

Ferritin

A ferritin blood test checks the amount of ferritin in the blood. Ferritin is a protein in the body that binds to iron; most of the iron stored in the body is bound to ferritin. Ferritin is found in the liver, spleen skeletal muscles, and bone marrow. Only a small amount of ferritin is found in the blood.

The amount of ferritin in the blood shows how much iron is stored in your body. Ferritin, a major iron-storage protein, normally appears in small quantities in serum. In healthy adults, serum ferritin levels are directly related to the amount of available iron stored in the body and can be measured accurately by radioimmunoassay.

Ferritin is normally found mainly inside of cells, with only a small amount in the blood. When there is damage to organs that contain ferritin (especially the liver, spleen, and bone marrow), ferritin levels can become elevated even though the total amount of iron in the body is normal. Ferritin levels may not be particularly helpful in persons with liver disease, chronic infections, cancers, or autoimmune diseases (which are all associated with organ damage).

Ferritin is produced in the liver to store any iron absorbed by the gut that is not immediately required by the bone marrow to make new blood. A low level of ferritin means that reserve iron stores are low. This is not particularly uncommon. When a child is born their mother gives them plenty of reserve iron. However, as this is used up it has to be replaced from the child's own diet. If this contains insufficient quantities of iron then the reserves (the ferritin levels) fall. Iron replacement is the correct treatment, along with dietary advice.

Consider possible causes of iron loss of which bleeding is the most common but most unusual in very young children. Intestinal or bladder parasites may commonly cause anaemia and low iron reserves.

Ferritin is a globular protein complex consisting of 24 protein subunits and is the main intracellular iron storage protein in both prokaryotes and eukaryotes, keeping it in a soluble and non-toxic form. Ferritin which is not combined with iron is called apoferritin.

Apo ferritin binds to free ferrous iron and stores it in the ferric state. As ferritin accumulates within cells of the reticuloendothelial system, protein aggregates are formed as hemosiderin. Iron in ferritin or hemosiderin can be extracted for release by the RE cells although hemosiderin is less readily available.

Ferritin is also used in materials science as a precursor in making iron nanoparticles for carbon nanotube growth by chemical vapor deposition.

Description

The ferritin protein consists of 24 protein subunits. In vertebrates, these are both the light (L) and the heavy (H) type with a molecular weight of 19 kDA or 21 kDA respectively. In plants and bacteria the complex only consists of the H-chain type.

Inside the ferritin shell, iron ions form crystallites together with phosphate and hydroxide ions. The resulting particle is similar to the mineral ferrihydrite. Each ferritin complex can store about 4500 iron (Fe^{3+}) ions.

Some ferritin complexes in vertebrates are hetero-oligomers of two highly-related gene products with slightly different physiological properties. The ratio of the two homologous proteins in the complex depends on the relative expression levels of the two genes.

Purpose

- To screen for iron deficiency and iron overload
- To measure iron storage
- To distinguish between iron deficiency (a condition of low iron storage) and chronic inflammation (a condition of normal storage)

- Find the cause of anemia, especially iron deficiency anemia.
- See whether inflammation is present.
- See whether too much iron (hemochromatosis) is present.
- Check to see whether iron treatment to raise or lower the iron level is working.
- Serum ferritin levels are measured in patients as part of the iron studies workup for anemia and for restless leg syndrome

You do not need to do anything before having this test.

Results

A ferritin blood test checks the amount of ferritin in the blood. Ferritin is a protein in the body that binds to iron; most of the iron stored in the body is bound to ferritin. The amount of ferritin found in the blood is the same amount that is in the body.

Normal

Normal values may vary from lab to lab.

Ferritin	
Men:	12–300 nanograms per milliliter (ng/mL) or 12–300 micrograms per liter (mcg/L)
Women:	10–150 ng/mL or 10-150 mcg/L
Children 6 months to 15 years:	7–142 ng/mL
Babies 2 to 5 months:	50–200 ng/mL
Babies 1 month:	200–600 ng/mL
Newborn babies:	25–200 ng/mL

High values

- Very high ferritin levels (greater than 1,000 ng/mL) can mean a large buildup of iron in the body (hemochromatosis). One form of this condition is passed on in families (genetic hemochromatosis). Some diseases, including alcoholism, thalassemia, and some types of anemia that cause red blood cells to be destroyed, can also cause hemochromatosis. Also, if you have many blood transfusions, this can sometimes cause the body to store too much iron (acquired hemochromatosis).
- High ferritin levels may also be caused by liver disease (cirrhosis or hepatitis), Hodgkin's disease, leukemia, infection, inflammatory conditions (such as arthritis or lupus), or a diet that is too high in iron.
- Too much iron in body organs, such as the pancreas or heart, can affect how the organ works.

High serum ferritin levels may indicate acute or chronic hepatic disease, iron overload, leukemia, acute or chronic infection or inflammation, Hodgkin's disease, or chronic hemolytic anemias. In these disorders, iron stores in the bone marrow may be normal or significantly increased. Serum ferritin levels are characteristically normal or slightly elevated in patients with chronic renal disease.

As ferritin is also an acute-phase reactant, it is often elevated in the course of disease. A normal C-reactive protein can be used to exclude elevated ferritin caused by acute phase reactions.

Ferritin can be elevated during periods of acute malnourishment.

If ferritin is high there is iron in excess, which would be excreted in the stool.

Low values

Low ferritin levels often mean an iron deficiency is present. This can be caused by long-term (chronic) blood loss from heavy menstrual bleeding, pregnancy, not enough iron in the diet, or bleeding inside the intestinal

tract (from ulcers, colon polyps, colon cancer, hemorrhoids, or other conditions). In rare cases, too much iron may be lost through the skin (because of a disease such as psoriasis) or in the urine. Low serum ferritin levels indicate chronic iron deficiency. If ferritin is low there is a risk for lack in iron which sooner or later could lead to anemia. Low ferritin levels have been associated with symptoms of restless leg syndrome even in the absence of anemia.

How to lower/raise:

Avoid or eat foods rich in iron: eggs, liver, red meat, soya products. Also cook or avoid cooking with a cast iron skillet.

What affects the Test

Reasons you may not be able to have the test or why the results may not be helpful include:

- Having a blood transfusion in the past 4 months.
- Being a female athlete doing sports that change the menstrual cycle.
- Having conditions that cause inflammation in the body, such as from illness or from a surgery.
- Having a radioactive scan in the past 3 days.
- Taking medicines, such as birth control pills and antithyroid medicines.
- Age. Older adults may have a higher ferritin value.
- Eating a diet high in red meats.

What To Think About

- A ferritin test is often done with other tests to check the amount of iron in the blood, especially the iron and iron-binding capacity levels.
- A bone marrow biopsy can check the amount of iron stored in the bone marrow.

Because inflammation in the body can cause high ferritin levels, a test result that is slightly high does not always mean a buildup of iron (hemochromatosis) is present.

Restless legs syndrome and iron metabolism

Restless legs syndrome (RLS) is known to be more common in blood donors, in late pregnancy, and in end stage renal disease, when iron stores are depleted.

There appears to be a strong link between decreased brain iron reserves, and impaired neurotransmitter function in part of the brain called the substantia nigra. This probably explains why dopaminergic substances and iron supplementation are effective for some people with RLS.

The possibility that RLS might be associated with iron metabolism has quite a long history. For instance, the observation that serum ferritin was lower in patients with RLS than in those without RLS suggested some link, albeit that the study had only 18 elderly patients. The inverse correlation of severity of RLS with serum ferritin levels, and improved symptoms after two months of treatment with oral iron salts helped to underline any association.

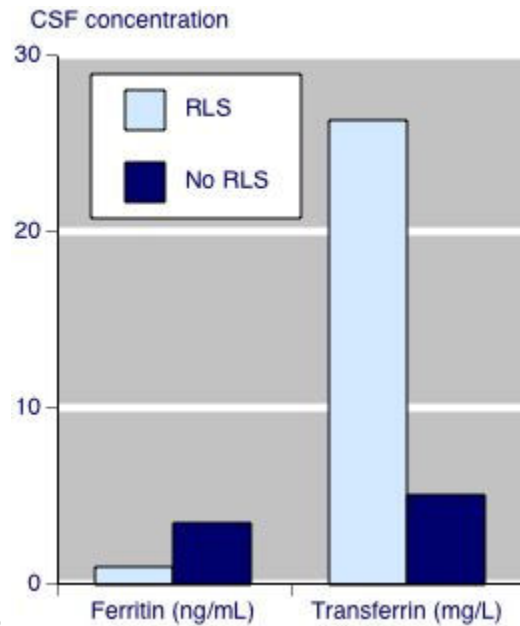
There are other associations between iron and RLS and confirmed an inverse response between RLS severity and serum ferritin, with worse sleep in patients with lower ferritin levels.

Yet case reports also indicate that there may be an important link, at least in some people. For instance, three teenagers with RLS had low body stores of iron, though without marked anaemia. Oral iron therapy for four months restored body stores of iron, and improved their RLS symptom severity, with decreased sleep latency and periodic limb movements, and improved sleep efficiency.

RLS and brain iron

Lower levels of CSF ferritin, and higher levels of CSF transferrin (Figure 1) can be found in patients with RLS compared to normal controls. An interpretation is that total brain concentrations of iron in patients with RLS are likely to be lower than those in patients without RLS. MRI measurements tuned to measure brain iron suggested that brain iron insufficiency was found in five RLS patients compared with five controls. The substantia nigra and putamen were implicated, with an indication that iron insufficiency was related to the degree of RLS severity. Substantially decreased iron staining in the substantia nigra was confirmed in a histopathological study of the brains of seven subjects who had been diagnosed with RLS. Electrophysiological changes in peripheral nerves, spinal cord and brainstem were normal in all 34 patients with iron deficiency anaemia, 14 of whom had RLS.

Figure 1: CSF ferritin and transferrin in the brains of patients with and



without RLS.

Thy-1 is a cell adhesion molecule playing a regulatory role in the release of neurotransmitters. In a study of brains of patients with RLS and without RLS, Thy-1 levels in the substantia nigra were half in patients with RLS compared with controls.

Local iron deficiency in the substantia nigra could impair dopaminergic function by limiting tyrosine hydroxylase activity or dopamine receptors or transporters. This indicates a possible link between decreased brain iron and responsiveness to dopamine and iron supplementation in RLS.

Some general questions

Is iron deficiency the same thing as anemia? What are the symptoms?

Iron deficiency refers to a decrease in storage iron, while anemia refers to a drop in the amount of hemoglobin in blood. It takes at least several weeks after iron stores are depleted for anemia to develop. Early iron deficiency usually causes no effects at all. If a person is otherwise healthy, symptoms seldom appear before the hemoglobin in your blood drops below a certain level (10 g per deciliter). Some signs that your body is low in iron include tiredness and heart palpitations.

As your iron continues to be depleted, you may have shortness of breath and dizziness. If the anemia is severe, angina (chest pain), headache, and leg pains may occur. Children may have learning (cognitive) disabilities. Besides the general symptoms of anemia, there are certain symptoms that are characteristic of iron deficiency. These include pica (cravings for specific substances, such as licorice, chalk, dirt, or clay), a burning sensation in the tongue or a smooth tongue, sores at the corners of the mouth, and spoon-shaped finger- and toe-nails.

What are signs of iron overload in my system?

The most common symptom is pain, as iron accumulates in your body, usually in your joints. Other symptoms include fatigue and lack of energy, abdominal pain, loss of sex drive, and heart problems. Some people, however, have no symptoms of this condition.

What foods contain the most iron?

If lab tests show that you are anemic, eating foods that contain iron, such as red meat, can help. Some good choices for an iron-rich diet include: meats, liver, eggs, green leafy vegetables (spinach, collard greens, and kale), wheat germ, whole grain breads and cereals, raisins, and molasses. If you have been diagnosed with iron deficiency anemia, or you are pregnant or breast feeding, vitamin pills or tablets are usually needed to provide extra iron. Ask your doctor about the right supplement for you.

Who needs iron supplements?

The people who typically need iron supplements are pregnant women and patients with documented iron deficiency.

Does anemia due to iron deficiency happen quickly or does it take a long time?

Iron deficiency anemia comes on gradually. When your rate of iron loss exceeds the amount of iron you absorb from the gut, iron stores are slowly used up. At this stage, ferritin will be low, but serum iron and TIBC are usually normal and there is no anemia. As iron deficiency worsens, serum iron levels fall, TIBC and transferrin rise, and anemia starts to develop. With prolonged or severe iron deficiency, the red cells become small and pale.

Does donating blood affect my iron levels?

Yes. Every time you donate a pint of blood, your body loses about 250 mg of iron. The level of serum ferritin, which is a reflection of the total amount of storage iron, drops with each donation. The more blood you donate, the lower the ferritin becomes. Other tests, such as serum iron and TIBC, are not as affected by blood donation.

Is there anything else I should know?

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