



HEALTH

Iron: An Essential Nutrient

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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.

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. 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.

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. All women of child-bearing age have increased requirements because of the losses from menstruation (see Table 1).

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 hematocrit reading. The capacity to transport oxygen to the cells of the muscle via myoglobin is impaired (energy production is limited), which is vital for competition. To ensure optimum iron stores, a female athlete 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.

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.

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).

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.

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

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		

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 and grain products. 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 grains, phosphates in cola drinks, and possibly fiber may interfere with iron absorption. These may be important factors if the diet already is low in iron.

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.

References

- Ascherio, A., et. al. 1994. *Dietary iron intake and risk of coronary disease among men*. Circulation 89:969.
- Cooksey, D.C. 1983. *The Bioavailability of Iron*. A Research Review. Texas Agricultural Extension Service.
- Lynch, S. R. 1994. *Overview of the relationship of iron to health*. Contemporary Nutrition 19:(4,5).
- Lecos, Chris. 1983. *Tracking Trace Minerals*. FDA Consumer, July-Aug. 1983.
- National Academy of Sciences. 2001. *Dietary Reference Intakes*. Washington, D.C.: National Academy Press.
- Salonen, J.T., et al. 1992. *High stored iron levels are associated with excess risk of myocardial infarction in Eastern Finnish men*. Circulation, 86:3.
- Shils, M.S., Olson J.A., Shike M. 1994. *Iron in medicine and nutrition*. Modern Nutrition and Health and Disease. 8th Edition. Philadelphia, Lea and Fibiger. pp. 185-213.

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