

MINERALS IN NUTRITION THEIR GENERAL FUNCTIONS AND CLASSIFICATION

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WHAT ARE MINERALS?

- ◉ Inorganic elements essential to the nutrition of humans
 - Play several key roles in overall health and well being
 - Help chemical reactions take place in cells
 - Help muscles contract
 - Keep the heart beating
- ◉ Two groups
 - Major minerals (7 Nos)
 - Trace minerals (15 Nos)
- ◉ Major: Ca, P, Mg, Na, K, Cl, S
- ◉ Minor: Fe, Cu, Co, I, Mn, Se, Zn, F

⦿ Major minerals

- Need to consume > 100 milligrams per day
- At least 5 grams of the mineral in the body
- Calcium, sodium, potassium, chloride, phosphorus, magnesium, and sulfur

◎ Trace minerals

- Need to consume < 20 milligrams per day
- The body contains less than 5 grams total
- Iron, zinc, copper, selenium, chromium, iodide, manganese, molybdenum and fluoride

GENERAL FUNCTIONS

Can be grouped in to:-

- ⦿ 1. Protective functions
- ⦿ 2. Structural functions
- ⦿ 3. Regulatory functions
- ⦿ 4. General metabolic functions

1. PROTECTIVE FUNCTIONS

- ◉ The minerals (Ca, P & F) protect the teeth from the wear and tear by providing hard structure like enamel which is the hardest substance in the body and has the lowest water content (5%) and contains only 3.5% OM.
- ◉ Ca has a protective function in blood clotting also which protects the body from excessive bleeding.

2. STRUCTURAL FUNCTIONS

- ⦿ (i) As a constituent of bone and teeth, they give strength and rigidity to the skeletal structure
- ⦿ (ii) Minerals are constituents of organic compounds such as proteins and lipids which make up the muscles, blood cells (other soft tissues of the body).

3. REGULATORY FUNCTIONS

- ⦿ Regulation of osmotic pressure - Na and Cl
- ⦿ Regulation of acid-base balance- K, P, Mg, Ca, Cl
- ⦿ Regulation of heart beat - Na, K, Ca
- ⦿ Regulation of general metabolism by thyroxin hormone - Iodine.

4. GENERAL METABOLIC FUNCTIONS

- ⦿ (i) Irritability of muscles and nerves - Ca, Mg,
- ⦿ (ii) Activation of many enzymes - zinc, iron, Cu, Mg
- ⦿ (iii) Digestive process- NaCl,
- ⦿ (iv) P as a constituent of ATP
- ⦿ (v) For Hb formation - Fe and Cu
- ⦿ (vi) For B12 synthesis In ruminants - Cobalt

FUNCTIONS OF MINERALS

Ca Builds bones and teeth, muscle contraction, heart action, nerve impulses, blood clotting

Mg Bones, liver, muscles, transfer of intercellular water, alkaline balance, neuromuscular activity

Na Electrolyte balance, body fluid volume, nerve impulse condition

K Cell membrane potential, nerve impulse conduction, heart rhythm, acid base balance

P Builds bones and teeth, energy production, acid-base balance, necessary in metabolism and cell membranes, calcium absorption

- Cu** Hemoglobin formation, production of RNA, elastic tissue formation, cholesterol utilization, oxidase enzyme activator
- Zn** Protein synthesis, carbon dioxide transport, sexual function, carbohydrate metabolism
- Fe** Hemoglobin formation, electron transport, oxygen transport, enzyme activator
- Mn** Carbohydrate metabolism, protein metabolism, connective tissue, joint fluid production, nerve tissue, Vitamin B1 utilization (TPP)
- Cr** Glucose utilization, insulin activity, heart muscle, cholesterol utilization
- Se** Peroxidase scavenger, glutathione peroxidase, anti-carcinogenic

FACTORS AFFECTING THE REQUIREMENTS OF MINERALS.

- The requirement of the minerals are very difficult to be accurately assessed. Because of the following factors :
 - 1. Inter-relationship among different minerals or between minerals and organic compounds
e.g. Ca and P for their best utilization must be present in a ratio of 2:1. If vit. D is sufficient this ratio becomes less important. Other inter-relationships are Cu-molybdenum, Cu- Zn, Ca and oxalates, P and phytates.

FACTORS AFFECTING THE REQUIREMENTS OF MINERALS.

- ② Actual amount of one mineral in the diet affects its efficiency of utilization. If Ca is supplied in more amount its efficiency of utilization reduces.
- ③ Mineral status of the animal also influence absorption- an iron deficient animal is more efficient in the absorption of iron than an animal with adequate iron stores

FACTORS AFFECTING THE REQUIREMENTS OF MINERALS.

- ④ 4. Form of mineral - The ferrous form of Fe is better utilized than ferric. Organic form is better utilized than inorganic form
- ④ 5. Genetic-nutrition - Some strains of rats have higher requirement for Cu, while other require higher amounts of Mn.
- ④ 6. Age, sex and productivity level - also influences the level

Table 12.1

Factors That Affect the Bioavailability of Minerals

Factors That Increase Bioavailability

Deficiency in a mineral increases absorption

Cooking increases the bioavailability of minerals in legumes

Vitamin C increases the absorption of some minerals such as iron

Vitamin D increases the absorption of calcium, phosphorus, and magnesium

Factors That Reduce Bioavailability

Binders, such as oxalates found in some vegetables

Phytates found in grains

Polyphenols in tea and coffee

Supplementation of single minerals affects absorption of competing minerals

MINERAL BALANCE

- Body maintains tight control over mineral balance
 - GI tract
 - ✓ Regulates absorption from food based on the body's need
 - ✓ Minerals in gastric juices and that slough-off intestinal cells are either excreted in the faeces or reabsorbed through the large intestine
 - Kidneys
 - ✓ Excretes excess and reabsorbs the minerals when the body needs them

MINERALS CAN BE TOXIC

- If ingested in high amounts, minerals can be toxic; however, mineral toxicity is rare
- Toxicity most often seen with
 - Large amounts of supplements
 - Certain conditions that interfere with the body's adaptive abilities

That's all