
UNIT 3 MACRONUTRIENTS AND THEIR FUNCTIONS

In Unit 2 you have already learnt that nutrients perform several important functions in our body. In this unit, you will study about macronutrients and their functions.

Structure

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3.0 OBJECTIVES

After studying this unit you will be able to :

- state the functions and importance of each macronutrient in our diet;
- list the important food sources of each of these nutrients; and
- describe the effects of deficiency of these different nutrients.

3.1 INTRODUCTION

By now you know that carbohydrates, proteins, fats, vitamins, minerals and water are the nutrients present in the food. But these nutrients are not present in the same amount in various foods. Some of these are present in larger amounts and others in smaller amounts. All these nutrients are important as they have varied functions in the body. In this unit you will learn about

definitions of macronutrient and micronutrient, and the functions and sources of Macronutrients.

3.2 DEFINITIONS OF MACRONUTRIENTS AND MICRONUTRIENTS

In Unit 2, you have studied the functions of food. In order to perform these functions, food contains a number of essential constituents known as nutrients which help in the performance of functions of body. Each nutrient has its own specific function to perform. You know that the nutrients are divided into six different categories. These are:

- | | | |
|------------------|---|----------------|
| i) Carbohydrates | } | Macronutrients |
| ii) Fats | | |
| iii) Proteins | | |
| iv) Water | } | Micronutrients |
| v) Vitamins | | |
| vi) Minerals | | |

The macronutrients are present in larger amount in any food while the micronutrients are present in much smaller amounts. For example, a food like rice (raw, milled) has 78.2 gm per cent carbohydrates, 6.8 gm per cent proteins, and 0.5 gm per cent fats, while it has only 0.06 mg per cent of vitamin B, and 10 mg per cent of calcium. Green leafy vegetables like spinach contain 92 gm per cent water while the amount of vitamin C is only 28 mg per cent. Our body's quantitative need for the macronutrients is higher than the need for the micronutrients.

In this unit we will be learning about each of the macronutrients; their sources, functions and their effects on the body, if these nutrients are not present in adequate amounts in our diet.

3.3 CARBOHYDRATES

Most foods that we eat contain some amount of carbohydrates. Carbohydrate is the nutrient that we consume daily in the maximum amount. These, therefore, make up the bulk of our diet. Carbohydrates are either naturally present as in rice, wheat, fruits, potato, honey, etc., or added in the form of sugar to food such as ice-cream, cold drinks, tea, coffee and so on.

There are some carbohydrates which are complex like starches which the body has to digest in order to use them. There are others which are simpler in nature like glucose, which can be used by the body directly. Sugar which is so commonly used is also an easily digestible carbohydrate.

3.3.1 Functions of Carbohydrates

Given below is a brief description of five important functions of carbohydrates:

- i) **Energy giving action:** Carbohydrates are the main source of energy. Each gram of carbohydrate gives four Kcal of energy to the body. Although fats and proteins also provide energy, the intake of carbohydrates is much greater and so it is the most important source of energy to us.
- ii) **Protein-sparing action:** Proteins about which you will be studying in the Section 3.4 in this unit, are required by the body mainly for body-building purposes. At the same time, they can also provide energy to the body when there is a short supply of carbohydrates and fats. However, if proteins are used exclusively to give energy it is wasteful, because they are mainly derived from expensive foods and their function is body building. It is, therefore, important that we should have sufficient amount of carbohydrates and fats in our diets. This will spare the proteins for their main task of body-building which carbohydrates and fats cannot perform.
- iii) **Fat utilising action :** Carbohydrates when present in adequate amounts in the diet help in the proper utilisation of fats in the body.
- iv) **Flavour enhancing action:** Carbohydrates like sugar, honey and jaggery give flavour to the food, making it tasty and acceptable.
- v) **Digestive action:** There are some forms of carbohydrates called fibre or roughage which are not digested by the body and therefore do not provide any energy. These are however, important to us. They give bulk to the diet and so help in normal movement of the food in the gastro-intestinal tract. This helps to prevent constipation. These are present in coarse grains, and green leafy vegetables.

CARBOHYDRATES ARE THE MAIN AND EASILY DIGESTIBLE SOURCE OF ENERGY

3.3.2 Sources

Sugar, jaggery and honey are pure carbohydrates. Cereals, pulses, roots and tubers like potatoes, sweet potatoes, beet root and yam, are very rich sources of carbohydrates. Fruits especially bananas, mangoes, pineapples and grapes are also a good source of carbohydrates.

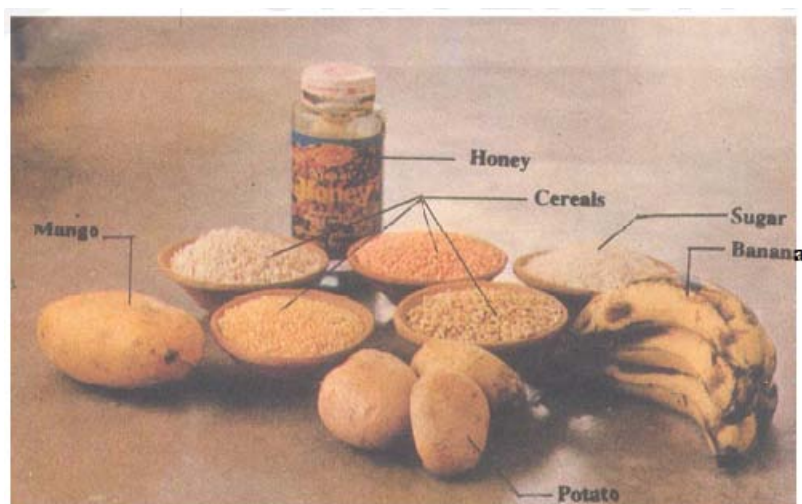


Figure 3.1: Carbohydrate-rich foods

3.3.3 Effects of Deficiency and Excess on the Body

The effects of carbohydrates on the human body can be related to their deficiency or excess in diet. Lack of carbohydrates in the diet: basically causes lack of energy. This leads to underweight, tiredness and poor work efficiency.

Excess of Carbohydrates in diet: If our diet has excess carbohydrates, it is converted into fat and stored in our body. Therefore, an increased intake of carbohydrates leads to overweight. This in turn can be one of the causes for other diseases like diabetes, high blood pressure, etc.

Practical Activity 1

List five good sources of Carbohydrates that you commonly consume.

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3.4 FATS

Fats are the concentrated sources of energy in our diet. They form an important part of our daily food. Though we mainly consume fats in the form of butter, ghee, oils, etc. some amount of fat is also present in foods like milk, nuts and meat.

3.4.1 Functions of Fats

We will discuss six major functions of fats:

- i) **Source of energy** : Fats are the richest sources of energy. One gram of fat gives 9 Kcal which is more than double the amount obtained from equal amounts of carbohydrates and proteins
- ii) **Carrier of fat soluble vitamins** : Some fat-soluble vitamins like A, D, E and K need fat for their proper absorption and utilisation in the body. The body can suffer from deficiency of these vitamins, if enough fats are not present in the diet.
- iii) **Insulation**: The layer of fat under the skin helps in maintaining body temperature.
- iv) **Protection** : Fats act as a cushion to important organs in the body and protect them from shocks and external injuries.

- v) **Palatability** : Fats are used for cooking and frying and so make the food tasty and acceptable.
- vi) **Satiety value** : They take longer time to be digested in the body. This gives us a feeling of fullness and satisfaction.

**FATS ARE CONCENTRATED SOURCE OF ENERGY
AND MAKE YOUR FOOD TASTY.**

3.4.2 Sources

Fats are obtained from vegetable as well as animal sources. What constitutes these two sources?

Vegetable sources: Vegetable cooking oils are extracted from oil seeds and nuts such as groundnut, mustard, sesame (til), soyabean, cotton seed and coconut.



Figure 3.2 (a) Source of vegetable fats

Animal sources : Milk, egg yolk and fats like ghee, butter, cream, fish liver oils are some of the fats of animal origin.

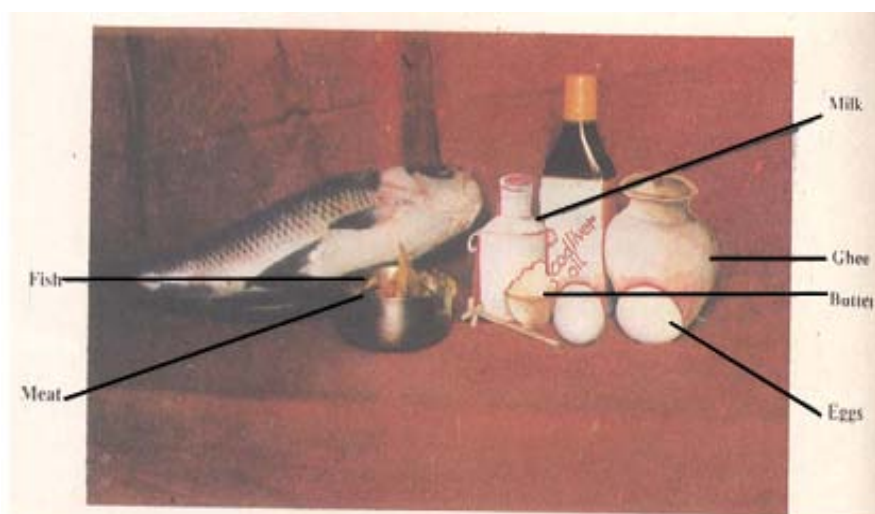


Figure. 3.2 (b) Sources of Animal fats

3.4.3 Effects of Deficiency and Excess on the Body

Deficiency of fat: Fats affect the body when either they are deficient or in excess. Lack of fats in the diet basically causes lack of energy. This leads to underweight, tiredness and reduced work efficiency. The body can suffer from deficiency of vitamins like A, D, E, and K if enough fat is not present in the diet.

Excess of fat: Excess of fat in our diet leads to overweight. This in turn can be one of the causes of diseases like diabetes, heart disease and high blood pressure.

EXCESS OF FAT IN DIET LEADS TO OBESITY

Check Your Progress Exercise 1

- 1) List three function of fats:
 - a)
 - b)
 - c)
- 2) Mention five good sources of plant and animal fats.
 - a)
 - b)
 - c)
 - d)
 - e)

3.5 PROTEINS

Protein is the chief component of all body tissues. We obtain proteins mainly from animal foods like milk and milk products, meat, fish and egg. Pulses and nuts are also good sources of protein.

3.5.1 Functions of Proteins

There are three important functions of proteins.

- i) **For growth and maintenance:** Proteins are required for growth and maintenance of the body tissues. More protein is required by the body during periods of growth for if is needed to build up new tissues. Therefore, children need more proteins per unit body weight to grow normally. Pregnant mothers need more protein for the growth of the foetus. Also, lactating mothers need extra proteins to help them in the secretion of milk.

**INCLUDE PROTEIN RICH FOODS FOR INFANTS,
CHILDREN, PREGNANT AND NURSING MOTHERS**

- ii) **Regulation of body processes:** Many body processes are controlled by the presence of proteins in the body. For this, proteins present in the form of enzymes and hormones help to regulate a number of important body processes. Proteins also give resistance to the body to protect itself against infections.
- iii) **Proteins as a source of energy:** One gram of protein provides four Kcal. But protein foods are expensive sources of energy. As already explained under carbohydrates, it is preferable to use proteins for body building only, by providing enough carbohydrates and fats in the diet so that proteins are spared. This is called protein sparing action.

3.5.2 Sources

Protein is obtained from the following two sources:

Animal protein sources: These include milk, egg, meat, fish, poultry and milk products like cheese, curd, khoa. These foodstuffs have good quality proteins or complete proteins as they are completely used up by the body.

Vegetable protein sources: Pulses like whole and split, soyabeans, nuts and oil seeds like peanuts, almonds and cashewnuts are rich sources of vegetable protein. Cereals like wheat and rice also provide some amount of protein. The proteins of these foodstuffs are not of good nutritional quality. If anyone of these foods is the only source of protein in the diet the protein is not completely used. However, a combination of these foods or their combination with any animal protein food improves their protein quality and they are used better. It is nutritionally better to use a mixture of cereals and pulses at a meal rather than using either cereals or pulses alone. Khichri, rice and dhal, missi roti (wheat flour + besan), idli, and dosa are some good examples of cereal and pulse combinations. Similarly addition of even a small amount of milk, curd or other animal protein like meat, fish improves utilisation of plant proteins, for example rice kheer, khichri with curd.

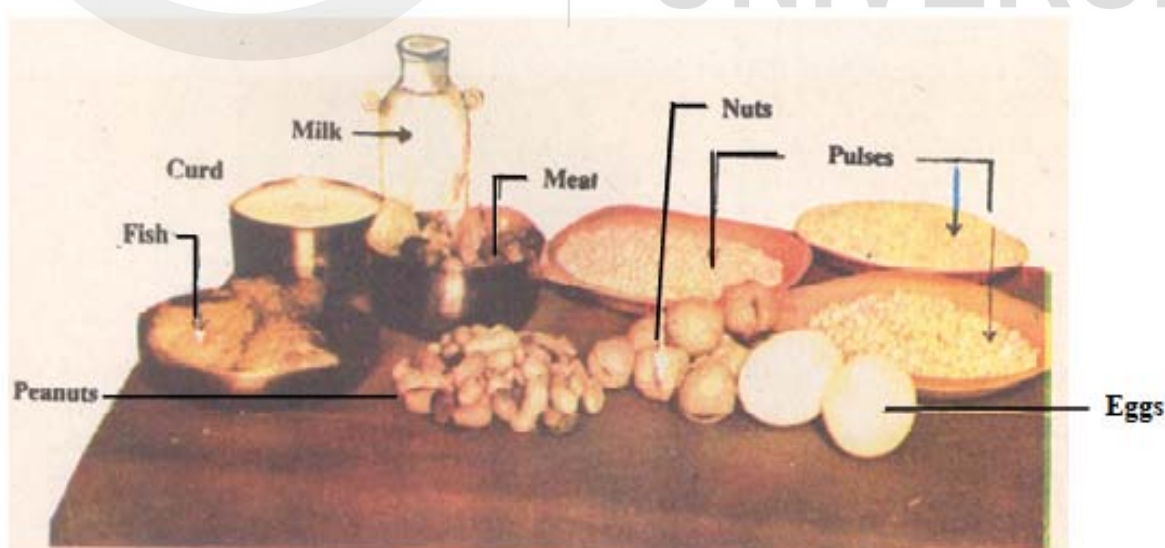


Figure 3.3: Protein-rich foods

**MIXTURES OF CEREALS AND PULSES ARE
GOOD FOR GROWTH OF CHILDREN**

3.5.3 Effects of Deficiency and Excess on the Body

Protein deficiency generally affects the children adversely and this condition is called ‘Kwashiorkor’.

This leads to retardation in normal growth pattern. In severe cases there is odema as well as changes in the hair and skin. It can lead to a lowering of resistance to infections, and children often suffer from diarrhoea.

In pregnant mothers, deficiency of protein in the diet retards the growth of the foetus. In lactating mothers it could lead to less production of milk.

Check Your Progress Exercise 2

- 1) Write three functions of protein
 - a)
 - b)
 - c)

Practical Activity 2

List four dishes which you prepare at home using combination of cereals and pulses.

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3.6 WATER

Water is the abundantly distributed nutrient in our body. It constitutes about two- thirds of our total body weight. It is present in every cell of the body tissues. Its basic functions are that of giving structure to the cell and participating in metabolic activities.

Water is important to maintain our body temperature. It also acts as a medium in which the body substances can dissolve and thus be transported to different tissues for metabolic activities. It is also the main component of urine formed in the body, thus helping in the excretion of waste material. As water surrounds the internal body tissues, it protects them from external shocks and injuries. We should take plenty of water as such or in the form of juices, milk and beverages like tea.

**TAKE PLENTY OF WATER DAILY IN ANY FORM
SO AS TO KEEP YOURSELF HEALTHY AND TO
PREVENT DEHYDRATION.**

Check Your Progress Exercise 3

1) Why is water considered important for our body? Write your answer in about five lines.

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Practical Activity 3

List three common foods rich in the following two nutrients and indicate the cost (per 100 gm)

- a) Energy
- b) Protein

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3.7 LET US SUM UP

You have just read that food contains various nutrients which have very specific functions to perform. Macronutrients are present in larger amounts in food while micronutrients are present in smaller amounts. Carbohydrates, fats, proteins and water are macronutrients.

Carbohydrates mainly provide energy and form the bulk of the diet. They are found in cereals, roots and tubers, sugar, jaggery, fruits, etc. Fats are concentrated sources of energy and are present in our diet in the form of ghee, vanaspati and oils, nuts and oilseeds, milk and egg yolk. Protein is the chief component of all tissues and is responsible for body building and repair of tissues. Milk and milk products, meat, fish, egg, pulses, nuts and oilseeds contain a good amount of protein. Water performs many different functions in the body. It is important to take plenty of water as such or in the form of different beverages.

3.8 GLOSSARY

- Gm per cent** : Grams of particular nutrient in 100 gm of food.
- Enzyme** : A protein substance produced by living cells which controls chemical changes without undergoing any change in itself.

- Foetus** : The young embryo (child) growing in the womb of the mother.
- Gastro-intestinal tract** : The tract extending from the mouth to the rectum through which food passes during the process of digestion and absorption.
- Hormone** : Secretion of an internal body gland which regulates various body processes.
- Lactating Mother** : A mother who is breastfeeding the child.
- Resistance** : Ability of the body to resist diseases in the body.

3.8 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

- 1)
 - a) Energy giving
 - b) Absorption and utilisation of fat-soluble vitamins
 - c) Maintenance of body temperature
- 2)
 - a) Groundnut oil
 - b) Mustard oil
 - c) Coconut oil
 - d) Ghee
 - e) Cream

Check Your Progress Exercise 2

- 1)
 - a) Growth and maintenance
 - b) Regulation of body processes
 - c) Protection from infections

Check Your Progress Exercise 3

- 1) Water is needed for giving structure to the body, metabolic activities, maintenance of body temperature, as medium for transport, and utilisation of body substances. It also helps in excretion of waste products. It protects us from external shocks