

## UNIT SIX Mineral Salts

### Learning objectives

At the end of this unit, students will be able to:

- Define minerals
- Describe the functions of minerals
- Understand the sources of minerals
- Identify the deficiency of minerals

### Definition

Minerals are elements that are essential for body functions that can't be synthesized in the body. They are vital elements without which life cannot continue, and their deficiency leads to serious pests.

Dietary minerals are divided into three groups:

- 1. Major minerals:** those that the human body needs more than 100 mg/day, and they are: calcium, phosphorous, sodium, potassium, magnesium, chlorine, sulfur.
- 2. Minor minerals:** the body needs less than 100 mg/day, which are: iron, iodine, zinc, copper, manganese, chromium, cobalt, selenium, molybdenum.
- 3. Secondary metals:** May be necessary, namely: silicon, nickel, tin, arsenic, aluminum, boron, vanadium.

### Benefits of minerals

1. Interfering with the composition of tissues, such as calcium and phosphorous in the bones.
2. It plays a key role in water metabolism, such as sodium and potassium.
3. It has a role in cellular functions.
4. It is involved in the installation of many vitamins and enzymes.
5. For normal muscular activity the ratio between potassium and calcium in the extra cellular fluid is important.
6. Integral parts of organic compounds in the body such as:
  - Iron in haemoglobin
  - Iodine in thyroxin
  - Cobalt in vitamin B12.
  - Zinc in insulin
  - Sulfur in thiamine.

## ❖ Calcium

**The normal level in the blood:** 8.2 -10,2 mg/100 ml.

**Physiological daily requirement:** 500-2000 mg/day.

**Adult:** 8 mg/kg/day

**Pregnant and breastfeeding women:** 24 mg/kg/day

**Children:** 17 mg/kg/day.

### Functions of calcium

- It accounts for about 2% of body weight, and 26% of the dry weight of bone and teeth
- An essential component of neuromuscular function.

### Sources of calcium

- Milk and its derivatives are the main source of calcium. In addition to eggs, meat, fish and some vegetables.
- The presence of vitamin D and exposure to sunlight contribute to an increase in the level of calcium and its absorption.

### Factors affecting calcium absorption

**1. Calcium content in food:** the intestine absorbs about 30% of the dietary calcium intake, but if the calcium content in the meal is low, the percentage doubles to 50%.

**2. Relationship with meals:** It is preferable to take calcium-containing compounds about an hour before a meal to prevent the formation of non-absorbable calcium salts.

**3. Intestinal motility:** absorption is reduced in case of diarrhea or taking laxatives

**4. The composition of the meal:** Cereals contain phytates that combine with calcium, forming insoluble calcium phytates (the phytates are destroyed by cooking, so good cooking reduces its harmful effects). Food rich in oxalates such as spinach forms with calcium the insoluble calcium oxalate.

**5. Vitamin D:** Calcium absorption from the intestine and its fixation on the bones depends on the presence of vitamin D, which either comes from food or is synthesized from cholesterol in the adipose tissue under the skin when exposed to sunlight, but in order for it to turn into an effective form, there must be PTH with normal renal tissue, **so vitamin D deficiency is seen in the following cases:**

- Not enough exposure to the sun
- In patients with renal insufficiency
- In hypoparathyroidism
- In intestinal malabsorption

### Deficiency

- **Chronic calcium deficiency leads to** osteomalacia, depression, memory disorder, brittle nails and hair, and skin roughness.
- **Severe calcium deficiency leads to** tetany attacks (painful muscle spasms and hyperexcitability of the nervous system).

## ❖ phosphorous

### Functions of phosphorous

- Phosphorous participates with calcium in the formation of bones
- Phosphorous plays an important metabolic role, as it enters the formation of vital energy-carrying complexes ATP
- It enters in the synthesis of amino acids and many enzymes

**The average daily need** 500-1000 mg/day.

### Sources of phosphorous

It is found in milk and its derivatives, meat, fish and eggs.

### Deficiency

Cases of deficiency are rare and may be seen in patients who take long-term antacids (such as aluminum hydroxide) because they reduce its absorption.

## ❖ Sodium

### Functions of sodium

- Its role is to contribute to the water balance in the organ and to the acid-alkaline balance
- Muscle contraction.
- Sodium is the main cation outside the cells and prevents dehydration
- Maintains arterial pressure
- Sodium ion is a specific transport factor for glucose through the intestinal cells to the blood.

**The daily requirement** averaging 3-9 g/day. **It varies with the degree of:**

1. Sweating
2. fluid loss
3. stage of growth

### Sources of sodium

It is found in many foods, especially those of animal origin, in table salt, and in all preserved foods.

### Deficiency

Deficiency is rare, **except in cases of excessive** sweating, physical exertion, severe urine output, and severe vomiting.

### ❖ Potassium

#### Functions of potassium

- It participates in maintaining the balance of electrolytes and fluids and controlling arterial pressure.
- It is an intracellular moiety.
- It has a role in neuromuscular transmission
- It has a role in insulin secretion
- It has a role in cell metabolic processes such as protein synthesis and energy production.

**Daily need** 3-4 g/day.

#### Sources of potassium

The richest foods in it are fresh vegetables, fruits and grains.

**Deficiency** The deficiency is seen in diarrhea and diuretics.

Potassium deficiency leads to cardiac arrhythmia, muscular weakness and constipation.

### ❖ Magnesium

#### Functions of magnesium

- It acts as a catalytic mediator in many cellular reactions
- It activates the synthesis of proteins from amino acids
- Facilitates the synthesis of the genetic material DNA
- Contributes to the transmission of nerve impulses to the muscles
- Acts as a muscle relaxant.

**Daily need** 100-300 mg/day.

#### Sources of magnesium

It is found in cereals, leafy green vegetables, dried fruits and chocolate.

#### Deficiency

Its deficiency leads to muscle weakness and convulsions (seen in alcoholics).

### ❖ Iron

#### Functions of iron

- Its primary role is in cellular respiration. Iron enters the synthesis of heme, which is an essential part of hemoglobin in red blood cells and myoglobin in muscles.

- It also enters the synthesis of important enzymes and cytochromes.
- Iron that is not bound to heme is bound to proteins and represents a reservoir of iron in the body.

**The daily requirement** is estimated to average 10-15 mg/day. **It varies according to:**

- Age
- Gender
- Pregnancy
- Lactation

The human body contains about 5g of iron, 60-70% of which is found in hemoglobin.

### Sources of iron

**Animal foods:** liver, red meat, eggs

**Plant foods:** grains, leafy green vegetables, beans and lentils.

The heme iron found in animal products is better absorbed than the non-heme iron found in plant sources. Animal iron is absorbed by 15 to 35% and vegetable iron by 2 to 20%.

Iron of animal is present in the form of **porphyrins** that are absorbed as they are and are not affected by the food's phytate content, or in the form of inorganic mineral salts, so the absorption of iron of animal origin is better than that of vegetable iron.

The acidity of the stomach helps to absorb it, as it provides the absorbable chemical form in the duodenum and the first jejunum. It is recommended to take vitamin C with a meal rich in iron (where triple iron is due to an absorbable binary).

### Deficiency

Iron deficiency **leads to** hypochromic anemia, and is **caused by** dietary iron deficiency, intestinal malabsorption, or bleeding.

### Iron deficiency symptoms

1. Fatigue and failure quickly
2. Rapid heartbeat, shortness of breath and headache, especially when exercising
3. difficulty concentrating
4. Dizziness
5. pallor of the face
6. Leg cramps
7. Insomnia
8. brittle nails
9. hair loss

## ❖ Iodine

### Functions of iodine

- It is required for normal physical and mental growth.
- It is required by the thyroid gland for the production of thyroxin, which regulates the metabolic rate.

**Daily need** 150 mcg/day

### Sources of iodine

It is found in fish and marine products, and in plant foods, it depends on its concentration in agricultural soils that are poor in mountainous areas and adjacent to the sea.

Iodine is naturally found in **the top soil**, most of the areas specially in the high lands, the top soil is eroded with deforestation, soil erosion and flooding, thus the crop we grow for food do not have iodine in them and as a result leads to iodine deficiency. People of all ages and sexes are vulnerable but become acute in fetus, children, pregnant women and lactating mothers.

### Deficiency

Deficiency **leads to** enlargement of the thyroid gland or a disturbance in its work.

### Iodine deficiency symptoms

1. Mental retardation
2. Defects in the development of nervous system
3. Impaired work performance
4. Decreased average intelligence
5. Loss of memory
6. Lower birth weight
7. Growth retardation
8. Impotency.

### Discussion questions

1. What are the benefits of minerals?
2. What are the functions of calcium, phosphorous, sodium, potassium, magnesium, iron and iodine?
3. What are the factors affecting calcium absorption?
4. What are the causes of iron deficiency?
5. What are the Iron deficiency symptoms?
6. What are the iodine deficiency symptoms?

## UNIT SEVEN Water

### Learning objectives

At the end of this unit, the students will be able to:

- Explain the importance of water,
- Tell the sources of water and the relation to body function,
- State the distribution of water in the body,
- Describe the normal and abnormal water loss from the body.

### Importance of water

1. Entering into the composition of cells and tissues
2. Improving the immune system.
3. Improving the functioning of the digestive system and reducing the occurrence of constipation.
4. Helping lose weight.
5. Helping the kidneys get rid of kidney stones.
6. Helping the body get rid of toxins and give the skin freshness.
7. Enhance energy levels, and raise the rate of blood and muscle cell production.
8. Reducing the rate of dehydration in the human body.
9. Regulating the temperature of the human body, which helps to feel energetic and energetic all the time.
10. Keep the mouth moist, so the bad smell caused by dry mouth will disappear.

### Body water

- About half of the adult body weight is water 55% for man and 47% for woman.
- About 2000 to 2500 cc of water is eliminated every day from the body carrying waste products with it.
- The lost water has to be replaced in the form of fluid or foods containing water.
- Although some water is formed, as end products of food metabolism, from 6 to 8 glass of water should be drunk every day,

### Normal loss of water

- From the skin, as perspiration
- From the lung, as water vapor
- From the kidney, as urine
- From the intestine, in the fasces

### Abnormally loss of water

- Due to kidney disease
- If there is excessive perspiration due to high environmental temperature.
- Due to diarrhoea and vomiting
- Due to haemorrhage and burn

### Dehydration

The term dehydration implies more than changes in water balance. There are always accompanying changes in electrolyte balance. Factors causing dehydration: when the water supply is restricted or when losses are excessive the rate of water loss exceeds the rate of electrolyte loss. Then the extra cellular fluid becomes concentrated and osmotic pressure draws water from the intra-cellular fluid into the extra-cellular fluid to compensate. This condition is called extreme thirst and dehydration.

### Discussion questions

1. Discuss the distribution of water in the body.
2. Mention the importance of water,
3. Describe the factors causing dehydration.

## UNIT EIGHT Basal Metabolism

### Learning objectives

After the end of this unit, the students will be able to:

- Understand what basal metabolism is.
- Explain factors that affect basal metabolism.

### Definition

Basal metabolism is the energy required to carry on vital body processes at rest, which include all the activities of the cells, glands, skeletal muscles tone, body temperature, circulation, and respiration.

### Factors affecting basal metabolism

1. **Size and shape:** The greater the skin area, the greater will be the amount of heat lost by the body and, in turn, greater the necessary heat production by the individual. E.g. tall person needs more food than short person with the same weight.
2. **Age and growth:** They are responsible for normal variation in basal metabolism. The relative rate is highest during the first and second years and decreases after that, although it is still relatively high through the ages of puberty. During adult life there is a steady decrease in rate with a marked drop in old age.

3. **Sex** :Sex probably has little effect on metabolism. Women have a lower metabolism than men. Women usually have a less fat and less muscular development than men.
4. **Climate**: Climate has little effect on BMR, which is always measured in a room temperature.
5. **Racial**: Differences in metabolism have been noted. Eskimos have been reported to have a BMR above accepted standards.
6. **State of nutrition**: In starvation or under nutrition the BMR is lower.
7. **Diseases**: Diseases such as infection or fevers raise the BMR in proportion to the elevation of the body temperature. The internal secretion of certain glands such as the thyroid and the adrenal, affect metabolism. Hyperthyroidism accelerates metabolism by increasing production of thyroxin.
8. **Sleep**: Sleep varies depending on individuals, some are restless and others are quiet.
9. **Pregnancy**: After four months of gestation the BMR will increase.

### Discussion questions

1. What do you understand about basal metabolism?
2. Explain factors that affect basal metabolism.