Minerals and Electrolytes

Electrolytes •

- Electrolytes are small, inorganic substances either single mineral elements or small compounds that can dissociate or break apart in solution and carry an electrical charge.
- These charged particles are called ions .

- **In any chemical solution , separate particles are constantly in balance between anions and Cations to maintain electrical neutrality.**

Cations are ions carrying a positive charge , e.g.,

- Sodium [Na^{+}] .
- Potassium [K^{+}] .
- Calcium [Ca^{2+}] , and
- Magnesium [Mg^{2+}]

Anions

Anions are ions carrying a negative charge e. g. ,

- Chloride [Cl^-] .
- Bicarbonate [HCO^{3-}] .
- Phosphate [$PO4^{3-}$] , and,
- Sulfate [$SO4^{2-}$] .
- Electrolytes can freely diffuse across most membranes of the body , thereby maintaining a constant balance between the intracellular and extracellular electrical charge .

Minerals

Minerals (inorganic elements) serve as catalysts in biochemical reactions.

They are classified according to their daily requirement (macrominerals, and microminerals)

Major macro minerals required by the body are:

1. Calcium. 2.Phosphourose. 3. Magnesium.

- **Calcium and phosphorus make up 80 % of all mineral elements in the body.**

Microminerals such as copper, fluoride, iodine, iron, selenium, and zin

- **play essential roles in metabolism.**

Minerals are inorganic elements that originate from rocks within the earth's crust.

Unlike organic substances in the body , minerals do not break down during metabolism , though they can combine with other compounds as they are incorporated into the body , for example , iron becomes part of hemoglobin in the red blood cell and zinc is incorporated into metabolic enzymes.

Functions of Mineral

1. Providing structure in the form of bones , teeth , and soft tissue (Example ,Calcium ,

Phosphorus , Fluoride) .

2. Exerting osmotic pressure to maintain fluid balance (Example , sodium ,potassium) .

3. Assisting in acid- base balance of fluids (phosphorus, HCO_3^-) .

Serving as cofactors and coenzymes for metabolic and hormonal reactions (iodine ,zinc , selenium , copper) .

Playing a role in crucial nerve transmission and muscle contraction . (e.g. , Sodium , potassium , magnesium , calcium)

.Categories of minerals

1. Macro minerals are those that people require daily in amounts over 100 mg. They include calcium, phosphorus, sodium, potassium, magnesium, chloride, and Sulphur.

2. Microminerals are those that people require daily in amounts less than 100 mg. They include iron, zinc, manganese, iodine, fluoride, copper, cobalt, chromium, and selenium. Common problems associated with the mineral nutrients are iron deficiency resulting in anemia, and osteoporosis resulting from loss of bone calcium.

Major minerals

1. Calcium

Functions

a. Structural component of bones and teeth .

b. Nerve impulse conduction .

c. Muscle contraction

Food Sources

Milk ,Yogurt ,Cheese ,Fish , fortified soy products , fortified juices ,green leafy vegetables .

Deficiency symptoms:- osteoporosis.

Toxicity symptoms :- Risk of kidney stones , high blood calcium calcification of soft tissues .

Recommended intake

In adults age 19-50 years 1000 mg/day ,during adolescence when bone depositionis increased to 1300 mg/day.

2 .Phosphorus

Functions

a. Structural component of bones .
b. Synthesis of ATP phospholipids.
c. Acid –Base balance

Food Sources

protein –rich foods such as dairy , meats, poultry and legumes .

Deficiency Symptoms :- Dietary deficiency rare hypophosphatemia → anorexia , muscle weakness , confusion.

Toxicity Symptoms :- Is rare with normal kidney function .

Elevated blood phosphorus → Calcification of tissues .

Recommended intake

In adults age 19 years and older the RDA is 700 mg/day

.3. Magnesium

function

a- Coenzyme of metabolism, muscle and nerve action

b- maintenance of heart rhythm, aids thyroid hormones secretion.

Food sources

Green leafy vegetables whole grains , nuts , legumes .

Deficiency Symptoms :- Low blood magnesium → neuromuscular excitability , cardiac arrhythmias.

Toxicity Symptoms :- occurs with supplements only diarrhea , mental status changes , muscle weakness , arrhythmias .

Recommended intake :- in males between 19-30 years the RDA 400 mg/day increased to 420 mg/day after 30 years , in females the RDA 310 mg/day from age 19-30 years and increased to 320 mg/day after age 30 years .

4. Sulphur Functions

a. Component of some amino acids (methionine and cysteine) , bile salts

b. Synthesis of connective tissue , fibrinogen , estrogen, heparin

Food Sources

Drinking water , high protein food.

Deficiency Symptoms :- Is rare , growth stunting .

Toxicity Symptoms :- Acute toxicity → osmotic diarrhea.

Recommended intake :- 2.8 mg /day.

5. Sodium (Major extracellular fluid control water balance)

Functions

a. acid-base balance , muscle action.

b. maintenance of plasma volume .

c. Cell membrane potential and active transport of substances across cell membranes.

Food Sources

pickled foodsمخللTable salt , processed and convenience foods , smoked and

Deficiency Symptoms :- Decreased extracellular fluid volume .

Toxicity symptoms :- altered fluid volume and potential for increased blood pressure.

Recommended Intake :- 1.5 gm /day for adults 19-50 years.

6. Potassium (major intracellular fluid control)

Functions

a. Nerve cell transmission .

b. Muscle contraction .

c. Fluid balance.

Food sources

Fruits (banana , dried fruit , melon) vegetables (tuberous , roots and green leafy ,potato , sweat potato , carrot , spinach) , (legumes) .

Deficiency Symptom :- cardiac arrhythmia , muscle weakness , ↑ urinary calcium ,

Deficiency Symptom :- cardiac arrhythmia , muscle weakness , ↑ urinary calcium ,
glucose intolerance.
Toxicity symptoms :- cardiac arrhythmia. Recommended intake :- for adult 4.7 gm./ day