

# 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