Al-Rasheed University College
Department of Dentistry
2st Stage

PRACTICAL BIOCHEMISTRY

lab 8
Serum Iron

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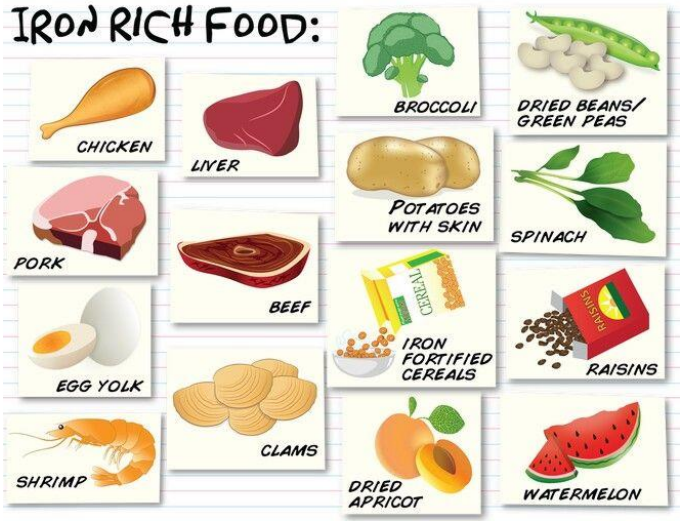
Iron is very important because it's part of the hemoglobin that carries oxygen. One of the main jobs of the red blood cell is to carry oxygen to all of the cells so aerobic metabolism can occur.

Serum iron is a medical laboratory test that measures the amount of circulating iron that is bound to transferrin.

Transferrin's are iron-binding blood plasma glycoproteins that control the level of free iron in biological fluids

Transferrin is a molecule produced by the liver that binds one or two iron (III) ions, i.e. ferric iron, Fe^{3+}; transferrin is essential if stored iron is to be moved and used.



Serum iron test is generally done, an important part of the diagnostic process for conditions such as ***anemia***, ***iron deficiency anemia***, ***anemia of chronic disease*** and ***Haemochromatosis***.

Iron has three main functions:

1- Carrying oxygen from the lungs to the rest of the body.
2- Maintaining a healthy immune system.
3- Aiding energy production.

Normal range:

- ***Males***: 75-175 microgram 100 ml (µg/dl)
- ***Females***: 65-165 microgram 100 ml (µg/dl)

Differences between myoglobin and hemoglobin

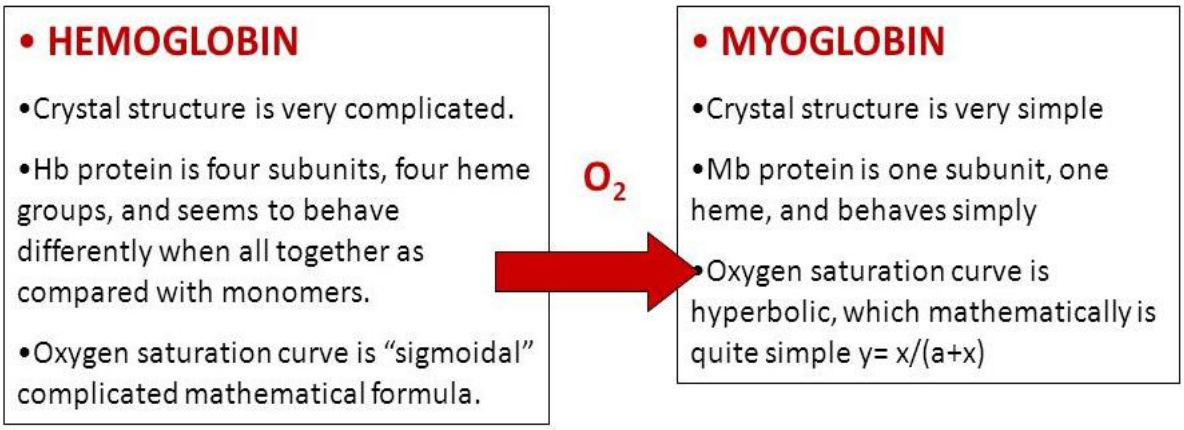
Myoglobin is similar to hemoglobin in that it is involved in the transportation of oxygen to cells.

Myoglobin is an iron and oxygen-binding protein found in the muscle tissue of vertebrates in general and in almost all mammals. It is related to hemoglobin, which is the iron and oxygen-binding protein in blood, specifically in the red blood cells.

Myoglobin can bind only one molecule of oxygen, because it contains only one heme group.

In contrast, hemoglobin can bind four oxygen molecules, one at each of its four heme groups.

The degree of saturation of these oxygen-binding sites on all myoglobin or hemoglobin molecules can vary between zero and 100%.



Distribution of body iron

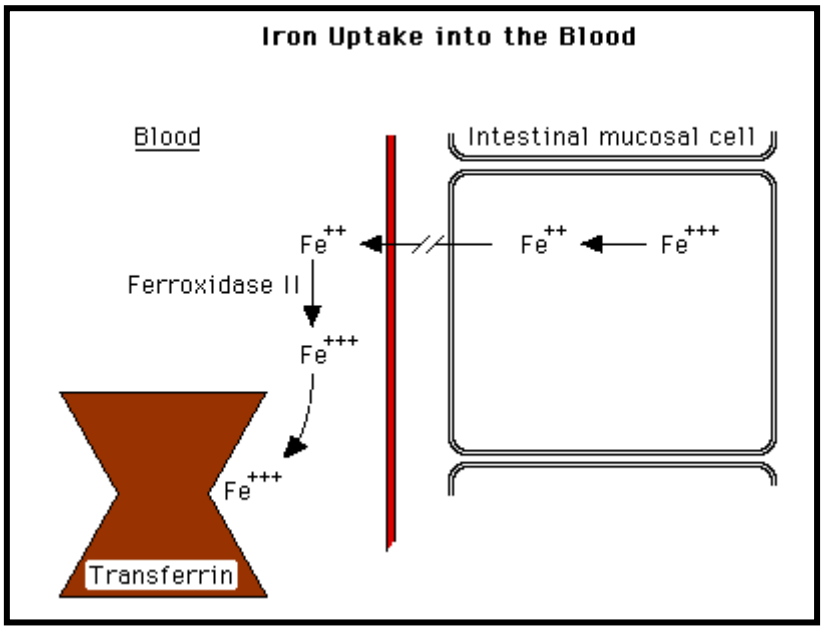
This distribution is approximate:

1. ***Hemoglobin***: 67% for oxygen transport.
2. ***Myoglobin***: 3% in muscles for oxygen storage
3. ***Ferritin***: 30% as iron storages present in liver, spleen and bone marrow.
4. ***Haem enzymes*** in different body cells like cytochromes, catalases and peroxidases (0.2%)
5. ***Transferring*** in plasma:0.1%

Physiological factors:

1. **Sex**: serum iron is higher in males
2. **Age**: is lower in infancy, adolescence and child bearing age.
3. **Diurnal variation**: lower values are found in the evening; therefore, it is best to take specimens for serum iron between 9-10 AM.
4. **Menstruation**: lower values are found just before and during menstrual period
5. **Pregnancy**: tends to cause higher values but is commonly complicated by iron deficiency that lowers serum iron
6. **Contraceptive pills**: cause an increase in serum iron level.

- Iron stored in the liver or intestinal mucosal may be transferred into the blood for transport to other tissues.
- The **iron (III) storage form** must be **reduced** to **iron (II)** in order to cross the plasma membrane.
- In the **blood**, **iron (II) is reoxidized to iron (III)** by **ferroxidase II.**



Iron (III) is carried by the serum protein, transferrin, which contains two sites that bind iron (III) tightly.

Iron Storage

Iron is stored, mostly in the *liver*, as ***ferritin*** or hemosiderin.

Ferritin *is the major form of iron storage; it is a protein with a capacity of about 4500 iron (III) ions per protein molecule.* If the capacity for storage of iron in

ferritin is exceeded, a complex of iron with phosphate and hydroxide forms. This is called hemosiderin; it is physiologically available.

Factors effect on the absorption of Iron:

- Factor that increased the absorption of iron

1. Body needs (during growth, pregnancy, lactation and childhood).
2. Acidic media.
3. Calcium.

- Factors decreased the absorption of Iron

1- Substances like; phosphate, tea, and coffee.
2- Reduce gastric acid secretion.
3- Infection.
4- GIT disease as malabsorption.

Clinical significance:

- ***Low serum iron:***

a. This is found in iron deficiency anemia which in children is frequently due to dietary deficiency because milk gas a low iron content.
b. In adults it almost always indicates chronic blood loss such as heavy menses or hookworm infestation or peptic ulcer.
c. In chronic disease such as rheumatoid arthritis, tuberculosis and some malignancies the low serum iron is due to defective iron utilization and metabolism.

- ***High serum iron:***

a. This is found in acute iron poisoning in children or after iron medication in adult and also in acute liver disease due to release of iron stores.
b. In the hereditary disorder known as haemochromatosis it is due to increased intestinal absorption.
c. In thalassemia audiopathic and chronic hemolytic anemias and after numerous blood transfusions the increase in serum iron level is due to chronic iron overload.

Iron deficiency anemia (IDA)

Iron deficiency anemia, also ***spelled iron-deficiency anemia***, is anemia caused by a lack of iron. Anemia is defined as a decrease in the number of red blood cells or the amount of hemoglobin in the blood.

Iron deficiency anemia (IDA) is the most common form of anemia which occurs due to low levels of iron all over the body. Children, infants and older people are at high risk of developing this condition.

Iron is essential to produce hemoglobin, an oxygen-carrying protein found in the blood, which transports the oxygen all over the body.

With insufficient iron, the body produces less red blood cells resulting to less hemoglobin that will be distributed throughout the body to function well. Thus, iron deficiency anemia develops.