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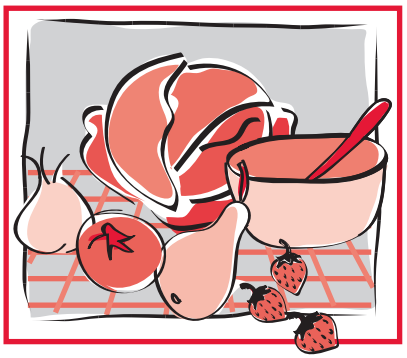

Iron: An Essential Nutrient

Fact Sheet No. **9.356** Food and Nutrition Series | **Health**

by J. Anderson and C. Fitzgerald*

Requirement

Iron has many different roles in the body. About 65 to 75 percent of the body's iron is in the blood in the form of hemoglobin. Hemoglobin is a protein in red blood cells that transports oxygen to tissues in the body. Myoglobin, the compound that carries oxygen to the muscle cells, also requires iron. In addition, iron is involved in reactions within the body that produce energy. Any excess iron is stored in the body as a reserve.

If iron is lacking in the diet, iron reserves in the body are used. Once this supply is depleted the formation of hemoglobin is affected. This means the red blood cells cannot carry oxygen needed by the cells. When this happens, iron deficiency occurs and anemia results.

According to the World Health Organization, iron deficiency anemia is one of the most common nutrient deficiencies in the world. It can be caused by a low dietary intake of iron, poor iron absorption, or excessive blood loss. Signs of anemia include: constantly feeling weak and tired; short attention span; irritability; decreased performance at work or school; delayed cognitive development in infants and young children; decreased immune function leading to increased illness; swollen and red tongue (glossitis), and difficulty maintaining body temperature. Several groups are at an increased risk for iron deficiency including children and adolescents, pregnant women, women of child-bearing age, athletes, and older adults.

The greatest need for iron is during growth or periods of blood loss. Young children, adolescents and pregnant women have increased needs because of the growth taking place during these periods. The demands during pregnancy are so large that an iron supplement is recommended for pregnant women. Women of child-bearing age have increased requirements because of the losses from menstruation (see Table 1). However, women taking oral contraceptives have slightly decreased iron needs because blood losses from menstruation tend to be less. See fact sheet number 9.323, *Nutrition and Oral Contraceptives,* for more information.

An active female athlete involved in a rigorous training program has an increased risk for iron deficiency anemia. Iron deficiency is common with or without anemia, decreases performance for the athlete, and often is not detected on a standard blood test. The capacity to transport oxygen to the cells of the muscle via myoglobin is impaired (energy production is limited), which is vital for competition. Male endurance athletes and vegetarian athletes may also be at an increased risk for iron deficiency. To ensure optimum iron stores, athletes should eat meals or snacks that contain adequate quantities of iron-rich foods and, in some cases, see a physician for a recommended iron supplement. See fact sheet number 9.362, *Nutrition for the Athlete,* for more information.

Table 1. Dietary Reference Intakes (DRI) for Iron.

Age	mg iron
Infants and Children	
0-6 months	0.27
7-12 months	11
1-3 years	7
4-8 years	10
Males	
9-13 years	8
14-18 years	11
19+ years	8
Females	
9-13 years	8
14-18 years	15
19-50 years	18
51+ years	8
Pregnancy	
≤18 years	27
18+ years	27
Lactation	
≤18 years	10
18+ years	9

Quick Facts

- A lack of iron in the diet may result in the development of iron deficiency anemia.
- The greatest need for iron is during growth or periods of blood loss.
- To ensure a diet adequate in iron: eat a variety of iron-rich foods, eat foods high in vitamin C, and combine plant sources of iron with meat, fish and poultry.
- Iron absorption is affected by the iron status of the individual, the type of food eaten and vitamin C intake.

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The elderly are another group at risk for iron deficiency. Seniors should consume adequate quantities of iron-rich foods and be particularly careful to incorporate vitamin C sources with their meals; for example, juice with their toast or cereal or fruit on their morning breakfast food. By eating foods in combination, the absorption of iron can be increased. See fact sheet number 9.322, *Nutrition and Aging,* for more information.

To meet the recommendations for dietary iron, eat a variety of foods. Iron is not concentrated in many foods except organ meats such as liver and heart. Other foods with lower, yet substantial amounts of iron include most meats (especially red meats), dried beans and peas, green leafy vegetables and dried fruit. Whole-grain, enriched, and iron-fortified bread and cereal products also are good sources (see Table 2).

Table 2. Iron-rich foods.

	Serving size	mg iron
Meats		
liver	3 oz.	7.5
beef heart	3 oz.	5.1
beef	3 oz.	2.6
pork	3 oz.	2.7
lamb	3 oz.	1.6
turkey		
dark	3 oz.	2.0
light	3 oz.	1.0
chicken		
dark	3 oz.	1.4
light	3 oz.	1.0
fish	3 oz.	0.9
Breads and cereals		
wheat bread, enriched	1 slice	0.6
wheat bread	1 slice	0.5
whole grain cereals	1/2 cup	4.5-9.5
iron fortified cereals	1 cup	1.1-4.5
iron fortified cereals (100% DRI)	1 cup	17.8
Macaroni, noodles, enriched	1/2 cup	0.7
Fruits and vegetables		
dried beans, cooked	1/2 cup	2.6
dried peas, cooked	1/2 cup	1.7
lentils, cooked	1/2 cup	2.1
greens, cooked	1/2 cup	1.8
dried apricots	10 halves	1.9
dates	5	1.2
raisins	1/4 cup	1.4
prunes	5 medium	1.2
Dairy products		
none		

Iron Absorption

Iron absorption is affected by the iron status of the individual, the type of food eaten, vitamin C intake and other factors in the diet. People with a low reserve of iron will absorb more iron than those with sufficient stores. This is the body's way of trying to maintain adequate levels of iron while protecting against iron toxicity.

There are two forms of iron - heme and non-heme. The iron in meat is about 40 percent heme and 60 percent non-heme. Much of the iron in the diet, however, is in the non-heme form. This is the form found in plant sources such as fruits, vegetables, grain products, and in iron fortified foods. About 25 percent to 35 percent of heme iron is absorbed, yet this percentage drops to 3 percent for non-heme iron. This difference is important because heme iron is found only in animal flesh. Vegetarians in particular need to be aware of the low absorption of non-heme iron.

There are, however, a number of methods to improve iron absorption. One of these methods is to include foods rich in vitamin C in the diet. Good sources of vitamin C include citrus fruits and juices, tomatoes, strawberries, melons, dark green leafy vegetables and potatoes. To have an effect, these foods must be eaten at the same meal as the iron source. Another method to improve non-heme iron absorption is to include a source of heme iron (meat) with the meal. Not only will more total iron be eaten, but the percentage of non-heme iron that is absorbed will be greater.

Other factors may decrease the availability of iron. Coffee and tea consumption at the time of a meal can significantly decrease iron absorption. Tea can cause iron absorption to drop by 60 percent and coffee can cause a 50 percent decrease in iron uptake. The tannins in both tea and coffee adversely affect iron availability. Phytates in some legumes and grains, phosphates in cola drinks, some proteins in soybeans, and possibly calcium and fiber may interfere with iron absorption. These may be important factors if the diet already is low in iron.

Vitamin A helps release iron from stores and makes it more available for the body to use. Vitamin A deficiencies, therefore, may manifest as iron deficiencies. The use of vitamin A and iron supplementation may help relieve iron deficiency more than iron alone. It is important that anyone who is concerned about an iron deficiency to talk to a doctor before beginning supplementation.

Iron Toxicity

Because intestinal absorption of iron is regulated by iron stores, iron toxicity is rare. Consuming large quantities of alcohol may increase the absorption of iron. Hemochromatosis, a genetic disorder, also increases iron absorption. Once iron is absorbed it is only excreted through blood loss. Excess iron will build up in tissues and organs, may increase the risk for certain cancers and may eventually lead to death.

The main concern with iron toxicity is overdoses in children. An overdose of iron supplements can cause toxicity in adults and children. However, in children as little as 20 to 60 mg of iron/kg body weight can cause toxicity and death. It is important to keep iron supplements away from children and tightly closed. The tolerable upper limits for iron as set by the Institute for medicine and the National Academy of Sciences is 40 mg/day for children under the age of 14 and 45 mg/day for anyone 14 years of age or older. This limit is set as the largest amount of iron a person can consume without risk of negative side effects.

Iron and Disease

Heart disease risk seems to be greater in societies that eat high amounts of red meat versus those that eat minimal amounts. The amount of iron stored in the body can influence a person's potential to develop heart disease. Excess iron is associated with the formation of free radicals, unstable molecules in the body that may injure vessels supplying blood to the heart. It has also been suggested that the incidence of heart disease rises dramatically in women once menstruation stops due to increased amounts of iron in the blood. There is no conclusive evidence that excess iron increases coronary heart disease. It is not recommended to eliminate red meat or other iron rich foods from the diet. Using the Food Guide Pyramid as a guide for daily food choices, red meat is

a good source of iron, protein and other important nutrients.

Excessive iron stores may play a role in type 2 diabetes. Patients with hemochromatosis have an increased risk for diabetes and some studies have shown elevated iron levels in patients with type 2 diabetes. There is not enough scientific evidence to prove a link between iron and type 2 diabetes and reducing iron intake to treat or decrease the risk of developing diabetes is not recommended.

Restless leg syndrome (RLS) is a neurological movement disorder. People with RLS experience an uncomfortable sensation in their arms and legs that result in the need to move and effects sleep patterns. Iron supplementation relieves the need to move in some patients with RLS. The mechanisms behind iron's benefit to RLS sufferers is not well understood, but they may be linked to iron insufficiencies in spinal fluid or parts of the brain.

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