COMPONENTS OF FOOD

Carbohydrates:

As the name of the group suggests, it includes nutrients that are made up of carbon, hydrogen, and oxygen, and the ratio between hydrogen and oxygen is always 1:2. Such as glucose and fructose($C_6H_{12}O_6$), sucrose($C_{12}H_{22}O_{11}$). Carbohydrates can be further divided into two major subgroups on the basis of complexity in the chemical nature.

Sugars :

All sugars are carbohydrates and are simple in their chemical nature that is made up of one or two molecules of glucose only. Fructose is found in fruits and galactose is found in peas, which are made up of only one molecule of glucose, hence fructose and galactose are called monosaccharide. These are isomers of glucose (i.e., they have the same molecular formula but different chemical structure). Although these are all simple sugars, but we commonly hear of patients being given glucose through drips and also people who need instant energy are given by glucose solutions, since glucose is the simplest form of sugar that is soluble and gets easily absorbed in the blood. As no time is required for its digestion and absorption, it instantly burns to give energy to the body. Also, as it is already in the simplest form, the patient's body can easily utilise it without spending energy for its digestion. Lactose found in milk and sucrose, which is the common sugar, is made up of two molecules of simple sugars (monosaccharide), and hence, they are called disaccharide. Lactose is made up glucose and galactose, whereas sucrose is made up of glucose and fructose.

- ***Starch and Cellulose:***

It is a complex form of carbohydrate, as it is made up of many molecules of sugar, and hence, it is also called polysaccharide. It can be represented as$(C_2H_{10}O_5)_n$. **Starch is stored in plant food in the form of starch grains and in animals in the form of glycogen**. It is not soluble in water and forms a white paste in it. Rice, wheat, corn, potatoes, and beans are rich sources of starch. The digestion of starch requires breaking it down into simple sugars that are soluble in water and can be easily absorbed into the blood. All starch-rich food forms the essential part of staple diet for the people of most regions, as they are an appropriate source of energy. Cellulose is also a polysaccharide similar to starch made up of many molecules of glucose, but the linkage of glucose molecules is different. In starch, the linkage of the glucose molecules can be branched, but in cellulose, it is only linear. **Therefore, cellulose is more rigid and is commonly present as a structural polysaccharide in plants**. From the perspective of humans, cellulose is an indigestible component of food as human does not have enzymes required for breaking it down into glucose. Thus, in humans, cellulose is not a source of energy but acts as roughage. Roughage is the fibrous part of the diet, which helps in normal functioning of the alimentary canal by facilitating the bowel movements. By adding bulk to the food, it helps in expanding the alimentary canal and preventing constipation. Roughage is also an important component of food, because it helps in water retention in the body as it can hold water. Whole grain cereals, fruits, and vegetables are good source of roughage.

Fats:
Fats are also made up of carbon, hydrogen, and oxygen, but they contain more carbon and hydrogen as compared to carbohydrates. Therefore, fats give more than twice the amount of energy given by carbohydrates if compared taking quantities by weight. But still carbohydrates are considered as the primary source of energy because it is more difficult to get energy from fats than carbohydrates. Also excess of fats gets deposited in the cells and tissues in the form or body fat. On the basis of kind of bonding between their carbon atoms, fats can be divided into two subgroups:

1. Saturated fats:
These are fats that have single bond between their carbon atoms in their chemical structure, as they are saturated with hydrogen atoms. Saturated fats are mostly found in animal fats and in some plant sources such as coconut and palm oil. These are solid at room temperature, as they have high melting point during winter season. They get deposited in the arteries leading to heart diseases, hence should be taken in limited quantity.

2. Unsaturated fats
These are fats that have double bond between their carbon atoms in their chemical structure and they can get converted into saturated fats by taking hydrogen atoms. Unsaturated fats are mostly found plant sources, such as vegetable oils like sunflower oil, olive oil, mustard oil, soyabean oil, etc., and are also found in some animal sources such as fish oil and red meat. These are liquid at room temperature as they have low melting point during winter season. These do not get deposited in the body and can be taken in more amounts as compared to saturated fats.

Proteins:
These nutrients are made up of chains of amino acids. The amino acids are linked together in the chain by peptide bonds, and hence, the chain is called polypeptide. Each amino acid is made up of carbon, nitrogen, oxygen, and hydrogen of which nitrogen is the most important part of proteins, since the products of leguminous plants are rich in proteins, as they have nitrogen-fixing bacteria (rhizobium) in their root nodules, such as peas, beans, etc., other sources of protein include the animal proteins that are found in the egg white (albumin), meat, fish, and dairy products. Proteins consumed by the body are broken down into small polypeptide chains and further into amino acids by the action of enzyme protease and hydrochloric acid. These amino acids recombine to form various proteins required by the body. This digestion of proteins provides amino acids that cannot be synthesized by our body and hence have to be taken in the diet. Such amino acids are nine in number and are called essential amino acids. Valine, leucine, lysine, and histidine examples of essential amino acids. Proteins have several functions in the body.

1. Structural proteins: Proteins are the main structural components of the cells and the body parts, such as keratin in hairs, collagen in connective tissues (tendons and ligaments), and glycoprotein in the membranes.
2. Contractile proteins: Proteins are involved in muscle contraction and movement such as myosin and actin in the muscles.
3. Transport proteins: They are also involved in the transportation of substances in the body such as hemoglobin and myoglobin.
4. They act as storage molecules, such as iron, and bind with a protein ferritin and stored in the liver.
5. Hormonal proteins: Proteins also act as hormones, such as insulin, that regulate the blood sugar and oxytocin which stimulates contractions of muscles during child birth.

6. Antibodies: In the immune system of the body, they act as antibodies (immunoglobulin) that fight infections.

7. Enzymes: Enzymes are biocatalysts that regulate various processes in the body. Like pepsin
That helps in the digestion of proteins in stomach and lactase that digests lactose sugar. Most enzymes are proteins only, but some enzymes may be RNA molecules.

- If the body does not take energy-giving foods, proteins can burn to produce energy in the same amount as the same quantity of carbohydrate gives. If proteins are taken in more quantity by the body than required, it gets converted into fat and is stored.

Mineral Nutrients

These are inorganic chemical elements required by the body for different functions. Calcium is commonly associated with bones and teeth, iron with blood, and iodine with functions of the thyroid gland. Similarly, all minerals have specific functions in the body, which are given as follows. Minerals are generally found in yellow and green vegetables and fruits. The minerals are required in small quantity as compared to other nutrients and can be classified into two grouped on the basis of the quantity in which they are required:

Major nutrients or macro minerals

These are nutrients that are required in more quantity and are seven in numbers. These are calcium, potassium, phosphorus, sulphur, sodium, magnesium, and chlorine. Each of these macro minerals has a specific role in our body that facilitates in the proper functioning of the body parts. Hence, it is important that those food items should be included in our that are good sources for these minerals in the appropriate quantity. Table 1.1 list the specific functions and some of the sources for each of these macronutrients.

1.1 Macro minerals: Their sources and specific function in our body

Macrominerals	Specific functions	Sources
Chlorine	Part of stomach acid (HCI), needed for proper water balance,	Common salt (NaCl), processed soy sauce
Sodium	Maintains fluid balance in the body and helps in muscle contraction and nerve transmission	Common salt (NaCl), canned, and processed foods
Calcium	Provides strength to bones and teeth; blood Clotting, helps in muscle contraction and never	Milk and milk products; green leafy vegetable, almonds, legumes, fortified foods
Potassium	Needed for muscle contraction and nerve transmission, facilitates reactions in the body	Fruits like banana and milk, whole grains, legumes
Phosphorus	Needed for the calcification of bones and teeth; required for energy metabolism in cells;	Milk, Meat, fish, poultry, eggs.
Magnesium	Found in bones; needed for making protein, Muscle contraction, never transmission, Immune system health	Seafood, dark green leafy bles, legumes
Sulfur	Component of protein molecules	Protein-rich food such as milk, legumes, egg, etc.