Dietary Iron– Too Much Too Little

Iron is a mineral found in every cell of the body. Iron is considered an essential mineral because it is needed to make hemoglobin, a part of blood cells that transfers oxygen.

In spite of the advertising from iron supplement manufacturers, "iron overload" is much more common in America than iron deficiency.

Function of Iron
The human body needs iron to make the oxygen-carrying proteins hemoglobin and myoglobin. Hemoglobin is found in red blood cells and myoglobin is found in muscles.

IRON Deficiency:

LOW IRON LEVELS
The human body stores some iron to replace any that is lost. However, low iron levels over a long period of time can lead to iron deficiency anemia. Symptoms include lack of energy, shortness of breath, headache, irritability, dizziness, or weight loss. Physical signs of iron deficiency are a pale tongue and spoon-shaped nails.

Anemia is a condition in which the body does not have enough healthy red blood cells. Red blood cells provide oxygen to body tissues. There are many types of anemia.

Iron deficiency anemia occurs when your body does not have enough iron. Iron helps make red blood cells.
Causes
Iron deficiency anemia is the most common form of anemia. Red blood cells bring oxygen to the body's tissues. Healthy red blood cells are made in your bone marrow. Red blood cells circulate through your body for 3 to 4 months. Parts of your body, such as your spleen, remove old blood cells.

Iron is a key part of red blood cells. Without iron, the blood cannot carry oxygen effectively. Your body normally gets iron through your diet. It also reuses iron from old red blood cells.

Iron deficiency anemia develops when your body's iron stores run low. This can occur because:

- You lose more blood cells and iron than your body can replace
- Your body does not do a good job of absorbing iron
- Your body is able to absorb iron, but you are not eating enough foods that contain iron
- Your body needs more iron than normal (such as if you are pregnant or breastfeeding)

Bleeding can cause iron loss. Common causes of bleeding are:

- Heavy, long, or frequent menstrual periods
- Cancer in the esophagus, stomach, small bowel, or colon
- Esophageal varices, usually from cirrhosis
- The use of aspirin, ibuprofen, or arthritis medicines for a long time, which can cause gastrointestinal bleeding
- Peptic ulcer disease
  The body may not absorb enough iron in your diet due to:

- Celiac disease
• Crohn disease
• Gastric bypass surgery
• Taking too many antacids that contain calcium
  You may not get enough iron in your diet if:

• You are a strict vegetarian
• You are an older adult and do not eat a full diet

**Iron Deficiency Anemia Symptoms**
You may have no symptoms if the anemia is mild.

Most of the time, symptoms are mild at first and develop slowly. Symptoms may include:

• Feeling grumpy
• Feeling weak or tired more often than usual, or with exercise
• Headaches
• Problems concentrating or thinking
  As the anemia gets worse, symptoms may include:

• Blue color to the whites of the eyes
  • Brittle nails
  • Desire to eat ice or other non-food things (pica)
  • Feeling lightheaded when you stand up

• Pale skin color
• Shortness of breath
• Sore tongue

  Symptoms of the conditions that cause iron deficiency anemia include:

• Dark, tar-colored stools or blood in the stool
• Heavy menstrual bleeding (women)
• Pain in the upper belly (from ulcers)
• Weight loss (in people with cancer)
Craving ice can be a sign of Anemia.

Those at risk for low iron levels include:

- Women who are menstruating, especially if they have heavy periods
- Women who are pregnant or who have just had a baby
- Long-distance runners
- People with any type of bleeding in the intestines (for example, a bleeding ulcer)
- People who frequently donate blood
- People with gastrointestinal conditions that make it hard to absorb nutrients from food

Babies and young children are at risk for low iron levels if they do not get the right foods. Babies moving to solid foods should eat iron-rich foods. Infants are born with enough iron to last about six months. An infant's additional iron needs are met by breast milk. Infants that are not breastfed should be given an iron supplement or iron-fortified infant formula.

Children between age 1 and 4 grow rapidly. This uses up iron in the body. Children of this age should be given iron-fortified foods or iron supplements.
Milk is a very poor source of iron. Children who drink large quantities of milk and avoid other foods may develop "milk anemia." Recommended milk intake is two to three cups per day for toddlers.

**Excess iron:**

Iron encourages the formation of cancer-causing free radicals. Of course, the body needs a certain amount of iron for healthy blood cells. But beyond this rather small amount, iron becomes a dangerous substance, acting as a catalyst for the formation of free radicals. Because of this, research studies have shown that higher amounts of iron in the blood mean higher cancer risk.

Once excess iron is absorbed by the digestive tract, the body stores it. Most of us accumulate much more iron than we need.

**In spite of the advertising from iron supplement manufacturers, *"iron overload"* is much more common in America than iron deficiency.**

Studies have shown that major contributors to iron excess are taking vitamin and mineral supplements that contain iron, excess consumption of red meat, and, to some extent, eating manufactured foods that have had iron added artificially. The iron present in these sources is highly absorbable. The iron in red meat, in particular, is a highly absorbable form (heme iron); however, iron from vegetarian food sources (nonheme iron) may prove to be a better choice because, while it isn't absorbed as well as heme iron, it is sufficient to promote adequate iron levels without encouraging iron stores above the recommended range. A diet of grains, vegetables, fruits, and beans provides adequate iron, without the risk of overload.

**Food Sources**

The best sources of iron include:

- Dried beans
- Dried fruits
- Eggs (especially egg yolks)
- Iron-fortified cereals
• Liver
• Lean red meat (especially beef)
• Oysters
• Poultry, dark red meat
• Salmon
• Tuna
• Whole grains
  Reasonable amounts of iron are also found in lamb, pork, and shellfish.

Iron from vegetables, fruits, grains, and supplements is harder for the body to absorb. These sources include:

  Dried fruits:
  • Prunes
  • Raisins
  • Apricots
    Legumes:
    • Lima beans
    • Soybeans
    • Dried beans and peas
  • Kidney beans
    Seeds:
    • Almonds
    • Brazil nuts
    Vegetables:
    • Broccoli
    • Spinach
    • Kale
    • Collards
Asparagus
Dandelion greens
Whole grains:
Wheat
Millet
Oats
Brown rice

If you mix some lean meat, fish, or poultry with beans or dark leafy greens at a meal, you can improve absorption of vegetable sources of iron up to three times. Foods rich in vitamin C (such as citrus, strawberries, tomatoes, and potatoes) also increase iron absorption. Cooking foods in a cast-iron skillet can also help to increase the amount of iron provided.
Some foods reduce iron absorption. For example, commercial black or pekoe teas contain substances that bind to dietary iron so it cannot be used by the body.

Side Effects
TOO MUCH IRON
The genetic disorder called hemochromatosis affects the body's ability to control how much iron is absorbed. This leads to too much iron in the body. Treatment consists of a low-iron diet, no iron supplements, and phlebotomy (blood removal) on a regular basis.
It is unlikely that a person would take too much iron. However, children can sometimes develop iron poisoning by swallowing too many iron supplements. Symptoms of iron poisoning include:

- Fatigue
- Anorexia
- Dizziness
- Nausea
- Vomiting
- Headache
- Weight loss
- Shortness of breath
- Grayish color to the skin

Recommendations
The Food and Nutrition Board at the Institute of Medicine recommends the following:
Infants and children

- Younger than 6 months: 0.27 milligrams per day (mg/day)*
- 7 months to 1 year: 11 mg/day
- 1 to 3 years: 7 mg/day
- 4 to 8 years: 10 mg/day

*AI or Adequate Intake

Males

- 9 to 13 years: 8 mg/day
- 14 to 18 years: 11 mg/day
- Age 19 and older: 8 mg/day

Females

- 9 to 13 years: 8 mg/day
- 14 to 18 years: 15 mg/day
- 19 to 50 years: 18 mg/day
- 51 and older: 8 mg/day
- Pregnant women of all ages: 27 mg/day
- Lactating women 19 to 30 years: 9 mg/day

Women who are pregnant or producing breast milk may need different amounts of iron. Ask your health care provider what is appropriate for you.

Alternative Names
Diet - iron; Ferric acid; Ferrous acid; Ferritin

Diet - iron; Ferric acid; Ferrous acid; Ferritin

It is easy to check whether your body has accumulated too much stored iron. The following set of tests will check for both iron deficiency and iron overload. The more general hemoglobin and hematocrit tests are not sufficient. Although general guidelines are given here, the tests should be interpreted by your doctor:
- Serum ferritin (normal values are 15-60 mcg/l of serum). This test may require interpretation by your doctor, but is the most reliable guide to the amount of iron in your body.²
- Serum iron
- Total iron binding capacity (TIBC)

Doctors divide the serum-iron value by the TIBC. The result should be 16 to 50 percent for women and 16 to 62 percent for men. This test is usually administered to detect iron deficiency, levels below normal values. Results above these norms indicate excess iron. TIBC results may fall within the normal range even when body iron measured by ferritin is considerably elevated. Therefore, further tests may be required as this test is not definitive.

A test sometimes used to check for iron deficiency is the red cell protoporphyrin test. A result greater than 70 units is considered abnormal. If two of these three values (serum ferritin, serum iron/TIBC, and red cell protoporphyrin) are normal, iron-deficiency anemia is not likely. Serum iron and TIBC should be measured after fasting overnight.

In a recent six-year study of 1,277 Veterans Administration Hospital patients with vascular disease, but no history of cancer, half the patients were randomly assigned to standard of care and half to the same care plus measured blood drawing to reduce iron levels to those present normally in premenopausal women and children. Analysis showed a 37 percent reduction in overall cancer incidence with iron reduction and reduced cancer-specific and all-cause mortality among patients who developed cancer in the iron-reduction arm compared with those in the control arm.²

Unfortunately, the body has no way to rid itself of excess iron. However, iron accumulation to levels that produce cancer can be prevented by avoiding excess iron in the diet (as indicated above) and by giving blood. This altruistic act of giving blood can have health benefits for the donor as well. Menstruating women lose iron-rich blood monthly and have ferritin levels that average about 25 mcg/l. Delayed iron accumulation because of menstruation is believed to explain why women generally live longer than men. It also explains why cancer risk is lower in premenopausal women compared to men of similar age and why cancer risk soars in women following menopause when iron levels rise dramatically. Men and women who live to very old age characteristically have body iron levels closer to those in menstruating women, presumably because of lifelong, relatively low dietary iron intake.
Iron: Too Much or Too Little Can Cause All-Too-Familiar Problems

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An article on iron deficiency and overload may seem like a funny one for a newsletter on chronic neuroimmune disorders (CND), but the fact is that both iron deficiency and overload can cause symptoms all too familiar to most of us: fatigue, memory problems, and more.

As part of the overall review my body's systems were being given this past year, my doctor identified a lot of things that weren't necessarily related to my CND - very low testosterone, excessively high estrogen, low DHEA, and uncomfortably high levels of mercury. I felt better after taking testosterone, something else to reduce my estrogen. I'm taking as much DHEA as I can without causing problems, and am going through mercury detox. But the unchanged fatigue was still a concern. The doctor knew that the iron testing normally done as part of a basic blood chemistry panel wasn't sufficient to detect certain iron deficiencies, and he had read an article relating these undetected deficiencies to fibromyalgia. So, even though the iron test I had has part of the chem panel showed I was okay as far as my iron went, he ordered a different test. And it turns out I am deficient.

I began eating animal protein a couple of years ago and switched to using cast iron skillets within the past year, but apparently they weren't enough to give me the iron I need. So I started taking iron supplements, staring with a 65 mg tablet, but quickly cut it down to a half, then a quarter. Let's just say, without getting to graphic, that severe nausea as a side effect would be preferable to the ones I was getting. So I stopped. (Okay, that was bad, but I have enough trouble getting through the day without making myself sicker!)

During this past month, I talked to one of our members who has a problem with iron overload - hemochromatosis. She knew little about it since, as a Kaiser member, they haven't done much for her other than to scare her ("well, there's nothing we can do until your organs fail" or some such nonsense&ldots;apparently it will take more than one $1 million dollar wrongful-death lawsuit to get them to understand that it make better business sense to properly diagnose and treat rather than not). In doing a little research for her, I found that there was indeed things that can be done&ldots;and that started me doing a little research on my behalf, to see if there was some other form of supplement I could take, or what I could do with food that would increase my iron intake and uptake. Both those research paths lead to this article. Much of the information here comes from Phys.com, Tufts Nutrition Newsletter, and the
Iron Overload Disease Association.

IRON
As part of the hemoglobin in red blood cells, iron transports oxygen from your lungs to every cell in your body which is why shortness of breath and overwhelming tiredness are two of the primary symptoms of iron-deficiency anemia. Too much iron can be just as bad as too little, as bacteria and cancer cells thrive in an iron-rich environment, reproducing fast and furiously. Too much iron causes free radicals to form, which have been linked to everything from cancer to heart disease to aging.

Iron Deficiency and Anemia
Two billion people around the world, mostly children and women of childbearing age, suffer from iron-deficiency anemia. Millions more suffer from lesser degrees of iron deficiency. In the United States, up to 6 percent of menstruating girls and women are anemic, and up to 11 percent are iron deficient.

Although the risks of anemia are well known, the impact of more marginal iron deficiency is less well-studied. Growing evidence, however, shows that even a minor depletion of iron stores can have a significant effect on health and well-being. “You don't have to be frankly anemic to manifest some of the early signs of iron deficiency,” says Henry Lukaski, Ph.D., of the United States Department of Agriculture's Human Nutrition Research Center in Grand Forks, North Dakota.

Even marginal iron deficiency can impair memory and mental functioning. Studies have shown that iron-deficient young women score lower on tests of short-term memory, attention span and verbal learning than those with healthy iron stores. Although these effects are less obvious than the pallor and exhaustion of anemia, they are no less devastating, particularly in children and young adults who are still in school. In those already suffering from chronic debilitating illness, especially those in which fatigue and cognitive problems are impaired, iron deficiency symptoms may be contributing to the degree of impairment. Symptoms of iron deficiency include:

- Paleness, especially in the hands and lining of the lower eyelids
- Tiredness and weakness
- Tongue inflammation
- Fainting
- Breathlessness
- Rapid heartbeat
- Appetite loss
- Abdominal discomfort
- Susceptibility to infection
- Unusual quietness or withdrawal in a child
Cravings for ice, paint or dirt (pica)

Detecting iron deficiency can be difficult, as the symptoms are so vague and can be caused by several different conditions. Accurate diagnosis requires several laboratory tests, to measure not only the iron in circulation but also the iron in storage. Three of the most useful measures are:

Serum hemoglobin: A test of the body’s iron-rich red blood cells. Although low hemoglobin is a clear sign of deficiency, a normal hemoglobin can be deceptive, since hemoglobin can be normal even when iron stores are not.

Serum ferritin: A measure of the body’s iron stores. Serum ferritin values are one of the first laboratory measures to show a change when iron stores are depleted.

Transferrin saturation ratio: Transferrin is a protein that "transfers" iron from one place to another in the body. It's one of the most reliable indicators of the body's iron stores.

In general, iron deficiency (and even mild anemia) is best treated with an iron-rich diet. When iron supplements are needed, it is usually a short-term treatment.

**Iron Overload (Hemochromatosis)**

Worldwide, some 24 million whites of northern European ancestry suffer from a genetic disorder called hemochromatosis. Another 600 million carry one of the genes responsible for the disorder, and absorb up to 50 percent more iron than non-carriers.

People with hemochromatosis absorb three to four times more iron from food than normal, leading to an overload of iron, particularly in the liver and other storage organs. When this excess iron interacts with oxygen in the body, it produces the free radicals which damage cells and eventually lead to organ failure (like cirrhosis of the liver), heart attack, cancer and pancreatic damage.

Until recently it was thought that women were unlikely to have hemochromatosis, since men are five times more likely to show symptoms of the disorder. Scientists now believe that women are equally at risk, but the blood loss of menstruation and childbirth temporarily protects women of childbearing age from the effects of excess iron absorption. After menopause, though, women with the disorder show symptoms at the same rate as men.

The symptoms of hemochromatosis tend to manifest themselves in middle age, because it takes time for the iron buildup to cause problems.
Hemochromatosis can mimic many other ailments - including iron deficiency. The most universal symptoms include the following:

Fatigue
Weakness
Arthritic aches and pains, including swelling and tenderness around the joints
Heart arrhythmias ("skipping beats")
Changes in skin pigment - most notably development of a bronze tone - that occur even without sun exposure and that don't fade with time
Impotence or loss of interest in sex
Late-onset diabetes (some 10 percent of diabetics may actually be suffering from iron-induced pancreatic damage)
Missed periods or premature menopause

**Diagnosis**
Hemochromatosis is fairly benign if caught and treated early. Diagnosis can be difficult, however, as the symptoms of hemochromatosis are common across a wide range of disorders. The gene responsible for the condition was recently identified, and a genetic test should be available soon. Until then, the only way to diagnose iron overload is to evaluate the amount of iron in storage (by measuring serum ferritin) and how much is en route to the cells (through a transferrin saturation test). Any physician can perform these tests.

Screening for iron overload is not usually done unless the doctor suspects an iron overload problem. Researchers at Rochester General Hospital in New York State, who recently tested 16,000 people for the condition, believe that it should be routinely checked for. "At the very least, all white people should be screened with a blood test, once, in their twenties or thirties," said their lead investigator, Pradyumna Phatak, MD.

The Centers for Disease Control and Prevention (CDC) disagree, recommending that only high-risk groups, such as immediate family members of people who have hemochromatosis or those with early symptoms of the disease, get tested. (Perhaps the funding for iron research was also diverted to more important things like the CDC's travel budget or measles research or something...abnormal iron levels, after all, only affect child development, ability of an adult to work productively, and causes cancer, organ failure, and serious neurological disorders, and occurs in as many as one in every 200 people, making it more common than other diseases such as cystic fibrosis, Huntington's disease, and muscular dystrophy.)

Those in favor of widespread screening argue that it's a powerful way to save lives. "If you catch it early enough, your life expectancy is completely normal, because treatment for hemochromatosis is so easy and effective," says Dr. Phatak. "But if you let it go, the consequences could be severe: cirrhosis of the liver, heart damage, diabetes, impotence, even degenerative arthritis."
Hemochromatosis throws off iron metabolism in such a way that the body absorbs too much of the mineral from foods. Since there’s no way to for the body to naturally flush out the excess, iron floods the system, depositing itself in organs like the liver, heart, joints, and pancreas.

In its early stages, when people are in their 20s and 30s, the condition is often easily ignored - or mistaken for other illnesses - because the symptoms, such as fatigue or aches and pains in the joints, are so vague. But if the disease progresses unchecked, by the time someone reaches his or her 40s or 50s, the growing iron deposits damage and eventually destroy surrounding tissues, leading to organ failure and chronic disease. The blood test used in the Rochester study, called the transferrin saturation test, costs only about $15. "Given that the disease is so avoidable, and the consequences are potentially so tragic, I think that $15 for hemochromatosis screening is a good investment, even if you have to pay for the test yourself," says James C. Fleet, PhD, an iron expert at the University of North Carolina at Greensboro.

Fortunately, treatment for iron overload is simple: blood-letting, or phlebotomy, to help rid the body of excess iron and thereby stop any tissue damage in progress. Because iron is found in red blood cells, the blood contains a large portion of the body's stores. Blood is drawn frequently - about one pint a week until iron storage levels are reduced to normal and then three or four times yearly thereafter.

Response of serum transferrin receptor to iron supplementation in iron-depleted, nonanemic women
Yi Zhu and JD Haas, Division of Nutritional Sciences, Cornell University, Ithaca, NY 14853, USA.

Serum transferrin receptor (sTfR) concentration has been recognized recently as a reliable indicator of functional iron deficiency, but its response to iron supplementation has not been investigated in marginally iron-deficient women. In this randomized, double-blinded trial, 37 female subjects aged 19-35 y with iron depletion without anemia (hemoglobin > 120 g/L and serum ferritin < 16 microg/L) received an iron supplement or placebo for 8 wk. Iron status was measured before treatment, after 4 wk of treatment, and posttreatment (ie, after 8 wk of treatment). Iron supplementation of these iron-depleted, nonanemic women resulted in a progressive and significant decrease in sTfR and a significant increase in serum ferritin, and prevented a fall in hemoglobin. The responsiveness of sTfR to iron treatment indicated that sTfR is a sensitive indicator of marginal iron deficiency in iron-depleted, nonanemic women, even when their body iron stores were being replenished.

http://www.anapsid.org/cnd/diffdx/irondisease.html
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References


The Law of Dualism States that very often the Symptoms caused by deficiency of a nutrient are most often the same symptoms caused by an excess of the nutrient, be it mineral or vitamin.