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## Review Article



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## Ferritin: A vital tool required by the body to function effectively

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### Abstract

Ferritin is an iron-containing protein in blood cells. The main protein involved in the storage of iron. The level of ferritin in the blood can be used as an indicator of the amount of iron stored in the body and may increase due to the presence of significant inflammation. Ferritin is shaped like a hollow sphere, allowing different amounts of iron to enter storage (as a complex of ferric hydroxide phosphate). In the ferritin test, if the test shows higher than normal levels, it may indicate that your physical condition is causing your body to store too much iron. It may also indicate liver disease, rheumatoid arthritis, other inflammation, or hyperthyroidism. Certain types of cancer can also cause your blood ferritin levels to rise.

**Keywords:** ferritin, vital tool, laboratory diagnosis, immune response

### Introduction

Ferritin is a universal intracellular protein that stores iron and releases it in a controlled manner. Protein is produced by almost all organisms, including algae, bacteria, higher plants and animals. In humans, it can act as a buffer for iron deficiency and iron overload (Wang W, et al. 2010). Ferritin exists as a cytoplasmic protein in most tissues, but a small amount is secreted into the serum as a siderophore. Plasma ferritin is also an indirect marker of total iron storage in the body; therefore, serum ferritin is used as a diagnostic test for iron deficiency anemia (Wang et al., 2010)

Ferritin is a globular protein complex composed of 24 It is composed of protein subunits and forms a metal-protein nanocage with multiple interactions (Wang et al., 2010). , 2010). It is the main intracellular ferritin in prokaryotes and eukaryotes, and maintains iron in a soluble and non-toxic form. The ferritin that does not bind to iron is called apoferritin (Wang et al., 2010). The structure of the mouse ferritin complex gene The ferritin gene is highly conserved among species. All vertebrate ferritin genes have three introns and four exons (Torti et al., 2000). In human ferritin, introns exist between amino acid residues 14 and 15, 34 and 35, and 82 and 83; in

addition, there are 1 to 200 untranslated bases at each end of the combined exon (Theil, 1987). The tyrosine residue at amino acid position 27 is considered to be related to biomineralization (De Zoysa, 2007)

### Protein structure

Ferritin is a hollow 474 kDa globular protein composed of 24 subunits, present in each type Types of cells (Theil, 1987). Its inner diameter and outer diameter are usually about 8 nanometers and 12 nanometers, respectively. In vertebrates, these subunits belong to the light (L) and heavy (H) types, with an apparent molecular weight of 19 kDa or 21 kDa, respectively; their sequences are homologous (approximately 50% identical) (Theil, 1987). Animals have an additional type of ferritin ("M"); (Andrews et al., 1997) The unique ferritin from plants and bacteria is more similar to the H type from vertebrates (Andrews et al., 1997) in the abdomen. Two types are found in Lymnaea. Somatic ferritin is different from yolk ferritin (see below) (Andrews et al., 1997). An additional ferritin-like subunit cell from Lymnaea is involved in the formation of pearl shells. There are two types of schistosome parasites, one in males and the other in females (Andrews et al., 1997). All of the aforementioned ferritins are similar to vertebrate H-type in terms of primary sequence (Andrews et al., 1997). In *E. coli*, 20% similarity to human Hferritin was observed (Andrews et al., 1997). In the ferritin layer, iron ions form crystallites together with phosphate and hydroxide ions. The resulting particles are similar to the mineral ferrihydrite. Each ferritin complex can store approximately 4500 iron ions (Fe<sup>3+</sup>) (Theil, 1987).

Some ferritin complexes in vertebrates are heterooligomers of two closely related gene products with slightly different physiological characteristics. The proportion of the two homologous proteins in the complex depends on the relative expression levels of the two genes.

Mitochondrial ferritin was recently identified as a protein precursor and classified as a metal-binding protein located in mitochondria (Levi *et al.*, 2001). Once the protein is taken up by the mitochondria, it can be processed into mature protein and assembled to form a functional ferritin layer. The structure was determined at 1.70 angstroms by X-ray diffraction and contains 182 residues. It is 67% spiral. The Ramachandran diagram (Levi *et al.*, 2001) shows that the structure of mitochondrial ferritin is mainly alpha helix and the prevalence of beta sheets is low. Unlike other human ferritins, it appears that there are no introns in its genetic code.

### Function

#### Iron storage

Ferritin is used to store iron in a non-toxic form, store iron safely, and transport it to where it is needed (Seckback, 1982). The function and structure of expressed ferritin vary in different cell types. This is mainly controlled by the amount and stability of the mRNA. The mRNA concentration will be further adjusted by changing its storage method and transcription efficiency. The presence of iron itself is the main trigger for ferritin production, with a few exceptions (for example, the vitelline ferritin of the gastropod Lymnaea, which lacks response units to iron) (Andrews et al., 1997).

Iron free is toxic to cells passes through fen Reaction of the ton acts as a catalyst in the formation of free radicals from active oxygen. Thus, vertebrates have developed a well-designed protective mechanism to bind iron in various tissue compartments. In the cell, iron is stored in protein complexes in the form of ferritin or haemosiderin. Apoferritin binds to free ferrous iron and is stored in the ferric iron state. As ferritin accumulates in the cells of the reticuloendothelial system, aggregates of proteins such as hemosiderin form. Iron from ferritin or haemosiderin can be extracted for release by RE cells, although haemosiderin is not readily

available. Under steady-state conditions, serum ferritin levels are correlated with total body iron stores; therefore, serum ferritin FR5R1 is the most convenient laboratory test for estimating iron stores.

Since iron is an important mineral in mineralization, ferritin is used in the shells of mollusks and other organisms to control the concentration and distribution of iron, thereby shaping the shape and color of the shell. It also plays a role in polyplacophora haemolymph, where it can quickly transport iron to the mineralized tooth leaves (Andrews et al., 1997). Iron is released from ferritin and used for the degradation of ferritin, which is mainly carried out by lysosomes.

### Immune response

The concentration of ferritin increases sharply in the presence of infection or cancer. Endotoxin is a positive regulator of the gene encoding ferritin, leading to an increase in ferritin concentration. In contrast, organisms such as *Pseudomonas* bacteria have endotoxins, but they cause a significant decrease in plasma ferritin levels within the first 48 hours of infection. Therefore, the iron reserves in the body of the infected person are rejected by the infectious substance, which hinders their metabolism (Ong et al., 2005).

### Stress response

The concentration of ferritin has been shown to increase with stress responses such as hypoxia; this means that it is an acute phase protein.

### Mitochondria

Mitochondrial ferritin has many functions related to molecular functions. It is involved in ferrous oxidase activity, binding (Wang et al., 2010), iron ion binding, oxidoreductase activity, ferric iron binding, metal ion binding and transition metal binding. In the scope of biological processes, it participates in redox, the transport of iron ions through membranes and the cell homeostasis of iron ions.

### Egg Yolk

In some snails, the protein component of egg yolk is mainly ferritin; (Bottke et al., 1988), which is a ferritin different from somatic ferritin and has a different gene sequence. It is produced in the glands of the midgut and secreted into the hemolymph, from where it is transported to the egg (Bottke et al., 1988).

### Industrial applications

Ferritin is also used in materials science as a precursor for the production of iron nanoparticles for the growth of carbon nanotubes by chemical vapor deposition.

### Diagnostic Uses

Serum ferritin levels are measured in medical laboratories as part of iron screening tests for iron deficiency anemia. The measured ferritin level is generally directly related to the total amount of iron stored in the body. However, in the case of anemia due to chronic disease, ferritin levels can be artificially increased, where ferritin increases its capacity as a protein in the acute phase of inflammation, rather than as a marker of iron overload (Wang et al. ., 2010).

### Normal range

The normal blood ferritin level, called the reference interval, is determined by many testing laboratories. The ferritin range varies from laboratory to laboratory, but the typical range is 30-300 ng / mL (=  $\mu\text{g} / \text{L}$ ) for men and 18-160 ng / mL (=  $\mu\text{g} / \text{L}$ ) for women.

### Reasons for the ferritin test

You may have a ferritin test for several reasons:

- Diagnose a disease. If other blood tests show a low level of oxygen-carrying protein (hemoglobin) in your red blood cells, or if the ratio of red blood cells to the liquid component of the blood (haematocrit) is low, your doctor may recommend a ferritin test. These may indicate that

you have iron deficiency anemia. The ferritin test can help confirm the diagnosis. Ferritin can also be measured in people with restless legs syndrome. The ferritin test can also be used to help diagnose conditions such as hemochromatosis, liver disease, and adult Still's disease.

When used to diagnose disease, the ferritin test can be combined with the iron and total iron-binding capacity (TIBC) test and the transferrin test. These tests provide additional information about the iron content in your body (Wang et al., 2010).

Monitor medical conditions. If you are diagnosed with a disease that causes too much iron in your body, such as haemochromatosis or hemosiderinosis, your doctor may use a ferritin test to monitor your condition and guide treatment (Gomella et al., 2003).

If other blood tests indicate that there may be anemia, which will lead to hypoxia in the blood, the doctor will order a ferritin test. It can be used to check whether there is too much or too little iron in the body. Doctors can also use it to diagnose restless legs syndrome and Still's disease (a rare fever and rash of arthritis) in adults.

Iron deficiency may be the cause of:

- You often feel dizzy, weak and tired
- You have a headache
- You look pale

You may also have strange cravings for licorice, chalk, dirt or clay. You may feel a burning sensation in your tongue (Wang et al., 2010).

If left unchecked, low iron levels can cause heart failure (when your heart cannot pump blood into your body as it should). It can also cause the following symptoms:

- Chest pain
- Leg pain
- Tinnitus or tinnitis

The ferritin blood test can also help your doctor determine if your body stores too much iron. High levels may indicate alcohol abuse, infection, liver disease, rheumatoid arthritis, overactive thyroid, or certain types of cancer.

Symptoms of high iron levels vary and may include:

- Fatigue
- Heart problems
- Joint pain
- Low libido
- Body hair loss
- Stomach pain
- Weight loss

### Preparation

Only ferritin is tested, and it is OK before the test. Eat a normal diet. If your blood sample will be used for other tests, you may need to fast for a period of time before the test. Your doctor will give you specific instructions (Gomella et al., 2003).

### Expected

During the ferritin test, a member of your medical team collects a blood sample by inserting a needle into a vein in your arm. The blood sample is sent to the laboratory for analysis. You can resume daily activities immediately.

### Results

The normal range of ferritin in the blood is:

- For men, 20 to 500 ng per milliliter
- For women, 20 to 200 ng per milliliter

Results are lower than normal

Ferritin levels lower than normal indicate you It is insufficient iron. You may also have anemia (Gomella et al., 2003). If your ferritin level is low, your doctor will work to determine the cause.

Higher than normal results

Higher than normal ferritin levels may be caused by:

- Hemochromatosis-a condition that causes your body to absorb too much iron from the food you eat
- Porphyria- A group of diseases caused by enzyme deficiencies that affect your nervous system and skin
- Rheumatoid arthritis or other chronic inflammation
- Liver disease
- Hyperthyroidism
- Leukemia
- Hodgkin's lymphoma
- Multiple blood transfusions
- Alcoholism

If your ferritin level is higher than normal, your doctor may need to look at the results and the results of other tests to determine the next step.

For more information about what your ferritin test results mean, please consult your doctor.

### Risk

Like other routine blood tests, ferritin testing is considered safe. You may feel the following:

- fainting or dizziness
- lumps or bruises under the skin
- mild pain where the needle enters

### Conclusion

Ferritin is an iron-containing protein in blood cells. The main protein involved in the storage of iron. In the ferritin test, if the test shows higher than normal levels, it may indicate that your physical condition is causing your body to store too much iron. It may also indicate liver disease, rheumatoid arthritis, other inflammation, or hyperthyroidism. Certain types of cancer can also cause your blood ferritin levels to rise.

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