THE PROPERTIES AND FUNCTIONS OF THE CELL

CONTENT

Animal Nutrition

All living things feed in order to obtain energy for their daily activities and also to carry out their metabolic processes. Plants can manufacture their own food (i.e. make complex chemical compounds) from simple raw materials (CO_2 and H_2O) through the process of photosynthesis. Plants need minerals to make some of the complex compounds and these are obtained from the soil as mineral ions. Animals however cannot manufacture their own food, they depend directly or indirectly on plants. Nutrients that animals require are present in their diet.

Food Substances

All food taken in by animals can be divided into six groups of food nutrients namely Carbohydrates, Protein, Fats, Vitamins, Minerals, and Water. Fibre/roughage is also an important component of a diet but it is not a nutrient. All these are needed for a balanced diet, for humans.

Carbohydrates, Protein, Fat & oil, and Water are primary food substances and are necessary for the maintenance of life. Minerals salts and Vitamins are welfare food substances and are essential for the well being of an individual.

Types of Food Substances

A. Carbohydrates

These contain the elements carbon (C), hydrogen (H) and Oxygen (O). The ratio of hydrogen to oxygen is 2:1. Carbohydrates are represented by the formula Cx (H_2O)y. The major sources of carbohydrate are Sugar (e.g. glucose, maltose) and starches (e.g. yam, maize, rice).

Types of Carbohydrates

1. Monosaccharides/Simple sugars: These are made up of only one unit of simple sugar e.g.

(a) Hexose sugars: These consist of six carbon atoms arranged into a ring e.g. glucose, fructose and galactose. They make up the most important energy storage molecules in an organism. Their chemical formula is $C_6H_{12}O_6$

(b) Pentose sugars: These consist of five carbon atoms e.g. ribose and de-oxyribose. They are used in the formation of nucleic acids.

2. Disaccharides/Complex sugars: These are formed by the condensation (i.e. chemical bonding of two molecules) of two simple sugar molecules. They are represented by the formula $C_{12}H_{22}O_{11}$.

Examples are:

(a) Maltose (glucose + glucose – H_2O) found in malted cereals and spouting grains.

(b) Lactose (glucose + galactose – H_2O) found in milk.

(c) Sucrose (glucose + fructose – H_2O) found in sugar cane stems, ripe sweet fruits, sugar – beet and carrot.

NB: All sugars are sweet and soluble and provide energy in a ready-to-use form.

3. Polysaccharides: These are formed by the condensation of hundreds of simple sugar molecules. They are represented by the general formula $(C_6 H_{10}O_5)_n$ where n represents a large number. Examples include starch, cellulose, glycogen (animal starch). Starch and glycogen are insoluble and do not taste sweet.

NB: Condensation is a reaction in which two or more molecules join to form a large molecules with the removal of a molecule of water (H_2O) or some other simple molecule.

Importance of Carbohydrates

(i) They provide us with energy.

(ii) It provides heat during its oxidation which is used in maintaining body temperature.

(iii) It is used in building the exoskeleton of arthropods.

B. Proteins

Proteins are complex molecules made up of carbon, hydrogen, oxygen and nitrogen (N) many also have sulfur (S). They are long – chain molecules made up of smaller molecules called amino–acid. There are 25 types of amino acids and these occur in different numbers and order in different types of protein. Thus one protein is different from the other. Each individual amino acid joins the chain by means of a peptide bond.

During digestion the breakdown of protein occur in the following sequence;

Protein → Proteoses → Peptones → Polypeptides → Amino Acids.

Examples of Proteins

Examples of proteins include:

(a) Soluble proteins e.g. haemoglobin (in blood), enzymes (in water/cytoplasm), antibodies, and some hormones (e.g. insulin).

(b) Insoluble proteins e.g. keratin (a fibrous protein found in skin and hair), collagen (found in bones and cartilage), myosin and actin (found in muscle cell). Sources of protein include (a) animal sources such as fish, meat, milk, egg and cheese. (b) Plant sources such as beans, groundnut and soya beans etc.

Uses/Importance of Proteins

1. Protein is used for making body building substances which are necessary for building new cells and replacing old ones.
2. Essential for the repair of cells and worn- out tissues.
3. Essential for formation of enzymes
4. Essential for formation of hormones
5. Essential for formation of antibodies
6. Essential for formation of heamoglobin etc.
7. Essential components of cell membranes
8. It may be required to provide energy.

C. Fats and Oils

These are also called lipids and are composed of carbon, hydrogen and oxygen. Each fat molecule is made up of one molecule of glycerol attached to 3 fatty acids. There are different types of fatty acids and these form different fats with different properties. At room temperature fats are solid while oils are liquid. Lipids are macromolecules and have to be broken down into fatty acids and glycerol before they can be absorbed into the body. Sources of fats include margarine, butter, cheese, fatty meat, melon, groundnuts, palm fruits, castor oil seeds, lard etc.

Importance of Fats and Oils

1. Fats and oil are used for energy storage in the body. They provide more energy to the body than carbohydrate when metabolized.
2. They are solvents for fat soluble vitamins and also for hormones.
3. They are important components of cell membranes.
4. They help in maintaining the body temperature / for thermal insulation in the body. In cold countries, the fat layers under the skins of mammals act as insulators and prevent loss of heat from their bodies.
5. Fats give buoyancy to marine animals e.g. whales have a thick layer of blubber.

D. Mineral Salts

These regulate the metabolic activities within the body. They are also important components of enzymes, pigments and structural parts.

The major source of mineral salts is the diet. Examples of minerals include sodium, potassium, calcium, chlorine, phosphorus, magnesium, iron, copper, cobalt, fluorine and manganese.

Sodium calcium and phosphorus are needed in large quantities in the body while some others like iron and iodine are only needed in small quantities.

A lack of minerals in the diet results to ill health and development of symptoms of deficiency diseases.

Sources, Functions and Deficiency Symptoms of Some Minerals

Mineral	Function	Deficiency symptom	Sources / Dail
Iron	Formation of haemoglobin in red blood cells; myoglobin in muscle cells and enzymes involved in cell respiration.	Tiredness, lack of energy (Anaemia)	Liver, meat, cocoa green vegetables (
Calcium	Strengthens bones and teeth; needed for blood clotting, proper functioning of heart and nervous system, and normal contraction of muscles.	Weak, brittle bones and teeth (Rickets)	Calcium
Muscle weakness and cramps.	Milk, fish, green vegetables (1g)	Muscle weakness and cramps.	Milk, fish, green vegetables (1g)
Sodium	Important component of blood plasma; maintains correct osmotic pressure of body fluids; needed in transmission of impulses in nerves, sensory cells and muscles and for normal cell membrane permeability.	Dehydration muscle cramps, kidney failure.	Salt, natural foods meat, milk and eg