Water and minerals metabolism

304 Biochem

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Sulfur (S)

- Adult male body weighing 60 kg contain about **150** g of sulfur
- It is widely distributed all over the body tissues and cells.

- It is present in the body in the following forms:

1. Mucopolysaccharides (chondriotin sulfate, keratin sulfate, dermatan sulfate, heparin and heparan sulfate)
2. Lipids as sulfolipids
3. Amino acids (cysteine, cystin, methionine and homocystiene)
4. Protiens contain sulfer amino acids
5. Bile salts(sodium and potassium taurocholate)
6. Vitamins (thiamin, biotin, lipoic acid)
7. Hormones (insulin and posterior pituitary hormones)
8. Coenzymes (CoASH and TPP)
9. Other compounds (glutathione,…..)

Sulfur (S)

- **Food sources: it is mainly supplied in two forms in the diet:**
  1. Organic form: S-containing amino acids present in protiens, chondriotin sulfate present in cartilages, sulfolipids and sulfur containing vitamins
  2. Inorganic form: e.g. Na, K, and Mg sulfate (minor portion and poorly absorbed)

- **Absorption:**
  - Inorganic sulfates are poorly absorbed from small intestine
  - Sulfur containing amino acids are absorbed after adequate protein digestion
  - Sulfur in chondriotin sulfate and glycoproteins splits at first after digestion, then oxidized to sulfate and absorbed
- **RDA**
  - adult: 2-5 g/day

Sulfur (S)

- **Excretion:**
- In urine: about 80% of sulfur is excreted as inorganic sulfates, 10% as neutral sulfur compounds e.g. vitamins and amino acids and 10% as ethereal sulfate e.g. indican
- In feces: this represent the unabsorbed dietary sulfate , small amounts of taurine and taurocholate and mercaptides formed by intestinal bacteria

Sulfur (S)

- **Utilization of sulfur in the body:**

- **Organic sulfates:**

1. The majority is changed to inorganic sulfate and excreted in urine
2. Small portion is changed to S-containing compounds in the body e.g. glutathione
3. Remaining amounts are excreted as neutral sulfur compounds in urine e.g. thiocyanate,thiosulfate

- **Inorganic sulfate:**

1. The majority passes to urine
2. Conjugated with phenolic compounds (e.g. phenol, indoxyl) and with certain hormones (e.g. estrogens, testosterone) forming ethereal sulfate excreted in urine

Microminerals

Trace elements are classified according to biological role into 3 groups:

1. **Essential**: an essential element is an element required for life; its absence results in death or a sever malfunction.
   They are (10 minerals): Fe, I, Cu, Zn, Mn, Co, Se, Mo, Cr and F

2. **Possibly essential**: Nickel, tin, vanadium and silicon

3. **Nonessential**: Aluminum, boron, cadmium, arsenic, germanium, lead and mercury

Microminerals

- iron
- zinc
- iodine
- selenium
- copper
- manganese
- fluoride
- chromium
- cobalt
- molybdenum

Iron (Fe)

- Adult male body weighing 60-70 kg contain about **4-5** g of iron

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

About 77% is present in the heme compounds (**65%** hemoglobin, **10%** myoglobin, **<2%** cytochromes, **<1%** peroxidase, **<1%** catalase)

About 21% is present in the nonheme iron compounds (**10-15%** ferritin, **9%** hemosiderin, **< 1%** transferrin)

About <5% is present in other iron compounds (mainly present bound to proteins)

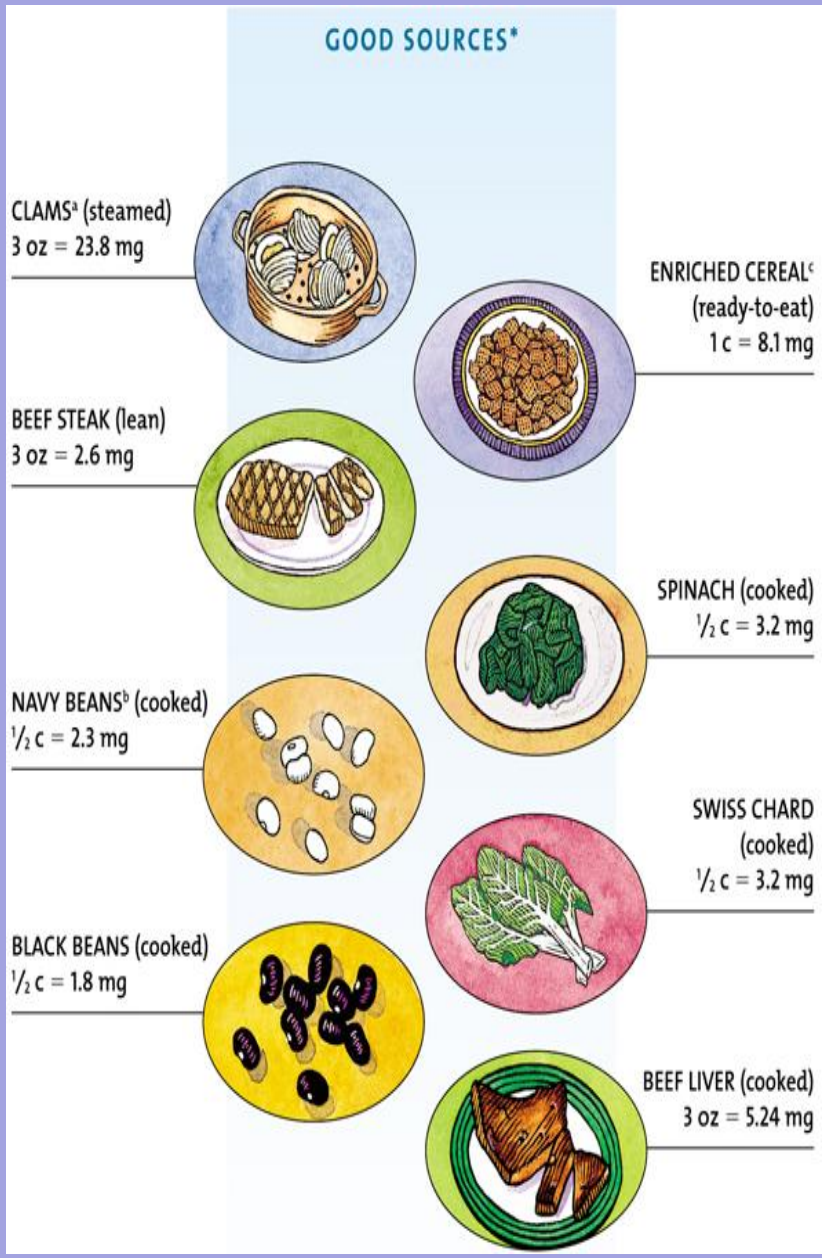
- **Iron metabolic turnover:**
  - It is unique in that it operates as a closed system
  - **<1%** mg/day is lost
  - **<10%** of dietary iron is absorbed
  - Iron stores are utilized

CHIEF FUNCTIONS:

Carries oxygen as part of hemoglobin in blood or myoglobin in muscles; required for cellular energy metabolism

Iron (Fe)

- **Food sources:** red meats, liver, heart, spleen, kidney, fish, poultry, eggs, legumes, date, molasses, nuts, sipnach are good sources
- **RDA**
  - adults: 10-19 mg/day
- **Plasma normal values :**
  - Total iron binding capacity (**TIBC**): 300-360 microgram%
  - Iron free transferrin-unsaturated iron binding capacity (**UIBC**): 60-70% of the total
  - Plasma protein bound iron: 30-40% of the total



Iron (Fe)

- **Absorption, transport and storage:**
- **Absorption:**
  - Ordinary diet contain 10-20 mg of iron, < 10% of them is absorbed into mucosal cells of the doudenum&proximal jejnum
  - **Heme iron** is absorbed as it is then broken down and iron released within the intestinal mucosal cells
  - **Nonheme iron** is absorbed in ferrous state
  - **Ferric ion** is reduced to ferrous ion before absorption
  - **Reducing substances** in the diet like vitamin C **enhance** iron absorption
  - While **substances that decrease the solubility of iron** in the intestine (such as phosphate, oxalate, phytic acid, fatty acids) and **increased pH inhibit** iron absorption