

Minerals in the body 3

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Slide 1



Trace elements

In biochemistry, a trace element is a chemical element that is needed in small quantities for the proper growth, development, and physiology of the organism.

In biochemistry, a trace element is also referred to as a *micronutrient*.



Trace elements

1. It must be present in healthy tissues.
2. Its concentration from person to person is almost contrasted.
3. It has a certain vital biochemical role and no substitute mineral will do.
4. Its deficiency produces certain clinical manifestations and can be fatal.
5. Its addition to diet must prevent these deficiency manifestations
6. Its excess can be fatal.



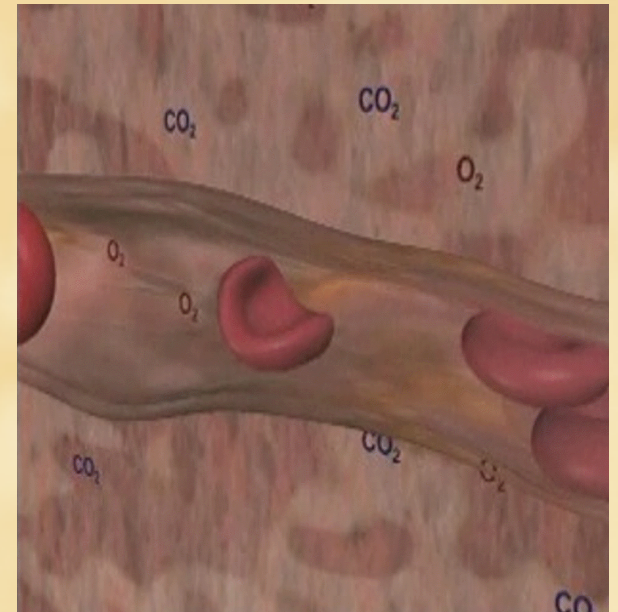
Iron:

- Every living cells-plant and animal- contain iron.
- Most of the iron in the body is found either in the heme component of heme proteins (mostly haemoglobin in RBCs and myoglobin in muscle cells and cytochromes) or in storage forms (ferritin and hemosiderin).
- Hb is the O₂ carrying protein of the RBCs.
- Myoglobin: the O₂ carrying protein of the muscle cells.



Functions of Iron

- Iron is important for the compounds essential for cellular respiration as haemoglobin.
- The iron in both (Hb and myoglobin) helps them to carry and hold O_2 for the muscles to use when they contract.
- Iron works as part of many enzymes e.g. cytochrome, oxidase, catalase, peroxidase.





Functions of Iron

- It is also important to make new cells, amino acids, hormones.
- The remaining iron is present in stored form as ferritin, transferrin and hemosiderin and used in haemoglobin synthesis.



Iron Excretion & Absorption

- Excretion: tiny amount of iron is lost mainly in faeces.
- Absorption: of the dietary iron, about 10-15% is absorbed, but if the body's need more (pregnancy) the absorption increase
- The blood protein (transferring) carries the iron to tissue throughout the body. When more iron is needed, more of those proteins are produced and more of usual amount of iron are carried and absorbed



Iron overload:

- Normally the body protects itself against absorbing too much iron by setting up a block in intestinal cells. The system can be over weakened resulting in iron overload (iron toxicity) which is due to disturbance of iron metabolism and regulation.
- Iron overload is known as hemochromatosis and is caused by a genetic disorder that enhances iron absorption.



Iron overload:

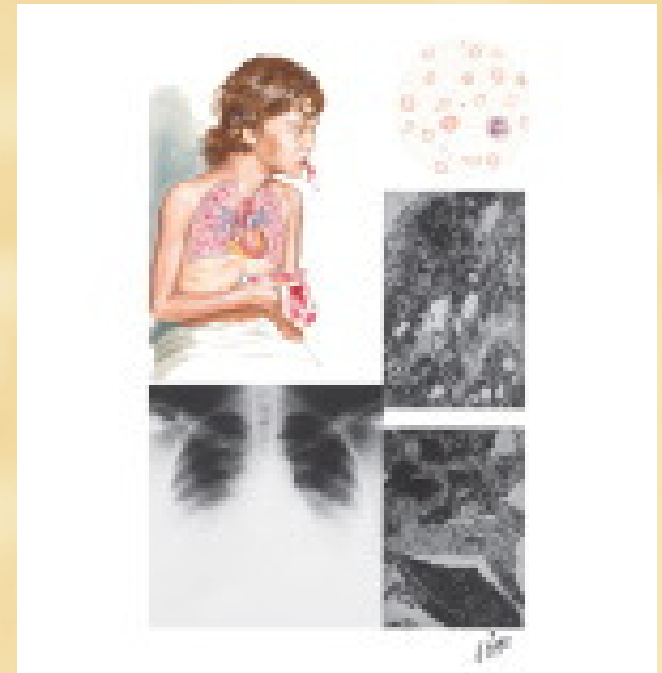
Other causes of iron overload include:

- Repeated blood transfusions in haemolytic anaemia.
- Massive doses of supplementary iron.
- Other metabolic disorder.



Iron overload and hemosiderosis

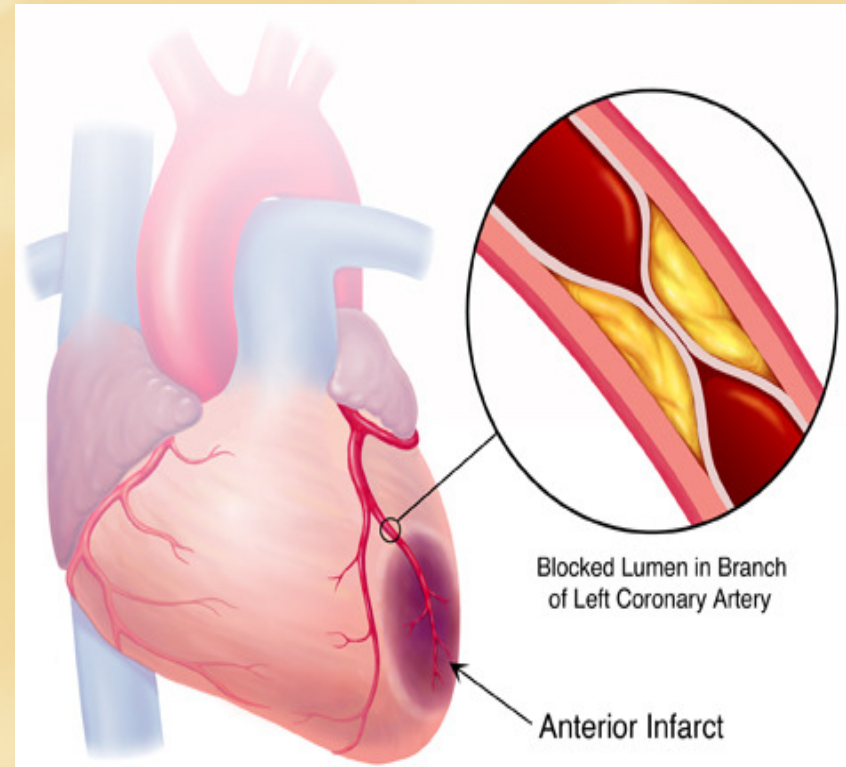
- Long-term over consumption of iron may cause hemosiderosis which is a condition characterized by the large deposits of the iron-storage protein hemosiderin in the liver, spleen, heart, pancreas and under the skin (hemosiderinosis). This condition may lead to bronze diabetes





Iron overload and myocardial infarction

- Iron overload is more common in men than in women.
- adult men should not use iron supplement, because high tissue level of iron correlate with increased risk of myocardial infarction

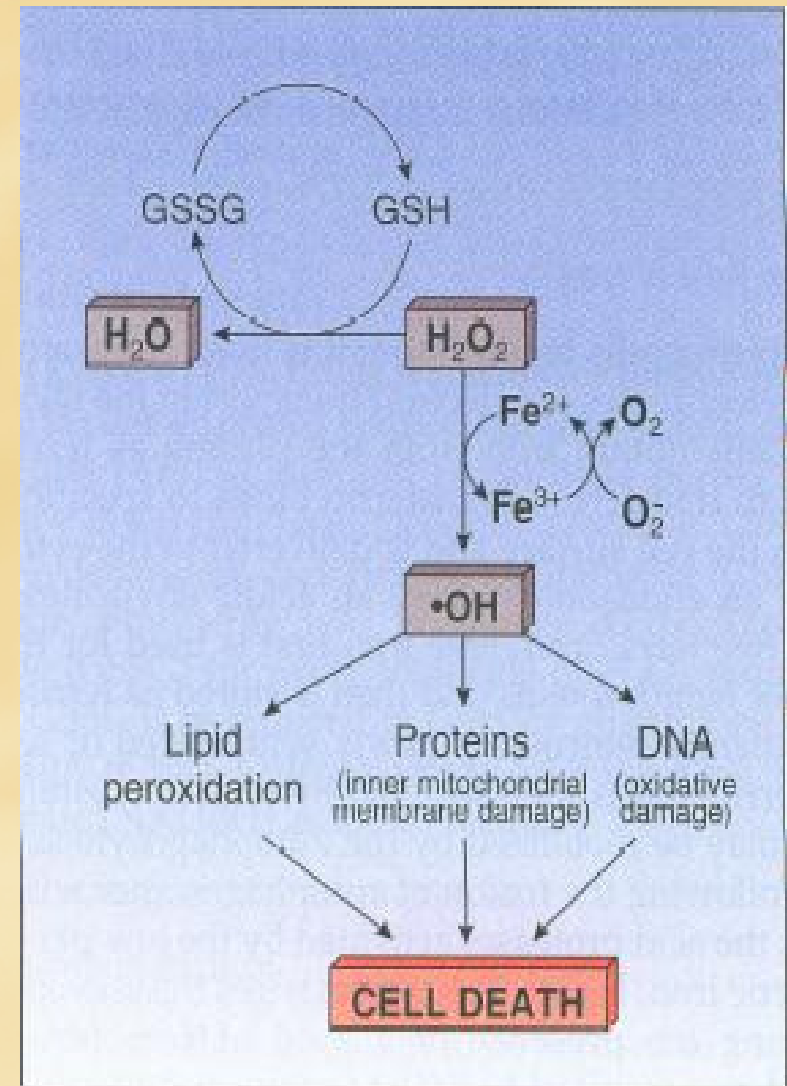


A heart attack, or myocardial infarction, occurs when one of the arteries that supplies blood to the heart muscle is blocked. As a result of this blockage, no blood can reach the area of muscle supplied by that artery or artery branch.



Iron overload free radicals

It has been suggested that unbound inorganic iron can promote the formation of reactive oxygen radicals, particularly the conversion of H_2O_2 to highly reactive hydroxyl radicals. The enhanced formation of oxygen radicals favours the oxidation of LDL. The oxidized LDL plays key role in development of cardiovascular disease.





Iron recommendation

- For men (19 and older): 10 mg/day
- For women (10- 50Y): 15 mg/day
- (>50Y): 10mg/day



Iron sources

There are two types of iron in foods i.e. haem iron and non-haem iron.

- Animals - heme iron – **MORE** readily absorbed
 - Meats, poultry, fish (clams)



N.B.: Milk is a poor source of iron

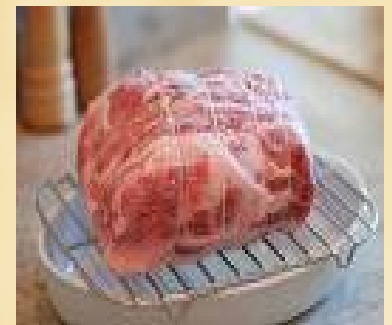
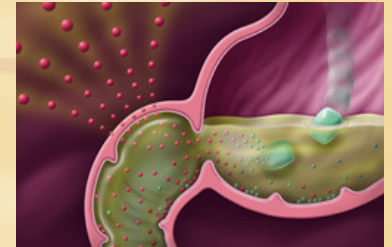
- Plant - **NON** heme iron
 - As dark leafy vegetables, cereals and beans





Factors that help iron absorption

- Acidity, as the low pH helps to liberate iron from organic combinations.
- Reducing agents as vit C change iron from ferric (Fe^{3+}) state to ferrous (Fe^{2+}) state.
- Proteins especially those containing sulfur containing amino acids also change iron from ferric to ferrous.
- Type of iron compounds in the diet, heme iron is absorbed easily.
- Iron deficiency enhances iron absorption.





Factors which inhibit iron absorption

- Achlorhydria or hypochlorohydra.
- Oxalate. (Oxalates are chemicals that are found in plant foods)
- Phytates



Achlorhydria and hypochlorhydria

- **Achlorhydria** and **hypochlorhydria** refer to states where the production of gastric acid in the stomach is absent or low, respectively.

High Oxalate Content (>0.9% in the food)

beet greens (and the tuber)
chocolate, cocoa
figs
lamb's quarters
parsley*
pepper, black
poke**
poppy seeds
purslane
rhubarb
sorrel
spinach***
Swiss chard
tea (black)

Moderate Oxalate Content (0.2-0.9%)

beans, green or wax
blackberries
carrots
celery
coffee
currants
dandelion leaf*
endive
gooseberries
grapes, Concord
green pepper
lemon peel
okra
onions, green
oranges, orange peel
raspberries
strawberries
sweet potatoes
tomatoes
wheat



Phytates

- Phytates are phosphorus compounds found primarily in cereal grains, legumes, and nuts. They bind with minerals such as iron, calcium, and zinc and interfere with their absorption in the body



Iron deficiency:

- Iron deficiency is the most common nutrient deficiency, affecting more than one billion people.
- In developing countries, $\frac{1}{3}$ of the children and women are suffering from iron-deficiency anaemia (IDA).

Women are especially prone to IDA because of:

- Blood losses during menstruation.
- Pregnancy.



Causes of ID:

- Nutritional causes: inadequate intake of iron-rich food.
- Non-nutritional:
 - Diminished absorption causes.
 - Blood loss (increased loss of iron).



Iron deficiency and anaemia

- Anaemia: is a symptom of a wide variety of disorders. Some unrelated to nutrition and some related to nutrients other than iron such as folate and vit. B₁₂ (the symptoms include headache, weakness, fatigue and pallor).