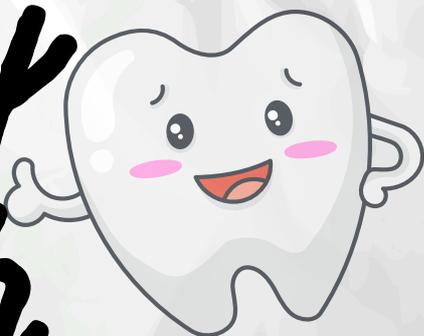




Biochemistry

**Summaries of
mineral metabolism
lecture 11**

*Ivory
patch*



minerals

Major [Macronutrients]:

- They are required in amounts >100 mg/day
- They include:** calcium, phosphorus, potassium, sodium, magnesium and chloride

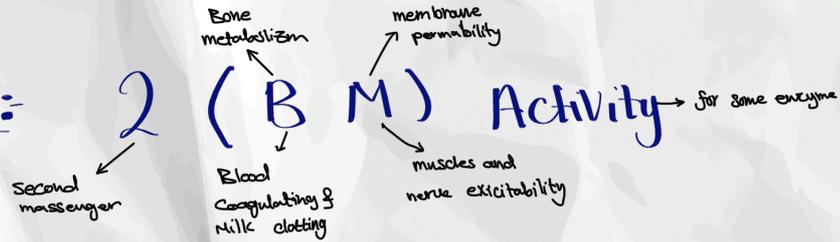
Trace elements [Micronutrients]:

- They are required in amounts <100 mg/day
- They include:** iron, copper, zinc, manganese, chromium, iodine, fluoride, cobalt, molybdenum, selenium and silicon.

Ca function



mnemonic :-



- Bone mineralization: Ca is an essential element in bone and teeth.
- Blood coagulation and milk clotting.
- Membrane permeability.
- Muscle and Nerve excitability
- Second messenger of many hormones
- For activity of some enzymes (Lipase, amylase)

Factors affecting Ca absorption

| <ul style="list-style-type: none"> Active Vitamin D [calcitriol] para thyroid Hormone (PTH) | <ul style="list-style-type: none"> pH of Intestinal content | <ul style="list-style-type: none"> Dietary factors |
|---|---|---|
| <ul style="list-style-type: none"> They are produced in response to low plasma Ca ⇒ ↑↑ Intestinal absorption of Calcium | <ul style="list-style-type: none"> Acidic pH ⇒ increase Ca absorption. Alkaline pH ⇒ decrease Ca absorption | <ul style="list-style-type: none"> Lactose and High protein diet ⇒ Increase Ca absorption phytate, oxalate, (insoluble Ca salts) and fatty acid ⇒ decrease Ca absorption. |

Ca

Regulated By
 Calcitriol, Vitamin D,
 PTH
 Calcitonine

Inhibits Ca^{2+}
 absorption By
 Intestines



| | Calcitriol | PTH secreted from "para thyroid gland" | calcitonine secreted from "para follicular cell of thyroid gland" |
|-------------------------------------|--|--|--|
| produced (Activated) response to | low Ca & P level | low plasma Ca level | |
| تأثيره على | increases their levels by: ✓ Increasing their intestinal absorption ✓ Increasing their renal tubular reabsorption. ✓ Stimulate bone | increases calcium level by the same mechanism as calcitriol + help activation of vit D (Activates renal 1 α -hydroxylase) | □ Lower both plasma calcium and phosphorus by: ✓ Inhibiting calcium mobilization from bone. ✓ Decreasing renal tubular reabsorption of calcium & phosphorus (increases Ca and Ph excretion) |

Disorders of blood calcium level

| Hypocalcemia | Hypercalcemia |
|---|---|
| Blood level < 9 mg/dl. | Blood level > 11 mg/dl |
| Causes: 1) Hypo-parathyroidism. 2) Vit D deficiency. 3) Alkalosis. 4) Hypoproteinemia. 5) Impaired renal function (inability to activate vit D) | Causes: 1) Hyperparathyroidism. 2) Vit D toxicity. |
| → bone deformity (Rickets and osteomalacia). | → Pathological bone fracture & Urinary calculi |

Iron function

Formation of: HB, myoglobin,
some enzymes (eg: respiratory
cytochromes- cytochrome
P450 peroxidases and
catalases

Absorption of iron

Factors increasing absorption

- ☀ Gastric HCl.
- ☀ Reducing substances
(e.g. vitamin C)

Factors decreasing absorption

- High dietary phosphate,
oxalate, phytate
(spinach is poor source)
- ☀ fatty acids
- ☀ Increased intestinal pH
- ☀ Gastrectomy

DISORDERS OF IRON

1. IRON DEFICIENCY

CAUSES:

- 🧩 DECREASE INTAKE E.G. HIGH CEREAL
DIET, LOW IN MEAT.
- 🧩 DECREASE ABSORPTION E.G.
DIARRHEA, INTESTINAL DISEASES.
- 🧩 EXCESSIVE BLOOD LOSSES.

Leads to iron
deficiency
anemia

IRON OVERLOAD

CAUSES:

- 🧩 EXCESSIVE INJECTABLE IRON.
- 🧩 REPEATED BLOOD TRANSFUSION.
- 🧩 INHERITED ANOMALY OF
INCREASED IRON ABSORPTION.

Leads to Hemosiderosis :
deposition
of iron in -liver → liver cirrhosis
-skin → bronzed pigmentation
-pancreas → bronzed diabete

Copper

Importance: Hb synthesis, bone formation, maintenance of myelin.

Enzymes/Functions: Constituent of

L-ascorbic acid oxidase

Cytochrome oxidase

Tyrosine hydroxylase

Dopamine hydroxylase

Lysyl & prolyl hydroxylases

Zinc

Importance: Insulin storage & release, reproduction, tissue repair & wound healing, vitamin A mobilization from liver.

Enzymes/Functions: Component of

Alcohol dehydrogenase

Alkaline phosphatase

Carbonic anhydrase

Retinal reductase

Manganese

Importance: Normal bone structure, CNS function, spermatogenesis.

Enzymes/Functions: Involved in activation of

Glycosyl transferase (mucopolysaccharide & glycoprotein synthesis)

Pyruvate carboxylase (gluconeogenesis)

Iodine

Importance: Formation of thyroid hormones.

Chromium

Importance: Component of chromodulin protein — potentiates insulin action (helps binding to cell receptors & glucose uptake).

