Water and minerals metabolism

304 Biochem

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Copper (Cu)

- **Menke's syndrome:**
  - An extreme form of copper deficiency an x-linked genetic defect in copper transport and storage. It is observed early in life (usually 3 months after birth) and death occurs within 5 years.

  - The affected infants exhibit an accumulation of copper in the duodenal mucosal tissues as the result of defective copper absorption, with low serum copper, low serum ceruloplasmin, low hepatic and cerebral copper and little or no cytochrome C oxidase activity in nervous tissues.

Copper (Cu)

- **Wilson's disease (hepatolenticular degeneration):**
  - It is an autosomal recessive **copper accumulation disease** that usually presents between 6-40 years of age. It is suggested that decreased copper excretion via bile may be a factor in the pathogenesis of the disease.
  - **The disease is characterized by**:
    - increased concentrations of in the liver, brain, kidney, and cornea.
    - Low total serum copper, and low serum ceruloplasmin.
  - **The disease symptoms include**: neurologic disorders, liver cirrhosis, Kayser-Fleischer ring in the cornea (a green or golden pigment ring around the cornea caused by copper deposits)
  - **The disease is treated** by penicillamine which increases the excretion of copper in urine.

Zinc (Zn)

- Adult male body weighing 60-70 kg contain about **2.0 - 2.3** g of zinc

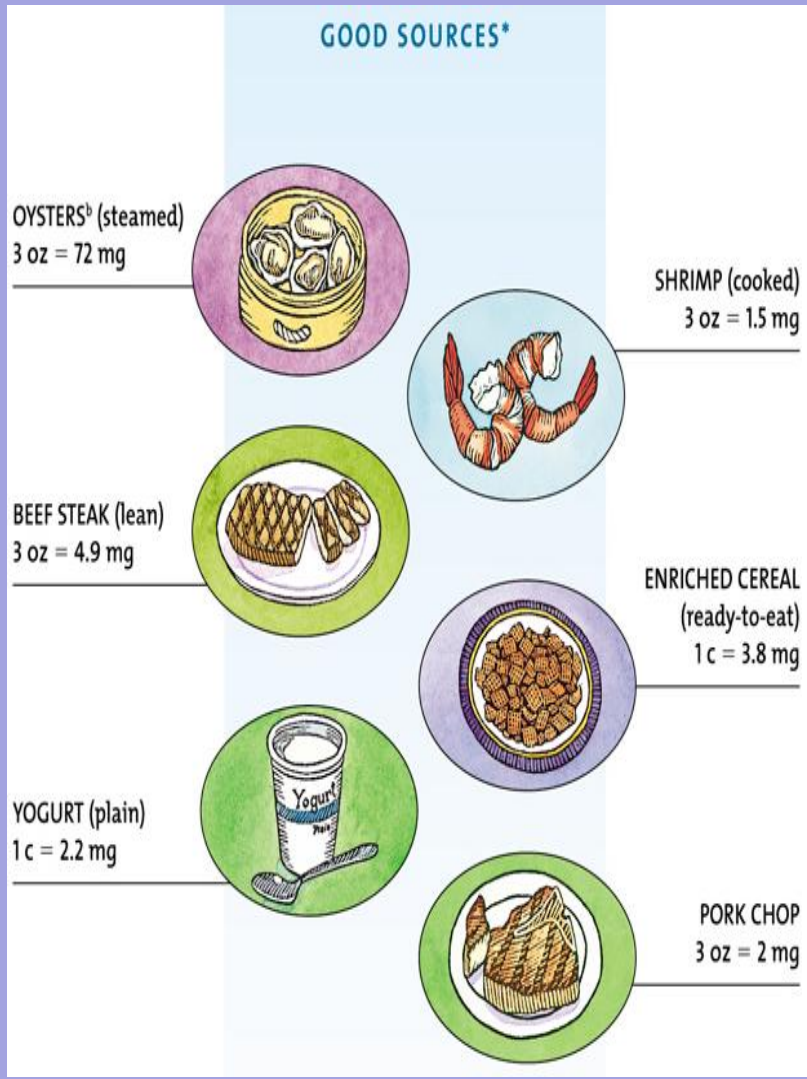
- **Distribution of zinc in the body:**

About 20% is present in the skin

High concentrations are present in semen spermatozoa, prostate and epididymis (i.e. in male sex organs)

A considerable proportion is present in the bones and teeth

- **Food sources:** animal protein containing foods and milk together with whole grain products are a good source of zinc
- **RDA**
  - adults: 15 mg/day
  - Pregnant and lactating women: 25-30 mg/day



Zinc (Zn)

- **Functions:**
  - Essential component of a number of enzymes including:
    - Alcohol dehydrogenase
    - Alkaline phosphatase (ALP),
    - Carbonic anhydrase,
    - Carboxy peptidase,
    - Cytosolic SOD
    - Retinene reductase (required for formation of retinal (vit. A) during the rhodopsin cycle
  - Essential for normal growth, reproduction, taste sensitivity, tissue repair, wound healing.
  - Essential to maintain normal levels of vit. A in plasma and mobilization of vit A from the liver
  - Insulin is sotred as zinc-insulin complex in beta cells of pancreas. Zinc adhering to insulin molecule increases the duration of insulin action when given by injection

Zinc (Zn)

- **Excretion:**
  - it is mainly excreted in feces (unabsorbed fraction),
  - smaller amounts are secreted in pancreatic juice, bile, and sweat.

- **Deficiency :**

Causes:

1. Marked reduced intake of zinc in diet
2. Malabsorption syndrome
3. Liver diseases as post-alcoholic cirrhosis

Symptoms:

1. Impaired taste sensitivity
2. Poor appetite
3. Growth retardation (dwarfism)
4. Delayed wound healing
5. Impaired sexual development (hypogonadism)

TOXICITY:
Loss of appetite, impaired immunity, reduced copper and iron absorption, low HDL cholesterol (a risk factor for heart disease)

Manganese (Mn)

- Adult male body weighing 60-70 kg contain about **0.012 – 0.02** g of manganese

- **Distribution of manganese in the body:**

Mitochondria are the main intracellular sites of manganese uptake.
Kidney & liver are the main storage organs for manganese

- **Manganese in blood:** its blood level is 4-20 microgram/dl, it is bound to beta-globulin

- **Food sources:** found in nuts, whole grains and leafy vegetables and fruits
- **RDA**
  - adults: 2.5-7 mg/day
  - Pregnant and lactating women: 25-30 mg/day
- **Absorption:**
- It is absorbed through the small intestine by a mechanism similar to that for iron

Manganese (Mn)

- **Excretion**
- It is excreted mainly via bile &feces, and very little in urine
- **Functions:**
  - Essential for normal bone structure, reproduction, and the normal functions of central nervous system
  - Manganese is a cofactor of several different enzymes:
    - Phosphoglucomutase
    - Isocitric dehydrogenase
    - Cholinesterase
    - Intestinal peptidase
    - Carboxylases
    - ATPases
    - Mitochondrial SOD
- **Deficiency :**
  - rare

Iodine (I_2)

- Adult male body weighing 60-70 kg contain about **0.02 – 0.05** g of iodine

- **Distribution of iodine in the body:**

About 33% is in the thyroid gland.
About 66% is distributed in all tissues particularly ovary, muscles and blood.

- **Iodine in blood:** most of iodine in blood is bound to protein at levels of 4 – 8 microgram/dl.
- **Food sources:** world's seas fish, seaweeds and iodized salt are best sources
- **RDA**
  - adults: 0.1-0.2 mg/day
  - Pregnant and lactating women: 25-30 mg/day