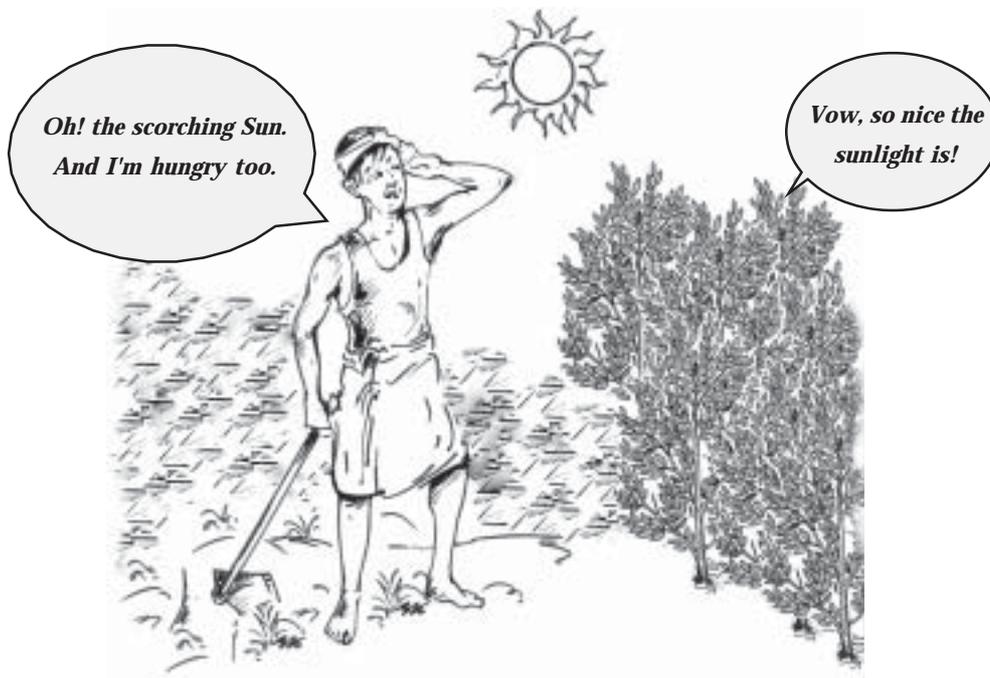


2

THE CHEMICAL CHANGES OF FOOD



Have you observed the illustration? Why do the farmer and the plant differ in their opinion about the sunlight?

Plants prepare food using sunlight. But animals cannot do this. If so, where do animals get their food from?

Animals depend on plants for their food. For what purposes do animals use the food that is produced by plants through photosynthesis?

- For obtaining energy
-
-

You have studied that the food we take for the production of energy and growth of the body should have different nutrients in it. Examine Figure 2.1, find out the important nutrients in the food items given below and complete Table 2.1.



Fig. 2.1

Different types of food items

Food items	Major nutrient
Rice	Carbohydrate
<i>Dhal curry</i>	
Ghee	
Fish curry	
<i>Avial</i>	

Table- 2.1

How does the body utilise these nutrients contained in the food items for various purposes? Analyse the description given below and prepare a note on the various nutrients contained in food, their sources, functions, and their simpler units.

What are Nutrients? What Purpose do They Serve?

We consider food as substances that contain nutrients that are essential for the smooth functioning of life activities. Mainly 6 components should be present in our diet.

- | | | |
|------------------|--------------|--------------|
| (1) Carbohydrate | (3) Lipid | (5) Minerals |
| (2) Protein | (4) Vitamins | (6) Water |

Carbohydrate

Carbohydrate is a chemical compound of carbon, hydrogen and oxygen combined in a particular ratio. Carbohydrate is the main source of energy for the functioning and growth of the body. Rice, other cereals, tubers, fruits etc., are the main source of carbohydrates. Carbohydrates are stored in food items mainly in the form of polysaccharides (substances that contain more than ten glucose molecules) such as starch, cellulose, glycogen etc., Glucose, fructose and galactose are the simplest units formed from polysaccharides. These are known as monosaccharides. Two monosaccharides combine to form a disaccharide. In some food items carbohydrates are found as disaccharides. Lactose in milk and sucrose in sugar-cane are examples.

Protein

Proteins are formed by the combination of simple units called amino acids. There are about 20 amino acids seen in proteins. All of them contain elements viz., carbon, hydrogen, oxygen and nitrogen. Some amino acids contain sulphur also. Proteins are mainly used for the building up of body tissues. Pulses, fish, meat, milk etc., are the main sources of proteins.

Lipids

Lipids are formed by the combination of the elements carbon, hydrogen and oxygen. The main sources of lipids are oil, ghee and butter. Lipids are mainly used for the production of energy. Lipids contain twice as much energy as that contained in carbohydrates and proteins. The excess lipid in our body is stored beneath the skin. Therefore lipids are considered to be a stored food. The simple units of lipid are fatty acids and glycerol.

Vitamins

Vitamins are organic compounds. Plants can synthesize almost all vitamins. But only some vitamins are synthesized in the human body. The others have to be obtained through food. Energy is not produced by vitamins. They act as factors that regulate and promote life activities. Based on their solubility, the vitamins are classified into two groups - fat soluble and water soluble. A, D, E, and K are fat soluble vitamins. B Complex vitamins and C are the water soluble ones. Deficiency or excess of vitamins in the diet may cause diseases.

Minerals

Like vitamins, minerals are also nutrients that promote and regulate life activities. Minerals like Ca, P, Na, K etc. are required in relatively larger quantities for day-to-day life activities. However, Cu, Zn, Fe, I, Mg etc., are needed in smaller quantities only. The excess or deficiency of minerals in food may cause diseases.

Water

Water is an important inorganic factor in the body. About 70% of the weight of the human body is water. The water taken in separately or along with food and water formed in the tissues due to metabolic activities are the main sources of water in the human body. Water is lost from the body mainly along with faeces, urine and sweat. The water content in a person's body is said to be balanced when the quantity of water lost from the body equals the quantity of intake by the body per day. This state of equilibrium is much essential for the smooth functioning of bodily activities.

Complete the Illustration 2.1 given below on the basis of your understanding about the nutrients.

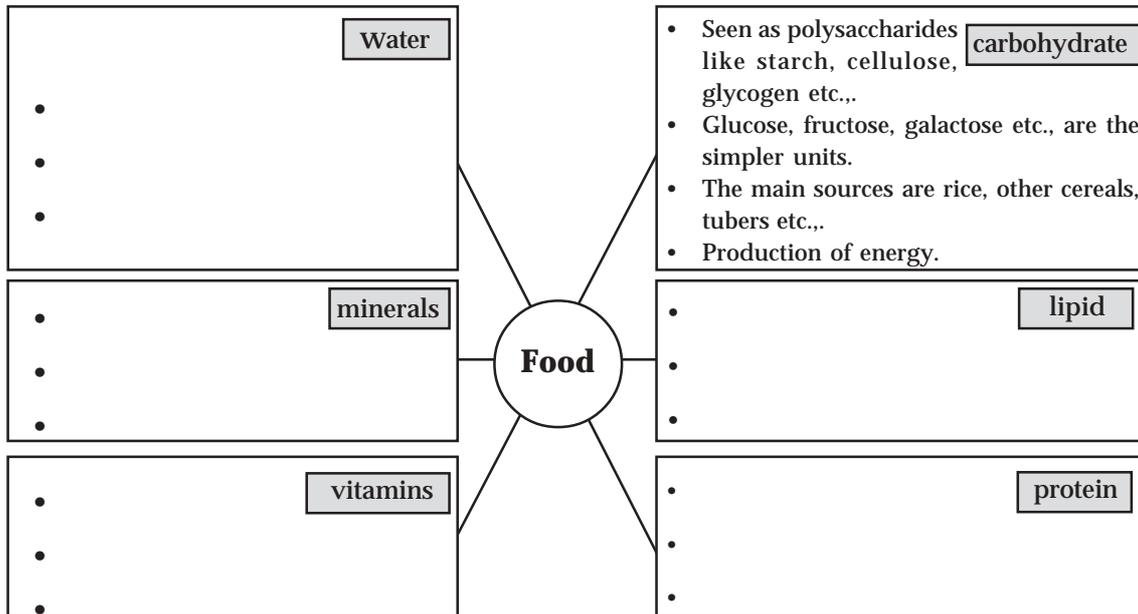


Illustration - 2.1

You have now gathered information on the different nutrients in food and their function. How do these factors present in the food materials get transformed into simpler units that can be utilized by the body? What happens to the food that we eat?

The passage of food

You know the different parts of the path through which the food passes. Observe Figure 2.2, identify and label the parts. Using the given figure find out the different parts of the alimentary canal through which food passes. Record it in your science diary in a sequence.

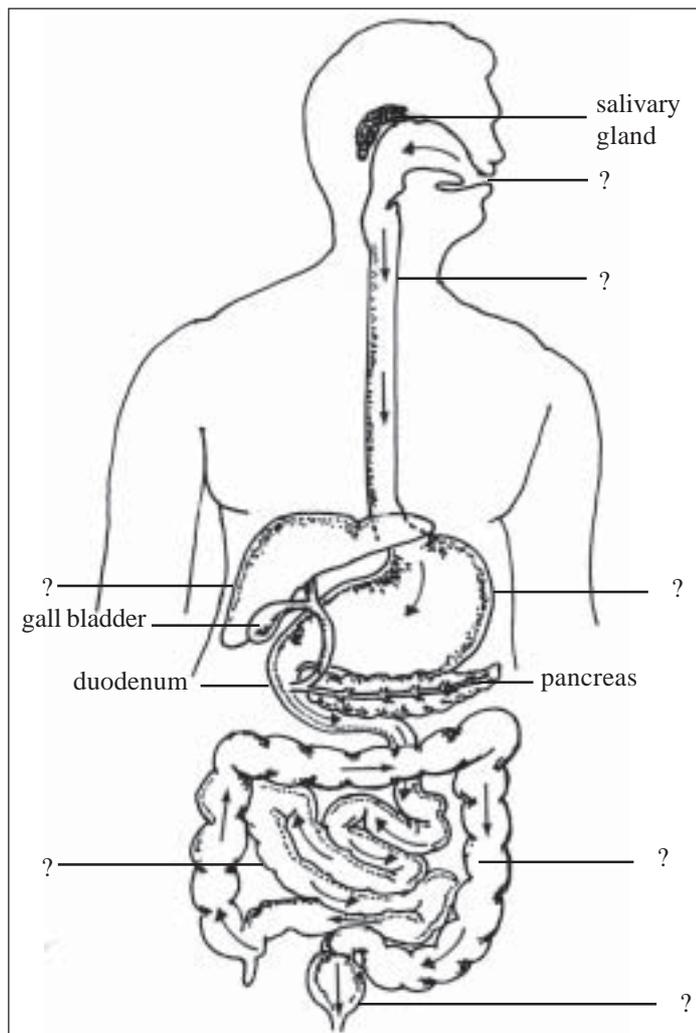


Fig 2.2 Different parts of the human alimentary canal

Digestion-mechanical and chemical

Digestion is the process by which the food we eat passes through the alimentary canal and breaks down into simple units at different parts of the alimentary canal. Mechanical and chemical processes are involved in this process. Chewing of food in the mouth and churning in the stomach are examples of mechanical digestion. By mechanical digestion food is broken down into smaller units which then mix with the digestive juices to become a paste. This, in turn, makes it easy for the enzymes in the digestive

juices act upon food. The chemical process of digestion is the process by which the nutrients in the food react with the enzymes in the digestive juices to convert them into absorbable simple units.

Let us see what happens to the food at various parts in the alimentary canal.

What happens to the food in the mouth? What are the parts in the mouth that help to convert food into small particles?

Analyse the description below using the indicators given and prepare a note in the science diary.

Organs of Digestion in the Mouth

In human beings, there are 32 teeth, a tongue and three pairs of salivary glands in the mouth. Each tooth is fixed in a socket in the jaw bone. (Figure 2.3) The first set of teeth formed during childhood is called milk teeth. By about 7-12 years these fall and permanent teeth grow in their place. Human beings have a set of 32 permanent teeth. Of these four grow only after attaining adulthood. These are known as wisdom teeth. Human teeth are of four different types (Figure 2.4).

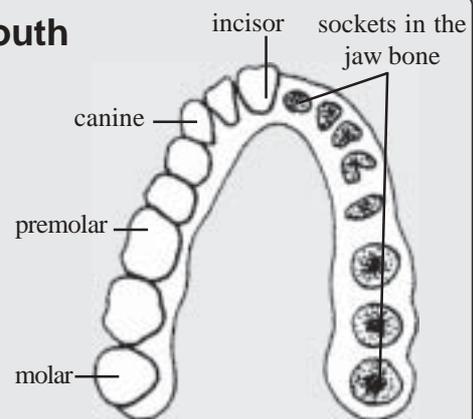


Fig 2.3

Different types of teeth

The incisor helps in cutting the food into pieces, the canines help in tearing the food, the premolar and molar help to chew the food. Teeth are covered with enamel which is the hardest substance in the human body. This covering makes teeth much harder. The tongue helps in chewing the food to recognize different tastes and swallow the chewed food. It is the taste buds on the tongue that help in differentiating the tastes.

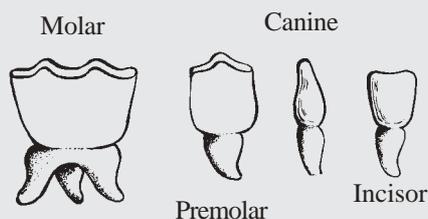


Fig 2.4

Indicators

- ★ How do the tongue and the teeth help in the process of mechanical digestion in the mouth?
- ★ Is there any difference in the number of teeth in children and adults?
- ★ How many types of teeth are present in the human mouth? What are their functions?
- ★ What is the special feature of teeth that helps to convert food into small particles?
- ★ Why do we say that food should be chewed well?

Is mechanical digestion the only process that takes place in the mouth? Let us try a simple experiment.

Take a little cooked rice and chew it well without adding any curry. Do you feel any difference in the taste?

When food reaches the mouth more saliva is secreted from the salivary glands. The saliva mixes with the food to make the process of chewing easier. Besides, the enzymes present in the saliva also help in digestion. Does saliva perform any other function?

Observe Figure 2.5 and Table 2.2 given below .

With the help of the experiment you have performed and the table given

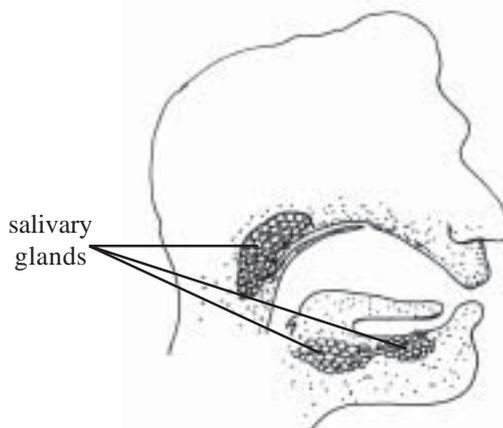


Fig 2.5
Salivary glands

below find out what happens to food in the mouth. Note your observations in your science diary. With the help of your teacher try an experiment to prove that salivary amylase breaks up starch .

Movement of food through the oesophagus

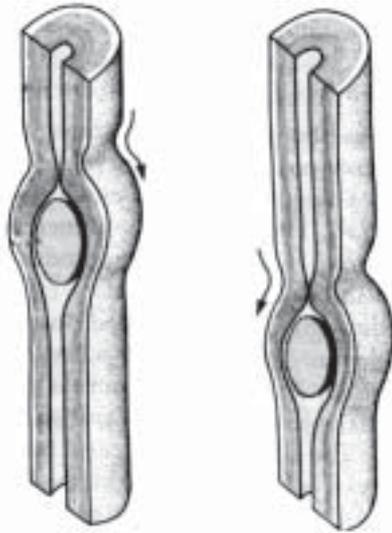
Food from the mouth first moves through oesophagus to the stomach and then to the small intestine.

You know that the oesophagus and small intestine are tubular organs. Let's see how food passes through these organs.

Observe Figure 2.6. How does the food move smoothly through the oesophagus and small intestine. Discuss it with your friends and find out.

The components of saliva	Function
Mucus Salivary amylase Lysozyme } Enzymes	<ul style="list-style-type: none"> • Conducts the food smoothly through the oesophagus. • Partially converts starch into maltose (disaccharide). • Destroys microorganisms if any, present in food.

Table - 2.2



The special muscles on the walls of the oesophagus contract behind the bolus.

The waves of muscular contraction and relaxation push the bolus forward.

Fig 2.6 - Peristalsis

The process by which food passes through the oesophagus and the small intestine by the wave like movement of muscles is called peristalsis. The food reaches the stomach in about eight seconds. The stomach is a J-shaped sac. The food we eat is stored in the stomach. The process of digestion in the stomach takes about 4 - 5 hours. The constant movement of the stomach grinds the food and mixes

it well. This is also an example for the process of mechanical digestion. Isn't it clear now why we say that there should be regular intervals between meals?

Digestion in the stomach

Is the stomach only a storage organ ?

Examine Figure 2.7 and Table 2.3 given below and find out what are the changes occurring to the food in the stomach. Record it in your science diary.

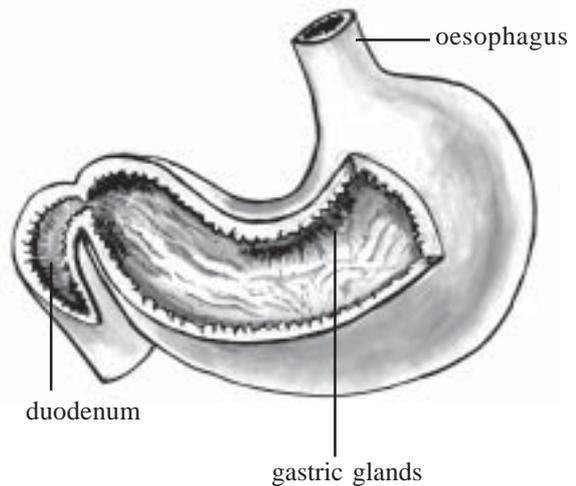


Fig 2.7

Stomach

Gland	Digestive juice	Components	Function
Gastric glands	gastric juice	mucus pepsin (enzyme) hydrochloric acid	<ul style="list-style-type: none"> Protects the walls of the stomach from the action of enzymes. Partially converts proteins into simpler units called peptones. Destroys microorganisms present in the food. Regulate the pH to be suitable for the digestive process that takes place in the stomach.

Table - 2.3

Digestion in the small intestine

The food that has undergone a partial digestion in the stomach reaches the duodenum - the beginning part of the small intestine. The liver is seen above the duodenum, on the right side of the stomach, just below the diaphragm. The liver is the largest gland in the human body. It is also the only organ in the human body that is capable of regeneration. Liver secretes bile that helps in digestion. Bile is temporarily stored in the gall bladder. The bile and the pancreatic juice secreted from the pancreas reach the duodenum and mix with the food.

Analyse the table given below with the help of the indicators provided and prepare a note for your science diary on the digestive process that takes place in the small intestine.

Indicators

- The role of liver in the process of

Glands	Digestive enzyme	Function
Liver	Bile	<ul style="list-style-type: none"> • Acidic food that comes from the stomach is converted to basic nature. • Helps to break down lipids into smaller particles.
Pancreas	Pancreatic juice <ul style="list-style-type: none"> • Pancreatic amylase • Trypsin • Pancreatic lipase } Enzymes	<ul style="list-style-type: none"> • Converts starch into maltose. • Proteins are broken down into peptides. • Converts lipids into fatty acid and glycerol.
Intestinal glands	Intestinal juice <ul style="list-style-type: none"> • Peptidase • Disaccharidase } Enzymes	<ul style="list-style-type: none"> • Converts peptides into amino acids. • Converts maltose and other disaccharides into monosaccharides like glucose, fructose and galactose.

Table 2.4

digestion.

- The simple units that are formed in the small intestine as a result of digestion.

You have now understood that the digestion is completed in the small intestine. The simple nutrient components are absorbed and the waste materials reach the large intestine. Here water in the waste is absorbed resulting in the formation of faeces. This faecal matter is collected in the rectum temporarily and then excreted through anus.

List out the nutrients in our common diet like gruel, peas and pappads. Find out at which parts of the alimentary canal, each of these is digested and what are the simpler components of each of these after digestion.

Write them down in the Table 2.5 as shown below, in your science diary.

Place of digestion	Digestive Gland	Digestive Juice	Enzyme	Process
Mouth				
Stomach				
Small intestine				

Table - 2.5

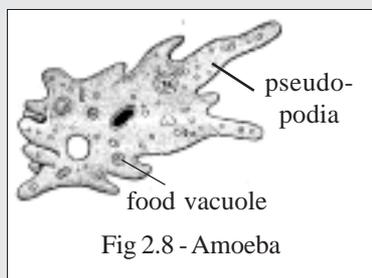
Traditional food and fast food

We need to take food that contains nutrients in the right proportion and quantity for normal growth and health. Isn't it possible to fulfil these requirements by our traditional food habits? Or are the modern food types and food habits unavoidable? Note down your opinion. Organise a debate in the class on the basis of the opinions.

Nutrition in other organisms

There are many similarities and differences in the nature of the food, mechanism of feeding and the process of digestion in living beings ranging from microorganisms like bacteria to the human beings. Analyse the food habits and peculiarities of the digestive processes in organisms given below. Analyse the similarities and differences and note them down in your science diary.

Amoeba



Algae, bacteria and small protozoa form the main food of amoeba. The amoeba gathers its food with the help of pseudopodia. Digestion takes place inside the food vacuole present in the cytoplasm. This food vacuole contains enzymes that can digest carbohydrate, lipids and proteins. Therefore the process of digestion in amoeba is intracellular digestion. The nutrients are absorbed into the cytoplasm surrounding the food vacuole. The waste materials are expelled through the body surface.

Hydra

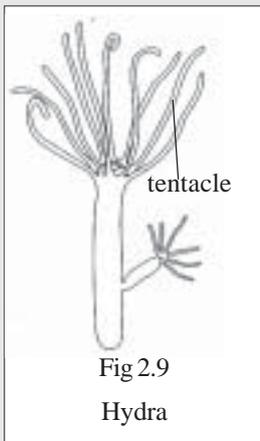


Fig 2.9
Hydra

The main food of hydra comprises small insects, larvae etc., that are found in water. Hence, hydra is considered carnivorous. Food is captured using tentacles. The prey caught by the tentacle, is taken into the body through the mouth. Close to the mouth certain protein digesting enzymes and mucus cover the food and digest it partially. The partially digested food enters the food vacuole. Digestion is completed there. Therefore digestion in hydra is partially intracellular and partially extracellular. Digestive wastes are expelled through the mouth by contraction of the body.

Tapeworm

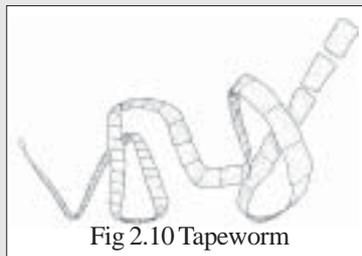


Fig 2.10 Tapeworm

The tapeworm is an endoparasite seen in the small intestine of man. Since it is an endoparasite, the tapeworm does not have a complete alimentary canal. It absorbs simple nutrients from the small intestine of man directly through body surface. It is believed that the usual enzymatic chemical process of digestion is not found in the tapeworm.

