the blood to body tissues, for example haemoglobin in the blood transports oxygen.
- Hormones serve as chemical messengers, which regulate body functions, for example insulin and thyroxine.

d) Vitamins

You have often heard your mother saying 'Eat carrots and your eyesight will improve'. This is because carrots contain vitamin A. What are vitamins? Vitamins (vita : essential or important) are complex organic compounds essential for life. We cannot make vitamins for ourselves and so must get them from our diet. Table 25.2 lists certain vitamins that are essential for humans. They are necessary for normal growth, and maintenance of the body, and are required in relatively small amounts. Deficiency of a particular vitamin for a long period causes disease. Overdose of certain vitamins, such as vitamins A and D, also proves harmful.

On the basis of solubility in water vitamins may be water-soluble or fat-soluble.

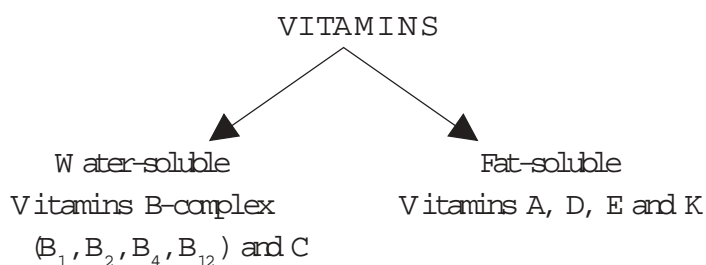


Table 25.2 : Types of vitamins, their sources, functions and deficiency diseases

Vitamin	Sources	Functions	Deficiency disease
A Retinol	Milk, green leafy vegetables, butter, carrots, tomatoes, cod liver oil, egg	Normal growth, keeps eyes and skin healthy	Night blindness (poor vision in dim light)
B ₁ Thiamine	Milk, peas, cereals, green vegetables, sea food, meat	Growth and development	Beri-beri (a disease which affects the nervous system)
B ₂ Riboflavin	Peas, yeast, egg, meat,	Healthy skin, growth	Skin disease and retarded growth
B ₃ Niacin	Whole cereals, potatoes, tomatoes, meat, fish	Healthy skin, digestive and nervous system	Pellagra (a disease which affects the skin, alimentary canal and nervous system)
B ₁₂ Cyanocobalamine	Liver, eggs, milk, fish	Formation of red blood corpuscles	Anaemia (deficiency of red blood corpuscles)
C Ascorbic acid	Amala, tomatoes, green leafy vegetables, citrus fruits, water chestnut	Healthy growth, strong blood vessels	Scurvy (a disease in which gums swell up and bleed)
D Calciferol	Sunlight, milk, butter, whole grains and vegetables	Formation of strong bones and teeth	Rickets (a disease which affects bones in children making them soft and deformed)
E Tocopherol	Vegetable oils, milk, butter, whole grains, vegetables	Protects the cell membranes	Affects fertility to some extent
K Phylloquinone	Green vegetables like spinach and cabbage, soya bean oil	Helps in the clotting of blood	Excessive bleeding from wounds

e) Minerals

Minerals are inorganic substances required by the body in small quantities. Minerals, such as iron, calcium, phosphorus, iodine, sodium and potassium, are essential for the formation of body tissues. They also help in regulating body functions and metabolism, i.e. the various chemical reactions taking place in the body. Following table indicates the sources and functions of some important minerals.

Table 25.3 : Some important minerals, their sources and functions

Mineral	Sources	Functions
Iron	Green vegetables, turnip, sprouts, yeast, liver, eggs, meat	Formation of haemoglobin, which is the oxygen-carrying pigment in RBCs
Calcium	Milk and milk products	Formation of strong bones and teeth, muscle contraction, clotting of blood
Phosphorus	Tapioca, green leafy vegetables Whole grains, meat, eggs, fish	For the development of strong bones, teeth, making energy-rich compounds in our bodies
Potassium	Green and yellow vegetables	For growth and keeping osmotic balance of cells and blood
Sodium	Common salt	Proper functioning of the nervous system, osmotic balance
Iodine	Sea food, iodized salt	Body metabolism, development of brain

Water

Water is an important part of our diet. It makes 65-70% of our body weight. Water does not provide any energy, yet it is considered an important constituent of balanced diet. It has the following functions:

- Water regulates the body temperature.
- Provides means of excretion of body wastes.
- Provides medium for biochemical reactions, such as digestion, respiration.
- Plays an important role in absorption, transportation and use of nutrients.

25.3.2 Balanced diet

Now that you are aware of the components of diet, try to analyze your own food intake. Do you include all the components in your diet?

For healthy growth and development of the body, you need to eat foods that provide enough of all the essential nutrients. Eating a variety of foods in proper quantity every day provides a balanced diet. A balanced diet contains adequate amount of essential nutrients such as carbohydrates, fats, proteins, vitamins, minerals and water. The amount of these nutrients in diet depends upon a number of factors, such as age, sex and nature of work an individual performs.

CHECK YOUR PROGRESS 25.3

1. Suggest one use of including roughage in our diet.
2. Which group of functional proteins serves as chemical messengers?
3. Which of the two will provide greater amount of energy – one gram of starchy food or one gram of fatty food?
4. Categorize vitamins on the basis of their solubility.
5. Highlight one difference between vitamins and minerals.

25.4 THE PROCESS OF NUTRITION IN HUMAN BEINGS

The food that we eat is in quite a different state from the one that can be used by the cells in the body. Conversion of complex food material into smaller units so that the cells can absorb it is called digestion. The digestive system enables conversion of ingested food into its simpler form. Digestion requires specific conditions for different nutrients present in the diet.

The digestive system includes the food canal (mouth, pharynx, esophagus, stomach, small intestine, large intestine, rectum), and the glandular organs (salivary glands, liver and pancreas). The long tube, starting from the mouth to the anus, is called alimentary canal and the digestive process is called extra-cellular digestion.

Digested food is transferred from the external environment to body's internal environment. Here it can be distributed to all body cells by the circulatory system.

25.4.1 Enzymes

The process of digestion requires a number of enzymes for the conversion of complex molecules into simpler ones.

Enzymes are chemicals needed for the completion of chemical reactions taking place in all living cells.

All enzymes are complex proteins and remain unchanged during the reaction. They can be used repeatedly. Since they speed up the rate of chemical reactions in the body they are also known as biocatalysts. Enzymes may help in joining or splitting of biomolecules.

25.4.2 Nutrition

Sum total of certain processes that enable a cell to utilize nutrients is called nutrition.

The entire process of nutrition includes the following steps: ingestion, digestion, absorption, assimilation and egestion.

a) Ingestion and digestion

The process of taking in of food through the mouth is called ingestion. The digestion of food starts from the mouth and ends in the intestines.

- i) **Mouth:** The food is ingested through the mouth. Carbohydrates, such as starch, are broken down or digested to form sugar. The saliva contains an enzyme salivary amylase that helps in the digestion of starch into sugar. The saliva also helps in lubricating the food and making it easier for swallowing. The tongue helps in rolling and pushing of food into the oesophagus.

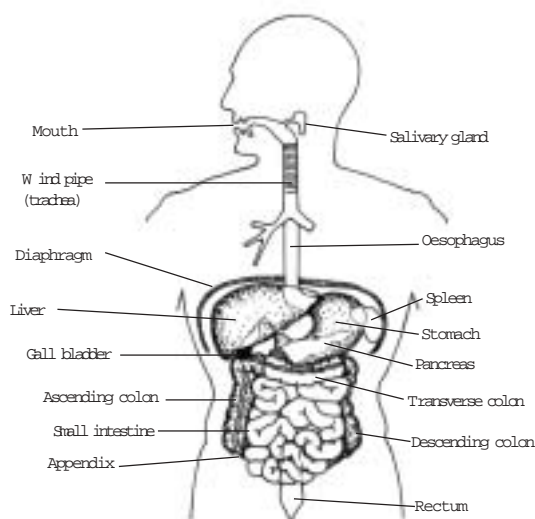
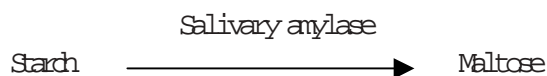


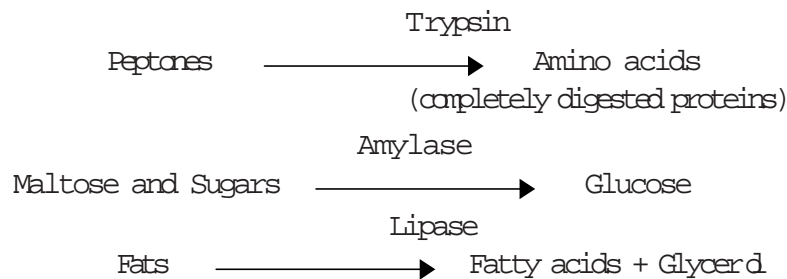
Fig. 25.7 Alimentary canal in human beings



- ii) **Oesophagus:** The oesophagus or the food pipe helps in pushing the food into the stomach. The expansion and contraction of muscles of the oesophagus is called peristalsis or peristaltic movement.
- iii) **Stomach:** The stomach is a highly muscular organ. The gastric glands present in its walls secrete gastric juices and help in the digestion of food. These juices contain hydrochloric acid (HCl) and enzymes like pepsin. HCl creates an acidic medium for the activation of enzymes and kills bacteria. These enzymes break down the proteins into smaller fragments called peptones. The muscles of the stomach help in churning the food so that it is properly mixed with the digestive juices.



- Pepsin
- Milk proteins \longrightarrow Calcium paracaseinate
- iv) Small intestine: The food moves from the stomach to duodenum, which is the upper part of the small intestine. Here the emulsification of fat (fat is broken in to fat droplets) takes place with the help of the bile juice secreted by the liver. The bile juice is stored in the gall bladder. Pancreas secretes trypsin, amylase and lipase (pancreatic juices) which are poured into the duodenum.



The food moves to ileum, which is the lower part of the small intestine. The inner surface of the ileum contains thin finger-like projections called villi. These are responsible for increasing the surface area of absorption of digested food in to the blood. The blood then carries the absorbed food to different parts of the body and undigested food is pushed into the large intestine.

- v) Large intestine : This part of the body absorbs water from the undigested food and solid waste is lubricated to form the faeces. The faeces pass on to the lower part of the large intestine, called the rectum, and thrown out of the body through the anus.

b) Absorption

The simple soluble food molecules are absorbed from the small intestine into the blood which takes them to all the cells of the body. This is known as absorption.

c) Assimilation

The absorbed food supplied to cells is used to release energy and build up the cell components. This is called assimilation. For example, glucose from digested food is broken down into carbon dioxide and water along with the release of energy. Amino acids are used to make proteins required by the cells.

d) Egestion

The process by which the undigested food material or waste is released from the body is called egestion.

CHECK YOUR PROGRESS 25.4

1. What are the finger-like projections present in small intestines called?
 2. Name the enzyme that converts proteins into peptones in the stomach?
 3. What is the movement of muscles of oesophagus that pushes down food called?
 4. Name the two glands associated with digestion.
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5 Name the acid that takes part in digestion process.

25.5 DEFICIENCY DISEASES OR NUTRITIONAL DISORDERS

A disease that occurs due to lack of adequate and balanced diet is called deficiency disease.

Eating too much of a nutrient or deficiency of a nutrient may lead to a number of nutritional disorders. Intake of improper or inadequate diet in human beings is called malnutrition. Inability of the body to absorb nutrients properly may also lead to malnutrition. Malnutrition is harmful for children as it retards their physical growth and may cause mental disabilities. Deficiency diseases caused due to malnutrition are of three types:

- Protein Energy Malnutrition (PEM)
- Mineral deficiency diseases
- Vitamin deficiency diseases

25.5.1 Protein energy malnutrition (PEM)

Deficiency of proteins in the diet may lead to malnutrition in children. This is the prime reason why your parents insist that you should drink milk, eat pulses and other sources of proteins. PEM is the most common nutritional disorder among children. Two diseases caused due to PEM are – marasmus and kwashiorkor.

a) Marasmus

It affects children up to one year of age. This occurs in deprived children of mother's milk. The symptoms of this disease include:

- loss or wasting of muscles,
- body develops loose folds of skin,
- ribs become prominent,
- digestion becomes weak,
- body growth and development slows down.

It can be cured by ensuring mother's milk for infants, by delaying another pregnancy in continuation and by having a diet rich in protein, carbohydrates, fats, vitamins and minerals.

b) Kwashiorkor

Amongst children of age group 1–5 years protein deficiency causes kwashiorkor. The symptoms of this disease are:

- enlargement of liver due to water retention,
- darkening of the skin with scaly appearance,
- hair become reddish-brown,
- legs become thin, and
- retardation of physical as well as mental growth.

Eating a protein-rich diet that consists of milk, meat, groundnut, soyabean, jaggery, etc. can cure it.

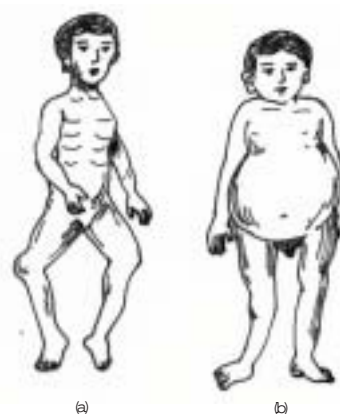


Fig. 25.8 Effect of
(a) Marasmus, and
(b) Kwashiorkor

25.5.2 Mineral deficiency diseases

You are aware of the importance of certain minerals in your diet (refer Table 25.3) deficiency of these minerals in your diet may lead to certain deficiency diseases. Let us study about two common mineral deficiency diseases – goitre and anaemia.

a) Goitre



Fig. 25.9 Goitre : enlargement of the thyroid gland

Iodine is required for the synthesis of hormone, thyroxine, produced by the thyroid gland located in our neck region. Prolonged iodine deficiency causes enlargement of thyroid gland i.e. goitre. Seafood is a good source of iodine. People living in coastal region do not suffer from iodine deficiency. Iodized salt, especially for people living in the hilly regions or even plains is recommended to reduce incidence of goitre.

b) Anaemia

This is a very common diet related condition in which the level of haemoglobin becomes lower than normal. Iron is an important constituent of haemoglobin, the respiratory pigment of our blood. Iron deficiency causes deficient

production of haemoglobin, resulting in the following symptoms:

- Body becomes pale,
- lack of appetite,
- exhaustion,
- loss of body weight,
- retarded growth.

An iron-rich diet consisting of spinach, apple, banana, guava, eggs, groundnuts, etc. can help to cure anaemia.

25.5.3 Vitamin deficiency diseases

a) Xerophthalmia

Lack of Vitamin A leads to Xerophthalmia, a disease in which the following symptoms are observed:

- cornea (white area of the eye ball) may become dry, foggy or cloudy and may ultimately lead to total blindness,
- retarded growth,
- dry scaly skin, and
- night blindness (improper vision in dim light).

This can be avoided by proper intake of green leafy vegetables like Spinach, yellow vegetables and fruits, such as carrots, pumpkin, papaya and ripe mango. Liver, cod liver oil, butter and ghee also provide vitamin A.

b) Rickets

Milk and liver are good sources of vitamin D, calcium and phosphorus. Beans, green vegetables, whole gram and tapioca are other sources of calcium.

Phosphorus is also in bajra, green leafy vegetables and nuts. Calcium and phosphorus are the major constituents of bones and teeth. Their deficiency may result in a disease called rickets in children.

Symptoms of this disease are pigeon chests and bone deformities, particularly of the long bones, as they cannot sustain body weight, like bow legs.

c) Beri-beri

Deficiency of Vitamin B₁ in the diet leads to beri-beri. It is a disease of heart and nerves. The symptoms of this disease include:

- swelling of tissues and water accumulation in the body,
- extreme weakness,
- headache,
- paralysis and even heart failure.

This disease is observed more in people consuming more of polished rice in their diet.

d) Pellagra

Deficiency of vitamin B₃ results in pellagra. This disease causes:

- reddening and drying of skin (eczema),
- swelling of gums and tongue, along with diarrhoea, and
- mental disorientation.

Consuming a lot of maize interferes with the absorption of Vitamin B₃ in the body. Pellagra can be avoided by having a diet full of whole grain cereals, beans, green vegetables, tomato, potato, fish and eggs.

25.6 FOOD ADULTERATION

Why do we prefer to buy food products sold in sealed packets?

Why do we prefer to buy items made by a standard reliable

company? A simple answer is that the manufacturer selling its products in sealed packets or brands ensures delivery of quality of its contents to the consumer. Any attempt to mix pure food substances with cheaper, sub-standard, edible or inedible substances is called food adulteration.

Adulterants not only deteriorate the quality and food value of the product but may also cause severe ill effects. Mixing water in milk may reduce its food value. Mixing colour (complex organic dyes), stones, toxic cereals and rotten ingredients in grains and pulses causes severe damage to body parts and hence sickness. Table 25.4 given below lists some of the adulterants used in different food materials.

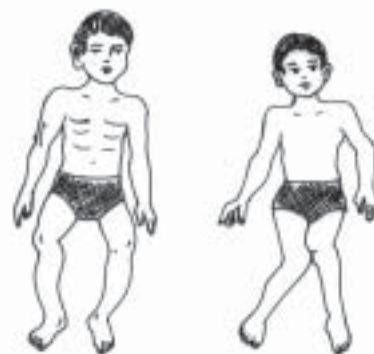


Fig. 25.10 Rickets : deformities in legs

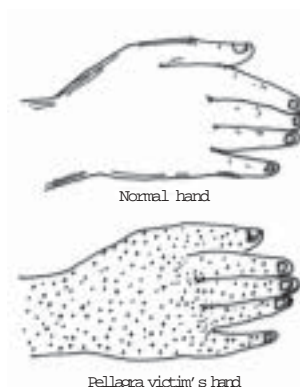


Fig. 25.11 Hands of a person suffering from pellagra

Table 25.4 : Some food items and their common adulterants

Food item	Common adulterants
Cereals	Straw, husk, mud, stones, grit, inferior quality grains, infected or insect infested grains
Pulses	Straw, kesari dal, inferior quality grains, infected grains, metanil yellow dye
Wheat flour, maida, suji, etc.	Grit, infested stock, excess of bran
Milk	Starch, water, milk of other animals, extraction of fats, synthetic milk
Edible oils	Mineral oil, argemone oil, artificial colors
Honey	Sugar syrup, jaggery
Tumeric (haldi)	Starch coloured with chromate or metanil yellow dye
Coriander	Powdered cow/horse dung, saw dust, starch
Black pepper	Dried papaya seeds
Chillies	Saw dust, colour dust

25.6.1 Prevention of food adulteration

To prevent adulteration of food products, our government has issued certain laws. These include: Prevention of Food Adulteration Act and Rules and Food Product Orders which serve the following functions:

- lay a minimum standard for the quality of food
- requires date of manufacture and expiry to be mentioned on the packet of the food item
- quantity of the content to be indicated

In India, the Bureau of Indian Standards carries out the certification of food products at the manufacturer's end.

CHECK YOUR PROGRESS 25.5

- 1 Give the full form of PEM.
- 2 Name any two diseases caused due to lack of vitamins.
- 3 Which type of salt intake can prevent occurrence of goitre?
- 4 List any two symptoms of anaemia.
- 5 Name one common adulterant used in edible oils.
- 6 Name the organization that certifies food quality in India.

LET US REVISE

- Food is the raw material that our body needs to grow and stay healthy.
 - Nutrition amongst organisms could be autotrophic or heterotrophic (parasitic and saprotrophic).
 - The process by which green plants synthesize their food is called photosynthesis.
-

- The raw materials of photosynthesis are carbon dioxide and water . The end products are glucose and oxygen.
- Extra glucose may get converted into sucrose, fructose, cellulose, starch, fats, oils, proteins, etc. in our body .
- A balanced diet includes all the essential nutrients, in the required proportion, along with water and roughage.
- Components of balanced diet are carbohydrates, proteins, fats, vitamins and minerals. The ratio of the above-mentioned items, in the diet, needs to change with the age, sex and profession.
- Lack of balanced diet leads to various nutritional disorders.
- The process of nutrition includes steps of ingestion, digestion, absorption, assimilation and egestion.
- Conversion of complex food material into smaller units so that it can enter the cells is called digestion.
- Certain chemicals called enzymes play an important role in the process of digestion .
- Hormones are the chemical messengers, which regulate body functions.
- Salivary glands in the mouth, liver and pancreas help in digestion and are called glandular organs or associated glands.
- Digestion of proteins yields amino acids. Digestion of oils and fats gives fatty acids and glycerol.
- Digestion starts in the mouth and continues up to the large intestine.
- The long tube or canal of the digestive system is called alimentary canal.
- Lack of balanced diet may lead to nutritional disorders.
- Deficiency diseases may be due to proteins(kwashiorkor and marasmus), minerals (goitre and anaemia)or vitamins(xerophthalmia, beri-beri, pellagra, rickets)
- Mixing pure food substances with cheaper , sub-standard, edible or inedible substances is called food adulteration.

TERMINAL EXERCISES

A. Multiple choice type questions.

1. One of the following is not a step of nutrition
 - a) Ingestion
 - b) Assimilation
 - c) Secretion
 - d) Egestion
 2. Rickets is caused due to deficiency of
 - a) Iron
 - b) Vitamin D
 - c) Proteins
 - d) Carbohydrates
-

- 3 One gram of a substance was oxidized. The energy released amounted to 9.0 Kcal. The substance was of the type:
 - a) Carbohydrates
 - b) Fats
 - c) Vitamins
 - d) Proteins
- 4 A person living in the hilly regions of Shimla developed swelling in his neck region. The doctor said his thyroid gland got swelled up. Can you name the nutrient deficient in his diet?
 - a) Calcium
 - b) Iron
 - c) Phosphorus
 - d) Iodine
- 5 The vitamin that helps in the clotting of blood is
 - a) Vitamin A
 - b) Vitamin D
 - c) Vitamin E
 - d) Vitamin K

B. Descriptive type questions.

- 1 List the major components of food.
 - 2 Define balanced diet.
 - 3 If equal amounts of fats or carbohydrates were oxidized, which of them would yield more energy?
 - 4 How would you establish the presence of starch in a given sample?
 - 5 What are vitamins? Name the different types of fat-soluble vitamins.
 - 6 List the functions of food?
 - 7 Define adulteration in food. Name an agency that certifies reliability of food produced.
 - 8 Name five common adulterants in food.
 - 9 Differentiate between parasitic and saprophytic nutrition.
 10. What are the main steps of photosynthesis? Is sunlight essential for photosynthesis and why?
 11. Give the chemical equation of photosynthesis.
 12. A patient complains of lack of appetite, exhaustion and is losing weight. Diagnose the deficiency. What kind of diet would you suggest for the patient?
 13. Deficiency of which vitamin causes night blindness. What would you suggest to prevent this deficiency?
 14. Why is water an essential nutrient of a balanced diet?
 15. Draw a neat and labelled diagram of the human alimentary canal.
-

16. Discuss the five steps involved in the process of nutrition.
17. Where does the digestion of starch, proteins and fats take place and what is the role played by the associated glands?
18. Which component in your diet will not be digested if the enzyme lipase is not secreted? Also name the secretion that helps in the activity of this enzyme.
19. What are the building blocks of proteins? Classify proteins on the basis of their functions along with one example.

ANSWERS TO CHECK YOUR PROGRESS

25.1

- 1 Autotrophs and heterotrophs
- 2 Mushrooms, bread mould, bacteria, yeast (any two)
- 3 Autotrophs/plants
- 4 Parasites: Live on or inside other living organisms to derive their food
Saprophytes: Derive their food from dead and rotten organisms
- 5 Parasites: leech, Cuscuta (dodder plant), head louse
Saprotrophs: yeast and mushroom
- 6 Dodder plant or Amar bel

25.2

- 1 Chloroplast
- 2 Dark reaction
- 3 Potato, onion, tapioca (any two)
- 4 Sucrose
- 5

6CO_2	+	$12\text{H}_2\text{O}$	$\xrightarrow[\text{chlorophyll}]{\text{sunlight}}$	$\text{C}_6\text{H}_{12}\text{O}_6$	+	$6\text{H}_2\text{O}$	+	6O_2
carbon		water		glucose		water		oxygen
dioxide								

25.3

- 1 Roughage adds bulk to the food and helps in digestion.
- 2 Hormones, such as insulin, growth hormone, thyroxine
- 3 One gram of fatty substance yields more energy upon oxidation;
Carbohydrates: 4.2 Kcal/g; Fats: 9 Kcal/g
- 4 Water soluble: Vitamins B and C; Fat soluble: Vitamins A, D, E and K
- 5 Vitamins are organic molecules, while minerals are inorganic salts.

25.4

- 1 Villi (sing. Villus)
- 2 Pepsin
- 3 Peristalsis
- 4 Salivary glands, liver and pancreas
- 5 HCl (hydrochloric acid)

25.5

- 1 Protein Energy Malnutrition
- 2 Night blindness, pellagra, beri-beri, rickets (any two)
- 3 Use of iodized salt
- 4 Lack of appetite, loss of body weight
- 5 Mineral oil, argemone oil (any one)
- 6 Bureau of Indian Standards

GLOSSARY

Nutrition: The process by which organisms obtain material for their growth and development (from their environment).

Autotrophs: Organisms that can manufacture their own food.

Heterotrophs: Organisms that depend upon other organisms for their food.

Saprotrophs: Organisms that derive their food from dead and rotten organisms.

Parasites: Organisms that live on or inside the body of other living organisms to derive their food.

Photosynthesis: The process by which green plants manufacture food from carbon dioxide and water in the presence of sunlight.

Nutrients: Chemical constituents present in our food and required for the nourishment of our body.

Balanced diet: Diet that contains adequate amounts of essential nutrients, such as carbohydrates, fats, proteins, minerals, vitamins and water.

Digestion: Conversion of complex food material into smaller units so that it can be absorbed by the cells.
