CHAPTER 3

Animal Nutrition

Food Substances

One of the basic requirements of life is food. The ability to make or obtain food is a characteristic feature of living things (i.e. plants and animals). While green plants carry out photosynthesis and manufacture their food themselves, animals depend on already made food which may be solid or liquid. Their sources of food are plants and plant products as well as other animals.

Sometimes, animals are classified on the basis of the type of food they feed on. Hence, we have terms like: (a) herbivores or herbivorous animals – these are animals which feed on plants, e.g. grasshoppers, goat, cow and elephant; (b) carnivores or carnivorous animals, (the flesh-eaters) — these feed on other animals, e.g. toad, Agama lizard, wall gecko, snake and lion; (c) omnivores or omnivorous animals feed on both plants and animals, e.g. pig and man.

Importance of food

Food is important to animals in several ways. It must be consumed if the animal is to carry out all its functions of building new cells or replacing worn out cells. It also regulates body activities like growth, respiration and reproduction.

Classes of food substances

All food substances eaten by animals can be grouped into seven classes. Those regarded as nutrients are carbohydrates, proteins, fats and oils and roughages. Those regarded as necessary foods are vitamins, mineral salts and water. The sources, examples and importance of each class of food are listed below.

Carbohydrates: Common sources include yam, cassava, potato, bread, cereals, e.g. rice, maize and millet.

Importance - They are required in great quantities for the supply of energy and warmth needed by animals for maintaining body temperature (in the case of homoiothermic animals); energy for carrying out chemical body activities and for mechanical work of muscles.

Carbohydrates consist of sugar, starches, cellulose and glycogen. They are grouped into simple sugars or monosaccharides, double

sugars or disaccharides and polysaccharides. Each carbohydrate consists of only three elements: carbon, hydrogen and oxygen. In it, hydrogen and oxygen exist in ratio 2 to 1 – just as in water.

Monosaccharides: These are the simplest sugars consisting of one molecule of simple sugar. They have a general formula $C_6H_{12}O_6$. Examples are glucose, fructose and ribose $C_5H_{10}O_5$).

Disaccharides: These are sugars which consist of two molecules of simple sugar which are formed by condensation. The general formula is $C_{12}H_{22}O_{11}$. Examples are sucrose, maltose and lactose.

Sucrose. It is a non-reducing sugar which is formed from a molecule of glucose and a molecule of fructose. Sugar cane is its main source.

Maltose. This is obtained from the condensation of two molecules of simple sugars, i.e. two molecules of glucose. It is a reducing sugar.

Lactose (Milk sugar). It is a reducing sugar. It is obtained from the condensation of a molecule of glucose and a molecule of galactose.

Polysaccharides: These are complex carbohydrates made up of more than two molecules of simple sugar. Examples are starch, cellulose, chitin and inulin.

(a) *Starch*. It has the formula $(C_6H_{10}O_5)n$ where *n* represents a large number. It is formed from the condensation of numerous molecules of simple sugars. Examples of the sources of starch are yam, cereals, cassava and bread.

(b) *Cellulose*. This is composed of several condensed units of monosaccharides. Plant cellwalls are made of cellulose. Man cannot digest it. It is a component of roughage (fibre) which stimulates peristalsis or it keeps food moving along the digestive system and prevents constipation. Sources of cellulose include wholemeal bread, cereals, fresh fruits and vegetables.

(c) *Glycogen (Animal starch)* This is the form in which animals store their carbohydrates; usually in the muscles and liver.

Proteins: Animal sources of protein are often described as first class proteins. Examples are milk, egg, fish, meat and chicken. Plant sources of proteins (often called second class proteins) include beans and soya beans.

Importance – Proteins are needed for growth and body building, regeneration of fresh cells, replacement of damaged or worn-out cells and tissues as well as healing of wounds. It is a component of the protoplasm, enzymes and hormones. It provides an alternative source of energy when there is a shortage of lipids and carbohydrates.

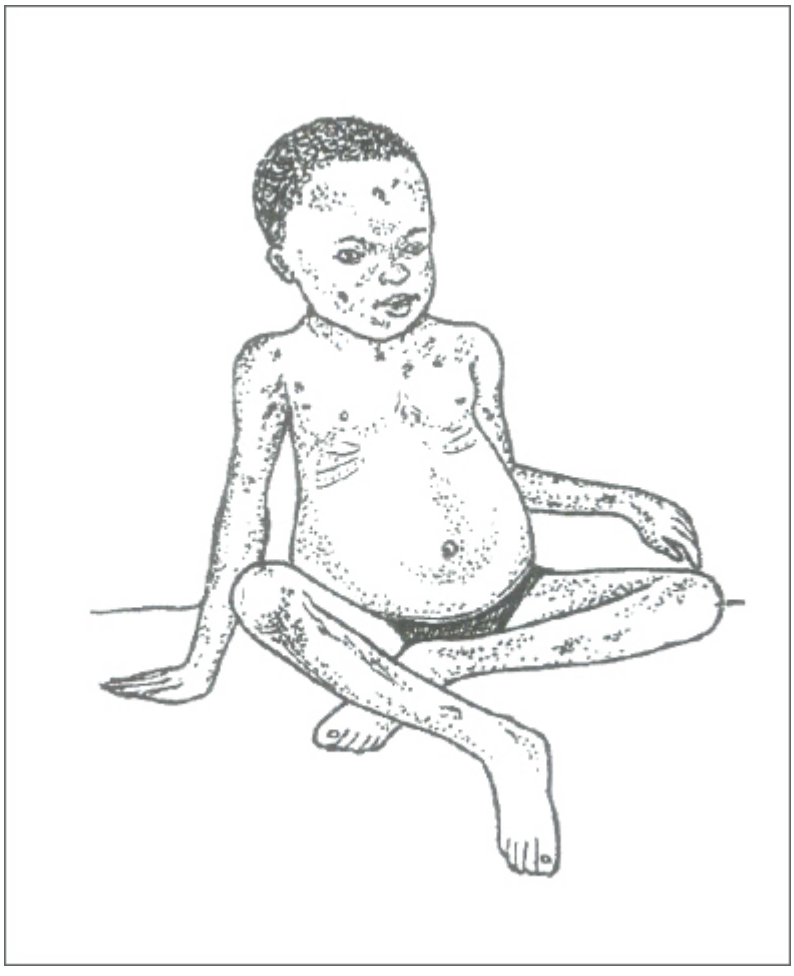

Fig. 3.1 A child suffering from kwashiorkor.

Lack of protein may result in starvation or **kwashiorkor**. This is a Ghanaian word meaning â€˜illness of the old baby deprived of its motherâ€™s milk by a new baby.â€™ It is a distressing protein deficiency disease. It is characterised by weakness or wasting of muscles marked by swellings caused by the accumulation of fluid in the tissues. The stomach distends. The child is listless and miserable. The skin is discoloured. The child does not grow properly. He may experience anaemia and diarrhoea. Kwashiorkor is common in West Africa. It is due to poverty and ignorance about proper diets. *(Fig. 3.1).*

Proteins consist of nitrogen, carbon, hydrogen and oxygen. Sometimes, proteins may contain sulphur or phosphorous, or both.

Fats and Oils: Plant sources of fats and oils include groundnuts, palm oil, soyabean oil and melon oil. Animal sources include butter, fish or cod liver oil and cheese.

Importance: They provide mainly energy for man and other animals. They yield about twice as much energy as equal quantities of carbohydrates. They serve as a store for food and energy which they release when a person is sick or fasting for a long period, hence the person looks lean.

They keep the body warm or act as insulators in man and other

animals, especially those living in cold regions.

Fats and oils are also called lipids. They consist of only carbon, hydrogen and oxygen like carbohydrates. However, the amount of oxygen in each lipid is very little, e.g. tristearin is $C_{57}H_{110}O_6$. Fats are solid lipids at room temperature but when heated, they melt into liquids, e.g. margarine and butter. Oils are liquid lipids at room temperature. Most of them are from plants, e.g. castor oil seeds and cashew nut.

Vitamins: They are organic food substances which are needed by man and other animals in only small quantities (traces) for normal, healthy growth. Absence or inadequate vitamin supply in diet may lead to deficiency diseases – See *Fig. 3.2*. These may result in illness or death. Vitamins are active in solutions. Some vitamins are soluble in water (Vitamins B and C). Others are fat-soluble (Vitamins A, D and E).

Common sources of vitamins are green vegetables, fats, eggs, milk, liver, oils and fresh fruits.

Mineral Salts: These are food substances that are required in traces for vital body processes. Mineral salts are taken in their ionic forms. Animals take in their elements mainly by feeding on plants or their products except a few, e.g. sodium chloride (table salt). Most of them are taken in small quantities. Occasionally, they are taken in form of tablets e.g. iron tablets.

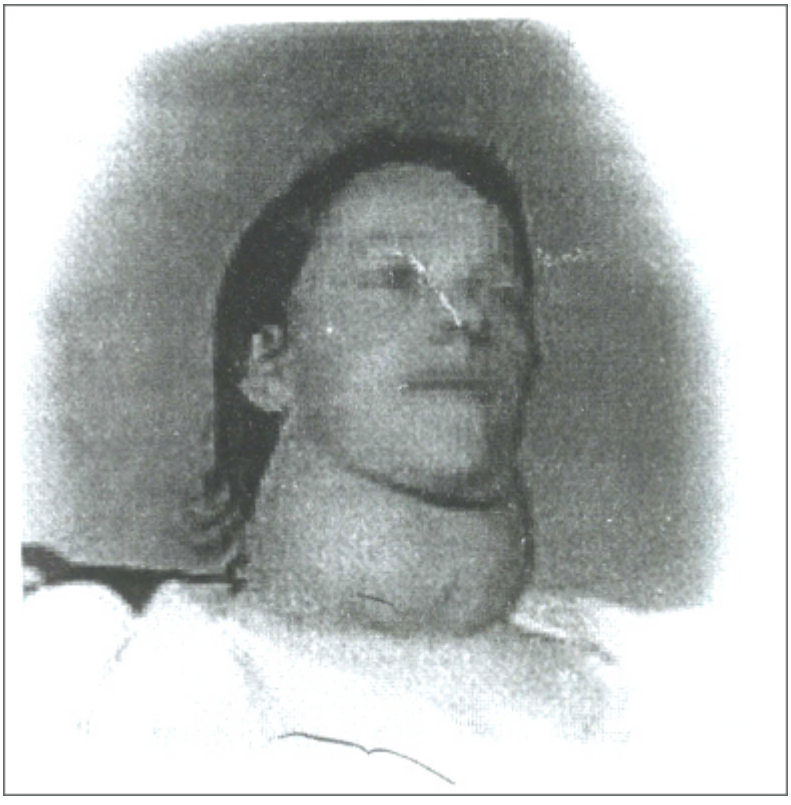

Fig. 3.2 A person with goitre caused by iodine deficiency.

A varied diet which contains calcium and iron will contain many other essential mineral salts. Lack of any essential element will lead to

mineral deficiency diseases – See *Table 3.1*. Some common sources of mineral salts are milk, egg, meat, fish, cereals and green vegetables.

Water: It consists only of hydrogen and oxygen in the ratio 2 to 1. Drinking is the main method of taking in water by man. Feeding on plants and their products is another source of obtaining water by man and many other animals.
Importance: Water is the main component of plants and animals. It is a basic component of manâ€™s body tissue comprising about 75 per cent. It is essential for life and for all biochemical activities of the body. It acts as a solvent for soluble food substances in digestion and as a medium of transport for nutrients.

It constitutes a large part of blood, aids excretion, regulates body temperature and maintains the osmotic content of body tissues. It is the basis of body secretions from endocrine glands and glands with ducts. Prolonged lack of water for just less than a week can be fatal to many animals including human beings.

Table 3.1 describes some of the mineral elements, their sources and importance.

Table 3.1 *Mineral elements*

Element	Sources	Importance	Deficiency diseases
Iron	Liver, kidneys, groundnuts, lean meat, egg, yeast, cocoa, raisins, beans, green vegetables, plaintains, okra.	Forms haemoglobin in red blood cells. Constituent of respiratory enzymes	Anaemia
Calcium as calcium phosphate	Milk, meat green vegetables, eggs, fish, bread, cheese.	Used in formation of bones and teeth. Controls normal clotting of blood. Needed for muscular contraction.	Rickets, dental decay, poor growth and deformationof long bones of the legs
Phosphorus (as calcium phosphate)	Proteinous foods, lean meat, fish eggs, milk, nuts, phosphates snails, vegetables, cheese.	Formation of strong bones and teeth, ATP which is involved in cell respiration and muscle action. Needed in nucleus of all cells and body fluids. Needed by pregnant women, nursing mothers and growing children.	Rickets, Dental decay
Iodine (a trace element)	Sea foods, salt, milk, iodized table salt, drinking water, prawn, crayfish, crab, etc.	Formation of thyroxin, a hormone of the thyroid gland Prevention of goitre.	Goitre. Reduced mental and physical development.
Flourine (trace element)	Drinking water, vegetables	Prevents tooth decay.	Tooth decay
Sodium (trace element) and Potassium (rarely deficient)	Table salt, vegetables, fruits, salted foods, fish.	Maintenance of tissue fluids, blood and plasma. Charge difference on membranes, transmission of nerve impulses.	Heat, muscle cramp

Roughage: This consists of plant fibres obtained from fruits, vegetables, carbohydrates and proteins. They are not nutrients but the intestinal walls do not function efficiently without them.

Balanced Diet

To grow properly and maintain good health, the human body needs a balanced diet. This is an adequate supply of all the classes of food i.e. proteins (10% – 15%), fats and oils (20%-35%), carbohydrates (50%-65%), water, roughage, vitamins and mineral salts in appropriate proportions. This is possible if a wide variety of food is eaten. A shortage of any of the classes of food may result in deficiency diseases. A very common disease is that due to absence or inadequate supply of protein (kwashiorkor). The importance of each class of food and their common sources have been described above.

Table 3.2 *Vitamins: Sources and importance*

Vitamin	Main sources	Importance	Deficiency diseases
Vitamin A	Fish, liver, eggs milk, carrots, fresh green vegetables and red palm oil	Needed for normal growth of body, skin and eyes	Eye diseases e.g. night blindness, reduced resistance to diseases.
Vitamin B_1 (Thiamine)	Unpolished cereals, yeast, palm wine, milk, beans, lean, meat and kidney	Needed for normal growth, keeps heart and nerves healthy	Beriberi — characterised by loss of appetite and weight, paralysis and tiredness.
Vitamin B_6 (Niacin)	Same as for Vitamin B_1, yams and green vegetables	Involved in cell respiration, heath of skin, digestive and nervous systems	Pellagra, skin diseases and digestive disorders.
Vitamin B_2 (Riboflaflavin)	Same as for Vitamin B_1, green vegetables, soya beans, eggs, milk and yeast	Needed for growth and health of skin and eyes	Sores in the skin, tongue and mouth, weak eyes and poor vision.
Vitamin B_{12} or cobalamine	Same as for Vitamin B_2	Red blood cell formation	Deficiency leads to pernicious anaemia
Vitamin C	Fresh fruits, fresh green vegetables	Increases resistance to infections and helps wounds to heal	Scurvy. It is characterised by bleeding gums, poor healing of wounds, lowered resistance to infection
Vitamin D	Formed in the skin by sunlight, fish, milk, egg and liver.	For strong bone and teeth formation	Rickets in children and bone deformities in adults, weak leg bones, poor teeth
Vitamin E	Green vegetables, liver, eggs	It promotes fertility in animals	Abortion and sterility in animals e.g. rats, disorders of muscles and nerves.
Vitamin K	Fresh green vegetables, especially cabbage and spinach	Enables blood to clot	Inability of blood to clot or prolonged bleeding.

Different people need different combinations of food. An actively growing child needs a diet different from that of a sick child. An expectant mother needs food combinations that are different from that of a woman who is not pregnant. A sedentary worker needs food with less calories than an active worker.

Reasons for deficiency diseases

1. Ignorance or lack of education on the importance of each food item especially proteins.
2. Poverty – Many foods, which are rich in proteins and vitamins are too costly for many poor people especially in developing countries like Nigeria.
3. Scarcity of certain food items – especially proteinous foods in some parts of the country.

Food Tests

Experiment 3.1. *To show the presence of water*

Dip a dry, blue, cobalt chloride paper in a food item. The colour of the paper changes from blue to pink. This shows that water is present.

Experiment 3.2. *Test for Proteins*

Biuretâ€™s Test

1. Take a small quantity of fresh milk, egg white solution or soya beans as sources of protein.
2. To 1cm^3 of any of the above, add sodium hydroxide and 1% copper(II) sulphate solution in drops.
3. Shake the mixture after each drop. Do not heat.

Observation: Solution turns purple or violet.

Inference: Protein is present.

Experiment 3.3 *Millonâ€™s Test*

1. Put 2cm of a protein substance, e.g. fresh egg in a test tube.
2. Add 2cm^3 of Millonâ€™s reagent carefully.
3. Warm in a water-bath for a few mintues.

Observation. A red precipitate would appear.

Inference. Protein is present.

Experiment 3.4 *Xanthoproteic Test*

1. Put a small quantity of a protein-containing substance in a test tube.
2. Add to it a small quantity of concentrated trioxonitrate(V) acid and excess ammonium hydroxide.
3. Warm the solution.
4. Cool afterwards.

Observation

1. After warming, orange-coloured precipitate would appear.
2. After cooling, a deep yellow colour appears.

Inference: Protein is present.

Experiment 3.5 *Test for Starch*

1. Take a starchy substance such as yam, bread, powdered starch or a cut maize grain.
2. Add a few drops of dilute iodine solution.

Observation: Depending on the concentration of the iodine solution, the colour changes into blue, blue-black or black immediately.

Experiment 3.6 *Test for fats and oils*

I. 1. Drop oil on a spot on a filter paper, tissue paper or newspaper.

2. Put another drop, this time around, of water beside the oil spot at once.

3. Let the drops dry out.
4. Observe the two spots against a source of light.

Observation

1. The drop of water would have disappeared.
2. The spot bearing drop of oil becomes more translucent, i.e. it allows more light to pass through when held in front of it.

Inference: The translucency shows the presence of fat or oil.

II. Add to a food substance a few drops of Sudan III solution. If a red colouration shows, then the substance is a fat or an oil.

III. Add to a food substance, a few drops of osmic acid with care. If a brownish-black colouration is shown, then the tested substance is a fat.

IV. Rub a food substance on a white piece of paper. If the spot on which the substance is so rubbed is translucent, then, the substance is a fat or an oil.

V. Emulsion Test:

1. Put some drops of groundnut oil or a small piece of margarine in a test tube.
2. Add 2cm^3 of ethanol to it.
3. Shake thoroughly and observe (A).
4. Pour the top part into another test tube which contains water.
5. Observe (B).

Observation

1. The fat or oil dissolves (A).
2. A milky appearance or a cloudy white precipitate results because tiny oil droplets spread in the water (B).

Experiment 3.7 *Test for Sugars*

1. Reducing sugars, e.g. glucose, maltose and fructose.
2. Non-reducing sugars, e.g. sucrose.
3. Simple sugars, e.g. glucose.
4. Complex sugars, e.g. sucrose.

A. *Test for reducing sugars.*

1. Put a small quantity of glucose solution in a test tube.
2. Add 2cm^3 of Benedictâ€™s solution.
3. Warm or boil this mixture for about five minutes.

Observation: A brick-red or orange precipitate is formed.

Inference: This shows the presence of a reducing sugar.

B. *Test for non-reducing sugars*

1. Put a small quantity of a sugary solution into a test tube.

2. Add about 2cm^3 of Benedictâ€™s solution.

3. Boil.

Observation If the solution does not give a yellow precipitate, it is a non-reducing sugar. Then, add a few drops of dilute hydrochloric acid. Boil for a few minutes, i.e. to hydrolyse the solution.

Observation: If a yellow precipitate shows, then sucrose or a non-reducing sugar is present.

C. *Test for Simple Sugar*

Fehlingâ€™s test

Mix equal volumes of Fehlingâ€™s solutions A and B just before use. To 1cm^3 of glucose solution, add 1 cm^3 of the Fehlingâ€™s mixture and heat to boil for 2 to 3 minutes. Observe

Observation

The solution changes from blue to green, then a yellow, orange, or reddish-brown precipitate indicating the formation of copper(I) oxide.

Inference: Simple sugar is present.

D. *Test for Complex Sugar*

To 1cm^3 of sucrose solution in a test, tube add 1 cm of dilute hydrochloric acid. Bring to boil in a water bath for five minutes (The dilute acid is needed to hydrolyse the sucrose and break it down to a simple sugar).

Cool the solution, then add sodium hydroxide (NaOH) solution until fizzling stops. This is to neutralise the acidity of the test tube content. Test with a litmus paper to ensure its neutrality.

Add Fehlingâ€™s solution already mixed. Bring to boil again in a water bath. Observe.

Observation

The colour changes from blue to green, then to orange or brick red.

Inference: A reducing sugar is present.

Digestive enzymes

Enzymes are organic catalysts. They are complex protein substances that are manufactured by living cells. They accelerate metabolic reactions without changing their composition in the process. Enzymes are produced by both plants and animals. They control many physiological processes. Enzymes may be named according to the processes in which they are involved. Examples are given below.

Processes	Enzymes
1. Photosynthesis	Photosynthetic enzymes
2. Respiration	Respiratory enzymes
3. Digestion	Digestive enzymes

Classification of Digestive enzymes

Enzymes may also be named according to the specific action they engage in by the addition of, *â€˜aseâ€™*, to a food class.

Proteases: These are protein digesting enzymes. They are not found in the mouth and large instestine. Rather, they are present in the stomach (e.g. rennin in children and pepsin in adults); duodenum (trypsin) and ileum (erepsin).

Amylases: They are enzymes which digest starches and sugars and convert them to glucose. Ptyalin (salivary amylase) is produced by the salivary glands in the mouth. It converts starch to maltose.

Pancreatic amylase is produced in the pancreas. It converts starch to maltose. Sucrase, maltase and lactase convert disaccharides into galactose, glucose and fructose.

Lipases: These are enzymes which convert fats and oils into fatty acids and glycerol. They are produced in the pancreas and the ileum.

Digestive enzymes are produced in certain glands and are then transported to where they carry out their functions. Usually, they are produced when food is in the alimentary canal. The glands can however also produce the enzymes if they are stimulated by the nervous system – especially the senses of sight and smell.

Characteristics of enzymes

1. Each enzyme is action-specific, i.e. an enzyme or a group of enzymes deal with one, and only one process. For example, a digestive enzyme is involved in digestion and nothing else. Also, a protein-digesting enzyme can digest only a protein-containing food.
2. Only a small quantity of an enzyme is required to catalyse a reaction.
3. Enzymes do not lose their chemical composition at the end of a reaction.
4. Enzymes have a specific temperature range; above or below which they become denatured or inactive . They work best at about 37Â°C, the optimal body temperature of a normal person.
5. Enzymes are affected by the pH (alkalinity or acidity) of a medium. An enzyme which is active in an acid medium, e.g. pepsin, becomes inactive in an alkaline medium and vice versa. They work best at specific pH levels.
6. Enzymes are usually involved in reversible reactions.
7. Enzymes are produced by glands of the system that require their effect, e.g. digestive enzymes are produced by various glands of the digestive system.
8. Certain enzymes are normally produced in an inactive form. Otherwise, they would digest the proteins of the cells which produce them. To perform their functions, they are activated by a co-enzyme or a precursor. For example, enterokinase activates

trypsinogen into trypsin; while chloride ions in the stomach activate pepsinogen into pepsin.

Table 3.3 shows enzymes, their pH, site of action, substrate and their effects.

Experiment 3.8 Test for enzymes

Ptyalin

1. Masticate a small piece of bread, yam or some *gari.*
2. Record the taste in the mouth at once (A).
3. Retain a small portion of this food material in a corner of your mouth.
4. After about 5-10 minutes, bring back the food item in the mouth with your tongue.
5. Record the taste again at once (B).

Table 3.3 *Enzymes –pH, Substrate and their effects*

Enzyme	Gland	Juice	*pH*	Site of action	Substrate	Effect
1. Ptyalin (sali-varyamylase)	Salivary glands	Saliva	alkaline	Mouth	Cooked starch	Converts starch to maltose
2. Rennin (in children, Pepsin in adults)	Gastric glands	Gastric juice	acidic (dilute)	Stomach	Protein	Converts proteins to poly-peptides and peptones.
3. Trypsin	Pancreas	Pancreatic juice	alkaline	Duodenum	Protein compounds	Continuation of the diges-tion of proteins to peptones
4. Amylase	Pancreas juice	Pancreatic	alkaline	Duodenum	Carbohydrate compounds	Continuation of the digestion of carbohydrates to Maltose
5. Lipase	Pancreas	Pancreatic juice	alkaline	Duodenum	Fats and oils	Conversion of fats and oils to fatty acids and glycerol
6. Erepsin	Small intestine	Succus entericus	alkaline	Small intestine (ileum)	Protein compounds e.g. peptones	Converts all protein comp-ounds into amino acids
7. Maltase, Sucrase Lactase	Small intestine	Succus entericus	alkaline	Small intestine	Maltose, Sucrose, Lactose	Complete digestion of car-bohydrates into glucose

Observation

1. (A) Taste is neither sour nor sweet.

   (B) Food material tastes sweeter than before. It has turned into a sugar.

Inference: A change has occurred on the food item. This is due to a substance present in saliva in the mouth. It is an enzyme called ptyalin or salivary amylase.

Experiment 3.9 *Activity on the effect of Saliva on starch.*

Method

1. Introduce 2ml of a 2% starch solution in three test tubes A, B, and C.
2. To A, add only saliva.
3. To B, add saliva and a few drops of dilute hydrochloric acid.
4. To C, add distilled water.
5. Keep all the test tubes in a beaker of water maintained at 37Â°C.
6. Take a drop of solution in A, B and C at intervals of 30 seconds.

7. Test with dilute iodine solution on a white tile labelled A, B, C respectively.

Observation

1. Material from A shows a brownish-yellow colour.
2. B and C show a blue-black colour.

Inference: The blue-black colour is the characteristic colour reaction of starch to iodine solution.

Explanation of colour reactions

In test-tube A, starch was no longer present, it had been converted by an enzyme (ptyalin) to maltose – a complex reducing sugar. That was why there was no characteristic blue-black colour reaction with iodine solution.

In Test-tube B, starch did not change. This is because ptyalin works in a slightly alkaline medium and not in an acidic medium. The enzyme was deactivated by hydrochloric acid.

In test-tube C, starch did not change. Hence, the positive iodine solution test reaction was obtained. This is because there was no ptyalin.

Inference: Ptyalin converts starch into a reducing sugar. It works in an alkaline medium. It is deactivated in acidic medium.

Experiment 3.10 *Action of pepsin on protein*

Method

1. Put three test tubes A, B and C in a beaker of water maintained at 37Â°C.
2. Put in each of the test tubes and a fourth one D, 5cm^3 of milk or egg-albumen suspension.
3. Add three drops of 10% hydrochloric acid to test tubes B, C and D only.
4. Add 1cm^3 of pepsin solution and sodium carbonate solution into test tube A.
5. Into B, add only dilute hydrochloric acid.
6. Into C, add pepsin and dilute hydrochloric acid.
7. Into D, add pepsin and dilute hydrochloric acid. Place it either in a refrigerator or in a beaker of boiling water.
8. A and C should neither be boiled nor put in a refrigerator.
9. Conduct Biuretâ€™s test at two minutes intervals. Alternatively put in:

   Test tube A — milk or albumen, pepsin and sodium bicarbonate solution.

   Test tube B — milk or albumen and hydrochloric acid

   Test tube C — milk or albumen, pepsin and hydrochloric acid.

   Test tube D — milk or albumen, pepsin, hydrochloric acid. Heat or

cool.

Conduct Biuretâ€™s test on the samples from each at two minute intervals.

Observation

1. Only C would give a pink colour. This is a positive test result for peptones.

Explanation of the reactions

Test tube A: Although the test tube contained pepsin, sodium carbonate gave it an alkaline medium. However, since pepsin works in acidic medium, the protein was not acted upon by the enzyme.

Test tube B: Contained no enzyme. Hence, no change took place; there was no colour change.

Test tube C: Had all the ingredients necessary. The protein, enzyme, acidic medium and adequate, temperature were available. The protein was converted to peptones. It gave a pink colour. This is a positive result for solutions containing proteins.

Test tube D: Contained all the elements as in C. However, because the mixture was boiled or kept in a refrigerator, the pepsin was deactivated. Hence, no pink colour (positive result) was obtained.

Conclusion

Pepsin works in acidic medium at 37Â°C converting proteins to peptones. It does not work in an alkaline medium. At very high temperatures (e.g. 100Â°C), it is destroyed or deactivated.

Suggested Practicals

1. *Classes of food*

(a) Compile a time-table of all the foods eaten at homes or in a boarding house for seven consecutive days.

(b) Class discussions will follow this exercise. Identify the various classes of food represented by the foods mentioned. At this point, balanced diet would be discussed — its meaning and importance.

(c) Deficiency diseases common in the school or locality should also be identified and discussed.

2. *Food tests*

(A) 1. Take four test tubes A, B, C and D.

2. Add to A, a small quantity of dilute iodine solution.

3. Add to B, a small quantity of osmic acid.

4. Add to C, small quantities of sodium hydroxide solution and copper (II) sulphate solution.

5. Add to D, some tap water.

(B) Test for the class of food which is present. Use 1cm^3 of each of the following food substances; starch, reducing sugar,

non-reducing sugar, simple sugar and complex sugar, protein and oil.

Summary

1. Animals feed on already made food substances. Plants are the primary sources of food for animals.
2. The food substances eaten by animals fall into seven classes – carbohydrates, proteins, fats and oils, roughage, mineral salts, vitamins and water.
3. Each class of food plays an important role in the normal functioning of man and animals. Their deficiency leads to certain deficiency diseases.
4. A balanced diet contains all classes of food in adequate proportions. Man must take balanced diet for proper healthy growth.
5. There are various food tests. Each is food specific. Tests can be performed on each class of food.
6. Some of the common food tests are iodine solution test for starch, Biuretâ€™s test for sugar, Millonâ€™s test for proteins, Sudan III test for fats and oils.
7. Enzymes are organic catalysts. They are found in every living cell of plants and animals.
8. Enzymes take part in various physiological processes, e.g. photosynthesis, respiration and digestion.
9. Digestive enzymes can work on different classes of food. These enzymes are proteases, amylases and lipases.
10. Some enzymes can work, both inside the living animal and under laboratory conditions.

Objective Questions

1. All of the following substances can supply mineral elements to man except
   A. carbohydrates
   B. drinking water
   C. lipids
   D. protein
   E. sunlight
2. Severe protein deficiency can result in
   A. night blindness
   B. rickets
   C. sterility
   D. kwashiorkor
   E. beriberi
3. In an enzymatic reaction involving, a protein, a protease and a peptone, the protein is referred to as
   A. reaction mixture.

B. an enzyme
C. a substrate.
D. a product
E. an enzyme substrate complex.

4. Which of the following enzymes requires an acidic medium to digest food in man?
A. Ptyalin.
B. Pepsin
C. Maltase
D. Galactose.
E. Erepsin

5. In a food test experiment, a student obtained a blue-black colouration. Identify the chemicals he used.
A. Fehlingâ€™s solutions A and B.
B. Sudan III.
C. Millonâ€™s reagent
D. Benedictâ€™s solution.
E. Iodine solution.

Essay Questions

1(a) Define the term balanced diet.
(b) State the importance of each class of food in a balanced diet.
(c) Give two reasons for the prevalence of deficiency diseases.

2(a) List **four** essential mineral elements.
(b) State their sources and importance to man.
(c) Mention two fat soluble vitamins and two water soluble vitamins.
(d) List the deficiency diseases that may result if the vitamins mentioned above are absent in a manâ€™s diet.

3(a) What is meant by the term enzyme?
(b) List five characteristics of enzymes.
(c) Describe an experiment to demonstrate the action of ptyalin on a named starch.

4. Draw a table of digestive enzymes showing the source, location, substrate and effect.