

Phosphorous (P)

1) P-Distribution

Human body contain about 840g m

- 80% in bone and teeth
- 20% in other tissue
 - 10% is found in muscles and blood in association with proteins/lipids and carbohydrate.
 - 10% in various chemical compounds

3) Dietary requirements

Based on the intake of Ca
 For adult, the ratio of Ca:P is 1:1, 800 mg/day
 For infant, however, the ratio is around 2:1, found in human milk.

Sources-

Milk/Cereals/Meat/Eggs/leafy vegetable.

5) Serum phosphate

In Blood → 40 mg/dl
 In Serum → (3-4) mg/dl

* RBCs and WBCs have very high content of (P).

* The serum may exist as:

- 40% Free ions
- 50% Cation as Ca^{2+} Mg^{2+} or Na^{+}
- 10% Bound proteins

7) Phosphorus Deficiency

1 → Rickets
 Ca x P is less than 30 + Before puberty.

2 → osteomalacia after puberty

3 → Osteoporosis

2) Functions

- Essential for the development of bones and teeth
- Phospholipids / Phosphoproteins
- Component of :
 - DNA & RNA
 - ATP, NAD⁺, NADP⁺
- Energy metabolism: ATP, GTP
- Maintenance of blood pH: Phosphate buffer system

4) Absorption and Excretion

Absorption from jejunum
 1) Calcitriol promotes (P) uptake along with Ca
 2) Absorption of P and Ca is optimum when the dietary Ca:P is (1:2-2:1) in one meal.
 3) Acidity favors while phytate decreases phosphate uptake by intestinal cells.
 Excretion:
 - 500 mg is excreted in urine/day
 - The reabsorption of (P) by renal tubules is inhibited by PTH

6) Importance of Ca:P

The ratio is important for calcification of bones.
 → The product of Ca x P in mg/dl - in child is around 50 in adults around 40.

8) Regulation of plasma (P)

- 3 hormones:
- Calcitriol
 - PTH
 - Calcitonin

Calcium (Ca)

99% in skeleton
 1% → blood/plasma

→ variable

1) Functions:

- Bone structure
 - Nerve function
 - Blood clotting
 - Muscle contraction
 - Cellular metabolism
- [Anticoagulant]

5) Factor Promoting Ca absorption

- Vit. D: induce the synthesis of Ca binding proteins.
- PTH: ↑ → ↑ by ↑ calcitriol
- Acidity (low pH): more favorable
- Lactose: ↑ → ↑
- Lysine + arginine: ↑ → ↑

8) Regulation of plasma Ca

- 3 hormones: Calcitriol / PTH / Calcitonin
 3 organs: Gut / Bone / Kidney
- Hormones =
- Calcitriol (1,25-OH₂D₃, 1,25 DHC) from kidney
 - Parathyroid hormone + V.D₃ → increase plasma Ca²⁺ (from biological)
 - Calcitonin → Decrease plasma Ca

2) Dietary requirements

- * Adult: 800 mg/day
 - * Women during pregnancy, lactation and post menopause: 1.5g/day
 - * Children: (0.8-1.2)g/day
 - * Infants: (500-500) mg/day
- Food sources
 Best: milk + milk product
 Good: Beans, leafy vegetables, fish, egg, cabbage

6) Factor inhibiting Ca absorption

- (Phytates + oxalates) form insoluble salt
- high content of phosphate → insoluble Ca phosphate
- The free fatty acids → forming Ca soaps
- The alkaline condition (high pH)
- high content of dietary fiber
- low estrogen levels (Postmenopausal women)

Ca Homeostasis

- * Ca²⁺ levels too high:
- Increase Ca²⁺ deposition in bones.
 - Decrease Ca²⁺ uptake in intestines.
 - Decrease Ca²⁺ reabsorption from urine.
- * Ca²⁺ levels too low:
- Increase Ca²⁺ release from bones.
 - Increase Ca²⁺ release from bones.
 - Increase Ca²⁺ uptake in intestines.
 - Increase Ca²⁺ reabsorption from urine.

3) Absorption of Ca

In small intestine (duodenum)
 First half jejunum against electr. and concentration gradient, by an energy dependent active process.

7) Plasma Calcium (9-11) mg/l

- Ionized Ca (diffusible): 50%
- Complex Ca with organic acid (diffusible): 40% is found in association with citrate and phosphate
- Protein bound Ca (non diffusible): 10% is found in association with albumin and globulin.

9) Ca-Deficiencies (2)

- Rickets: weakness and deformity of the bones that occurs from V.D deficiency or dietary deficiency of (Ca, P)
- Osteoporosis: Progressive loss of bone density, thinning of bone tissue and increased vulnerability to fractures in the elderly people of both sexes. check slide (17) - osteoporosis

4) Excretion of Ca

- Urine → (100-300) mg/day
- Sweat → (5) mg/day
- Stools → unabsorbed Ca²⁺ in diet (50-70%)

Iron (3-5)g in adult

1) Iron distribution

- 70% : in the erythrocytes of blood as a constituent of Hb
- 5% : in Mb of muscle
- Heme is the most predominant iron containing substance. eg: Hb, Mb
- cytochromes
- Non-hem iron: eg. Transferrin / Ferritin

3) Dietary requirements

- * Adult man: 10 mg/day
- * Menstruating women: 18 mg/day
- * Pregnant and lactating women: 40 mg/dl

→ Sources:

- Rich source: organ meats (liver, heart, kidney)
- Good source: leafy vegetables, pulses, cereals, fish, apple, molasses / dried fruit.
- Poor source: milk / wheat / Bhusel rice

5) Iron storage

7) Disease states

2) Functions

- 1) O₂ and CO₂ transport via hemoglobin
- necessary for ATP production
- 2) Essential component of many enzymes.
- 3) Immune function
- 4) Brain function
- Iron deficiency / toxicity thought to slow mental development in kids
* lung has ↑ affinity for O₂
* cells have ↓ affinity for O₂

4) Iron absorption

6) Iron transport in the plasma