

# Iron Overload Destroys Mitochondria and Sabotages Health

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## STORY AT-A-GLANCE

- › Iron is essential for life as it transfers oxygen to your tissues. Hemoglobin, the protein in your red blood cells, contains iron at its core, which reversibly binds to oxygen and supplies your tissues with it
- › Without proper oxygenation, your cells quickly start dying. However, excess iron can also cause severe problems by encouraging oxidation and tissue damage
- › Common health problems associated with elevated iron levels include cirrhosis, cancer, hepatitis C, gouty arthritis, arrhythmia, cardiovascular disease, Type 2 diabetes, Alzheimer's and more
- › Recent research shows excessive iron damages mitochondrial function and impairs your heart function by inducing the death of muscle cells in your heart
- › Your iron level can be easily determined with a serum ferritin test. I believe this is one of the most important tests that everyone should have done on a regular basis as part of a preventive, proactive health screen

**This article was previously published January 15, 2020, and has been updated with new information.**

Iron is necessary for life as it is essential to transfer oxygen into your tissues. Hemoglobin, the protein in your red blood cells that contains iron at its core, reversibly binds to oxygen and supplies your tissues with it. Without proper oxygenation, your cells quickly start dying.

Iron is also a key component of various proteins and enzymes, and is involved in energy production, immune function, metabolism and endocrine function. For these reasons, low iron (anemia) can cause significant health problems.

However, what many don't realize is that excess iron is actually more common than too little, and iron overload can be even more problematic. Because your body has a limited capacity to excrete iron, it can easily build up in organs like your liver, heart and pancreas. This is dangerous because iron is a potent oxidizer that can damage your tissues and contribute to a variety of health problems, including but not limited to:

Cirrhosis<sup>1</sup>

Cancer, including bowel,<sup>2</sup> liver<sup>3</sup> and lung cancer<sup>4</sup> – Elevated ferritin is associated with a 2.9 times higher risk of death from cancer<sup>5</sup> and blood donors have been shown to have a lower likelihood of developing certain cancers than nondonors<sup>6,7</sup>

Hepatitis C<sup>8</sup> – As noted in a 2007 paper,<sup>9</sup> even "mild or moderate increase of iron stores appears to have significant clinical relevance" in this and other conditions

Gouty arthritis<sup>10</sup>

Cardiac arrhythmia<sup>11</sup>

Cardiovascular disease<sup>12</sup>

Type 2 diabetes<sup>13</sup> and metabolic syndrome – Elevated ferritin has been linked to dysfunctional glucose metabolism,<sup>14</sup> raising the risk of diabetes fivefold in men and fourfold in women, a magnitude of correlation similar to that of obesity.<sup>15</sup>

Alzheimer's disease<sup>17</sup>

High ferritin also doubles your risk of metabolic syndrome,<sup>16</sup> a condition associated with an increased risk of high blood pressure, liver disease and heart disease

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## **Iron Overload Impairs Mitochondrial Function**

Iron causes significant harm primarily by catalyzing a reaction within the inner mitochondrial membrane. When iron reacts with hydrogen peroxide, hydroxyl free radicals are formed.

These are among the most damaging free radicals known, causing severe mitochondrial dysfunction, which in turn is at the heart of most chronic degenerative diseases. The hydroxyl free radicals are an oxidative stress that will also damage your cell membranes, stem cells, protein and DNA.

In addition to all this damage, research<sup>18</sup> shows excessive iron also promotes apoptosis and ferroptosis in cardiomyocytes. Apoptosis is the programmed cell death of diseased and worn-out cells, and as the name implies, ferroptosis refers to cell death that is dependent on and regulated by iron specifically.<sup>19</sup>

Cardiomyocytes are muscle cells in your heart that generate and control the rhythmic contractions in your heart, thus allowing it to maintain a healthy rhythm.<sup>20</sup> In short, this tells us that excess iron has the ability to impair your heart function by inducing mitochondrial abnormalities and the death of muscle cells in your heart.

## **How Iron Overload Affects Your Risk of Alzheimer's Disease**

Aside from raising your risk of heart-related problems, iron overload is also of particular concern in Alzheimer's disease,<sup>21,22,23</sup> the prevalence of which has dramatically risen in recent decades.

According to research<sup>24,25</sup> published in 2018, buildup of iron – which increases oxidative stress and has a type of "rusting effect" in your brain – is common in most Alzheimer's patients. As noted by the authors:<sup>26</sup>

*"In the presence of the pathological hallmarks of [Alzheimer's disease], iron is accumulated within and around the amyloid-beta plaques and neurofibrillary tangles, mostly as ferrihydrite inside ferritin, hemosiderin and magnetite.*

*The co-localization of iron with amyloid-beta has been proposed to constitute a major source of toxicity. Indeed, in vitro, amyloid-beta has been shown to convert ferric iron to ferrous iron, which can act as a catalyst for the Fenton reaction to generate toxic free radicals, which in turn result in oxidative stress."*

Other research<sup>27</sup> suggests elevated cerebrospinal fluid iron levels are strongly correlated with the presence of the Alzheimer's risk allele APOE-e4, and that elevated levels of iron in your brain may actually be the mechanism that makes APOE-e4 a major genetic risk factor for the disease.

A primary focus of conventional treatment so far has been to clear amyloid proteins, but while that approach seems logical, such attempts have met with limited success. Researchers now suggest clearing out excess iron may be a more effective way to reduce damage and slow or prevent the Alzheimer's disease process.

## **Iron Dysregulation Is Surprisingly Common**

It's easy to get too much iron as it's commonly added to most multivitamins. Many processed foods are also fortified with iron. Two servings of fortified breakfast cereal may provide as much as 44 milligrams (mg) of iron in some cases,<sup>28</sup> bringing you dangerously close to the upper tolerance limit of 45 mg for adults, and well over the recommended daily allowance, which is a mere 8 mg for men and 18 mg for premenopausal women (i.e., women who still get their monthly period).<sup>29</sup>

Unfortunately, many doctors don't understand or appreciate the importance of checking for iron overload. One of the greatest risk factors for iron overload is having a condition

called hemochromatosis<sup>30</sup> – one of the most prevalent genetic diseases in the U.S. – which impairs your body's iron regulation, causing you to absorb higher than normal amounts.

The C282Y gene mutation is thought to be responsible for the majority of hemochromatosis cases. It takes two inherited copies of the mutation (one from your mother and one from your father) to cause the disease (and even then, only some people will actually get sick).

More than 30% of Americans are thought to have two copies of this defective gene<sup>31</sup> and, according to one study,<sup>32</sup> an estimated 40% to 70% of those with two defective C282Y genes will develop clinical evidence of iron overload.

If you have just one copy, you won't become ill but you will still absorb slightly more iron than the rest of the population,<sup>33,34</sup> thus placing you at increased risk for overload and the complications associated with it.

## **Common Factors That Increase Your Risk of Iron Overload**

Virtually all adult men and postmenopausal women are also at risk for iron overload since they do not lose blood on a regular basis. Blood loss is the primary way to lower excess iron, as the body has no active excretion mechanisms. Other potential contributors to high iron levels include:

- Cooking in iron pots or pans – Cooking acidic foods in these types of pots or pans will elevate iron absorption.
- Eating processed food products like cereals and white breads fortified with iron – The iron used in these products is inorganic iron, not much different from rust, and it is far more dangerous than the iron in meat.
- Drinking well water that is high in iron – The key here is to make sure you have some type of iron precipitator and/or a reverse osmosis water filter.
- Taking multiple vitamins and mineral supplements, as both of these frequently have iron in them.

- Regularly consuming alcohol, as this will increase the absorption of iron in your diet.

## **How to Check for and Address Iron Overload**

Checking your iron levels is easy and can be done with a simple blood test called a serum ferritin test. I believe this is one of the most important tests that everyone should have done on a regular basis as part of a preventive, proactive health screen. The test measures the carrier molecule of iron, a protein found inside cells called ferritin, which stores the iron. If your ferritin levels are low, it means your iron levels are also low.

The healthy range of serum ferritin lies between 20 and 80 nanograms per milliliter (ng/ml). Below 20 ng/ml is a strong indicator that you are iron deficient, and above 80 ng/ml suggests you have an iron surplus. An ideal range is between 40 and 60 ng/ml.

Please note that many health sites will tell you that "normal" can be much higher than that, but levels over 300 ng/ml are particularly toxic and will eventually cause serious damage.<sup>35</sup> If you have hemochromatosis, or if a serum ferritin blood test reveals elevated iron levels, donating your blood two or three times a year is the safest, most effective and inexpensive remedy. If you have severe overload you may need to do more regular phlebotomies.

If, for some reason, a blood donor center is unable to accept your blood for donation, you can obtain a prescription for therapeutic phlebotomy. At the same time, you'll also want to avoid consuming excess iron in the form of supplements, in your drinking water (well water), from iron cookware or fortified processed foods.

You can also limit iron absorption by not eating iron-rich foods in combination with vitamin C-rich foods or beverages, as the vitamin C boosts iron absorption. If needed, you could also take a curcumin supplement. Curcumin acts as a potent chelator of iron and can be a useful supplement if your iron is elevated.

## **GGT Test Is Also Advisable to Rule Out Iron Toxicity**

Aside from a serum ferritin test, a gamma-glutamyl transpeptidase (GGT) test can also be used as a screening marker for excess free iron and is a great indicator of your risk for sudden cardiac death, insulin resistance, cardiometabolic disease<sup>36</sup> and chronic kidney disease<sup>37</sup> as well.

In recent years, scientists have discovered GGT is highly interactive with iron. Low GGT tends to be protective against higher ferritin, so if your GGT is low, you're largely protected even if your ferritin is a bit higher than ideal.

When both your serum ferritin and GGT are high, you are at significantly increased risk of chronic health problems and early death,<sup>38</sup> because then you have a combination of free iron (which is highly toxic), and the iron storage to keep that toxicity going.<sup>39</sup> That said, even if your ferritin is low, having elevated GGT levels is cause for concern and needs to be addressed.

For this reason, getting a GGT test in addition to a serum ferritin test is advisable to rule out iron toxicity. The ideal level of GGT is below 16 units per liter (U/L) for men and below 9 U/L for women. Above 25 U/L for men and 18 U/L for women, your risk of chronic disease increases significantly.

To lower your GGT level you'll need to implement strategies that boost glutathione, a potent antioxidant produced in your body, as GGT is inversely related to glutathione. As your GGT level rises, your glutathione goes down. This is in fact part of the equation explaining how elevated GGT harms your health. By elevating your glutathione level, you will lower your GGT.

The amino acid cysteine, found in whey protein, poultry and eggs, plays an important role in your body's production of glutathione. Red meat, which does not contain cysteine, will tend to raise GGT, as will alcohol, so both should be avoided.<sup>40</sup>

Certain medications can also raise your GGT. If this is the case, please confer with your doctor to determine whether you might be able to stop the medication or switch to something else. General detoxification is another important component if your GGT is high, as your liver's job is to remove toxins from your body. The fact that your GGT is elevated means your liver is under stress.

# Annual Ferritin Test Is an Important Health Screen

For adults, I strongly recommend getting an annual serum ferritin test to confirm you're neither too high nor too low. When it comes to iron overload, I believe it can be every bit as dangerous to your health as vitamin D deficiency, and checking your iron status is far more important than your cholesterol.

While a full iron panel that checks serum iron, iron-binding capacity and ferritin can be helpful, you really only need the serum ferritin test, plus the GGT test. Your doctor can write you a prescription for these tests, or you can order them from [Healthelron.com](https://www.healthelron.com).

Again, if your ferritin is high, the easiest way to lower it is to donate blood two or three times a year. U.S. legislation allows all blood banks to perform therapeutic phlebotomy for hemochromatosis or iron overload. All you need is a doctor's order.

Also, unless you have a lab-documented iron deficiency, avoid iron-containing multivitamins, iron supplements and mineral supplements that contain iron if your levels are already high.

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