

Iron: What is it?

Iron, one of the most abundant metals on Earth, is essential to most life forms and to normal human physiology. Iron is an integral part of many proteins and enzymes that maintain good health. In humans, iron is an essential component of proteins involved in oxygen transport [1,2]. It is also essential for the regulation of cell growth and differentiation [3,4]. A deficiency of iron limits oxygen delivery to cells, resulting in fatigue, poor work performance, and decreased immunity [1,5-6]. On the other hand, excess amounts of iron can result in toxicity and even death [7].

Almost two-thirds of iron in the body is found in hemoglobin, the protein in red blood cells that carries oxygen to tissues. Smaller amounts of iron are found in myoglobin, a protein that helps supply oxygen to muscle, and in enzymes that assist biochemical reactions. Iron is also found in proteins that store iron for future needs and that transport iron in blood. Iron stores are regulated by intestinal iron absorption [1,8].

What foods provide iron?

There are two forms of dietary iron: heme and nonheme. Heme iron is derived from hemoglobin, the protein in red blood cells that delivers oxygen to cells. Heme iron is found in animal foods that originally contained hemoglobin, such as red meats, fish, and poultry. Iron in plant foods such as lentils and beans is arranged in a chemical structure called nonheme iron [9]. This is the form of iron added to iron-enriched and iron-fortified foods. Heme iron is absorbed better than nonheme iron, but most dietary iron is nonheme iron [8]. A variety of heme and nonheme sources of iron are listed in Tables 1 and 2.

Table 1: Selected Food Sources of Heme Iron [10]

Food	Milligrams per serving	% DV*
Chicken liver, cooked, 3½ ounces	12.8	70
Oysters, breaded and fried, 6 pieces	4.5	25
Beef, chuck, lean only, braised, 3 ounces	3.2	20
Clams, breaded, fried, ¾ cup	3.0	15
Beef, tenderloin, roasted, 3 ounces	3.0	15
Turkey, dark meat, roasted, 3½ ounces	2.3	10
Beef, eye of round, roasted, 3 ounces	2.2	10
Turkey, light meat, roasted, 3½ ounces	1.6	8
Chicken, leg, meat only, roasted, 3½ ounces	1.3	6
Tuna, fresh bluefin, cooked, dry heat, 3 ounces	1.1	6
Chicken, breast, roasted, 3 ounces	1.1	6
Halibut, cooked, dry heat, 3 ounces	0.9	6
Crab, blue crab, cooked, moist heat, 3 ounces	0.8	4
Pork, loin, broiled, 3 ounces	0.8	4
Tuna, white, canned in water, 3 ounces	0.8	4
Shrimp, mixed species, cooked, moist heat, 4 large	0.7	4

Table 2: Selected Food Sources of Nonheme Iron [10]

Food	Milligrams per serving	% DV*
Ready-to-eat cereal, 100% iron fortified, ¾ cup	18.0	100
Oatmeal, instant, fortified, prepared with water, 1 cup	10.0	60
Soybeans, mature, boiled, 1 cup	8.8	50
Lentils, boiled, 1 cup	6.6	35
Beans, kidney, mature, boiled, 1 cup	5.2	25
Beans, lima, large, mature, boiled, 1 cup	4.5	25
Beans, navy, mature, boiled, 1 cup	4.5	25
Ready-to-eat cereal, 25% iron fortified, ¾ cup	4.5	25
Beans, black, mature, boiled, 1 cup	3.6	20
Beans, pinto, mature, boiled, 1 cup	3.6	20
Molasses, blackstrap, 1 tablespoon	3.5	20
Tofu, raw, firm, ½ cup	3.4	20
Spinach, boiled, drained, ½ cup	3.2	20
Spinach, canned, drained solids ½ cup	2.5	10
Black-eyed peas (cowpeas), boiled, 1 cup	1.8	10
Spinach, frozen, chopped, boiled ½ cup	1.9	10
Grits, white, enriched, quick, prepared with water, 1 cup	1.5	8
Raisins, seedless, packed, ½ cup	1.5	8
Whole wheat bread, 1 slice	0.9	6
White bread, enriched, 1 slice	0.9	6

*DV = Daily Value. DVs are reference numbers developed by the Food and Drug Administration (FDA) to help consumers determine if a food contains a lot or a little of a specific nutrient. The FDA requires all food labels to include the percent DV (%DV) for iron. The percent DV tells you what percent of the DV is provided in one serving. The DV for iron is 18 milligrams (mg). A food providing 5% of the DV or less is a low source while a food that provides 10-19% of the DV is a good source. A food that provides 20% or more of the DV is high in that nutrient. For foods not listed in this table, please refer to the U.S. Department of Agriculture's Nutrient Database Web site: http://www.nal.usda.gov/fnic/cgi-bin/nut_search.pl.

What affects iron absorption?

Iron absorption refers to the amount of dietary iron that the body obtains and uses from food. Healthy adults absorb about 10% to 15% of dietary iron, but individual absorption is influenced by several factors [1,3,8,11-15].

Storage levels of iron have the greatest influence on iron absorption. Iron absorption increases when body stores are low. When iron stores are high, absorption decreases to help protect against toxic effects of iron overload [1,3]. Iron absorption is also influenced by the type of dietary iron consumed. Absorption of heme iron from meat proteins is efficient. Absorption of heme iron ranges from 15% to 35%, and is not significantly affected by diet [15]. In contrast, 2% to 20% of nonheme iron in plant foods such as rice, maize, black beans, soybeans and wheat is absorbed [16]. Nonheme iron absorption is significantly influenced by various food components [1,3,11-15].

Meat proteins and vitamin C will improve the absorption of nonheme iron [1,17-18]. Tannins (found in tea), calcium, polyphenols, and phytates (found in legumes and whole grains) can decrease absorption of nonheme iron [1,19-24]. Some proteins found in soybeans also inhibit nonheme iron absorption [1,25]. It is most important to include foods that enhance nonheme iron absorption when daily iron intake is less than recommended, when iron losses are high (which may occur with heavy menstrual losses), when iron requirements are high (as in pregnancy), and when only vegetarian nonheme sources of iron are consumed.

What is the recommended intake for iron?

Recommendations for iron are provided in the Dietary Reference Intakes (DRIs) developed by the Institute of Medicine of the National Academy of Sciences [1]. The RDA recommends the average daily intake that is sufficient to meet the nutrient requirements of nearly all (97-98%) healthy individuals in each age and gender group [1]. Table 3 lists the RDAs for iron, in milligrams, for women.

Table 3: Recommended Dietary Allowances for Iron for Women [1]

Age	Females (mg/day)	Pregnancy (mg/day)	Lactation (mg/day)
14 to 18 years	15	27	10
19 to 50 years	18	27	9
51+ years	8	N/A	N/A

Iron intake is negatively influenced by low nutrient density foods, which are high in calories but low in vitamins and minerals. Sugar sweetened sodas and most desserts are examples of low nutrient density foods, as are snack foods such as potato chips.

Adapted from Office of dietary Supplements Fact Sheet: Iron

For more information and references, visit <http://ods.od.nih.gov/factsheets/iron.asp> or ask your midwife.