

Iron

Applicable to: Nurses, Physicians and Other Health Professionals

Recommendations

- The Dietary Reference Intakes for iron change throughout the lifecycle. The Recommended Dietary Allowances (RDA) and Tolerable Upper Intake Levels (UL) are:

Life stage group	RDA (mg/ day)				UL (mg/day)		
	Males	Females	Pregnant Females	Lactating Females	Males	Females	Pregnant/Lactating Females
1 to 3 years	7	7			40	40	
4 to 8 years	10	10			40	40	
9 to 13 years ^a	8	8	27	10	40	40	45
14 to 18 years ^a	11	15 ^b	27	10	45	45	45
19 to 30 years	8	18	27	9	45	45	45
31 to 50 years	8	18	2	9	45	45	45
>51 years	8	8 ^c			45	45	

^a During growth spurts adolescent boys and girls need extra iron: 2.9 mg/day and 1.1 mg/day above the DRI respectively.

^b Assuming menstruation begins at the age of 14. If it has not begun the RDA is 10.5 mg/day.

^c It is assumed that women 51 years and older are post-menopausal.

- Individuals who are at risk for iron deficiency may have higher iron requirements than the RDA's. For example, the requirement for iron is 1.8 times higher for vegetarians due to the lower bioavailability of iron from a vegetarian diet.
- Individuals should not take an iron supplement unless recommended by a physician.
- Iron supplements can be toxic to children. Vitamin and/or mineral supplements that contain iron should be kept out of their reach.

Health Benefits¹

- Iron deficiency is the most common nutritional deficiency in the world, thus it is important to ensure children and adults have an adequate iron intake. Adequate iron intake:
 - is needed for normal cognitive and psychomotor development in children.
 - is needed to deliver oxygen to the body's tissues and systems. Without enough iron individuals will tire easily and be less able to fight off infections.
 - in pregnancy reduces the risk of premature delivery, low birth weight infants, and decreased perinatal mortality.

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Key Questions**Where is iron found in the body?**

Iron is incorporated into several proteins including enzymes, cytochromes, myoglobin, and hemoglobin.¹ Hemoglobin (red blood cells) contains about 66% of the body's iron. Hemoglobin carries oxygen throughout the body.¹

Iron stores in the body contain about 25% of the iron found in the body.¹ These stores are easily accessed if iron is needed.¹

The remaining 15% of iron in the body is found in myoglobin.¹ Myoglobin carries oxygen to muscle tissues.²

What is iron deficiency anemia?^{3,4}

Iron deficiency anemia is a condition resulting from eating insufficient amounts of iron. In this condition red blood cells have an abnormal appearance, and are unusually small and pale. This pale color reflects their low hemoglobin content. The symptoms of iron deficiency anemia include dizziness, malaise, pallor and breathlessness as insufficient amounts of oxygen are getting to the body's cells.

Who is at risk for iron deficiency?⁵

Individuals with at least one of the characteristics below are at risk for iron deficiency:¹

- Decreased stomach acidity, such as people who over-consume antacids like Tums® or Zantac® or have decreased acid production in the stomach (because of partial gastrectomy or achlorhydria).¹
- Ingestion of clay, including people with the eating disorder pica, or those who ingest clay for its presumed health benefits.¹
- Impaired iron absorption (e.g. bowel problems such as partial gastrectomy, inflammatory bowel disease, celiac disease).⁵
- Low dietary intake of iron.
- Following a vegetarian diet. People eating vegetarian diets need about 1.8 times more iron than non-vegetarians because the iron from plant foods is not as well absorbed as the iron in animal foods.¹
- Have an intestinal parasite. Intestinal parasites can cause significant blood loss and put an individual at risk for iron deficiency.¹
- Donate blood regularly.¹
- Women with heavy menstrual periods.⁶
- Pregnant women have higher iron requirement.⁷
- Postmenopausal women on hormone replacement therapy (HRT). In some women HRT can cause uterine bleeding which increases their iron losses.¹
- Performing regular, intense exercise. Individual requirements, particularly for females, may be 30% to 70% higher than for people not exercising at this level.¹
- Young children who have not been breastfed, who were not fed iron-containing formula or whose introduction to iron-containing solids has been delayed.¹

Refer to Guidelines: Vegetarian Eating; Children and Adolescents

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Do pregnant women need more iron?⁷

Additional iron is needed during pregnancy to increase the maternal red blood cell mass and to supply the growing fetus and placenta. The iron obtained from a mixed diet as recommended by Canada's Food Guide and a multivitamin containing iron will help women obtain the amount of iron they need for pregnancy.

Pregnant women should take a multivitamin supplement each day that has between 16 and 20 mg of iron. Health care providers should confirm with pregnant women the type and amount of iron supplements they are taking, and discuss whether they have requirements above those stated here.

When iron deficiency with or without anemia is diagnosed, larger doses of iron supplements may be advised to improve iron status as early in the pregnancy as possible.

Refer to Guideline: Pregnancy

What about the iron needs of children?

Children require reliable dietary sources of iron from around 6 months of age to ensure normal cognitive and psychomotor development.⁸ Risk of iron deficiency is increased if breast milk or formula is replaced early by cow's milk, or if the introduction of iron-rich solid foods is delayed. Cow's milk should not be introduced until 9-12 months of age. Iron-rich solid foods such as appropriately-textured meats (beef, pork, chicken, fish) and iron-fortified infant cereals should be introduced to infants at around 6 months of age.⁸ Parents and caregivers should continue to provide iron-rich foods throughout childhood. See '*How can an individual ensure they are getting enough iron in their diet?*' below for foods that are sources of iron.

Find more information about iron and introduction of solid food see Health Canada's document *Nutrition for Healthy Term Infants: Recommendations from Birth to Six Months* at <http://www.hc-sc.gc.ca/fn-an/nutrition/infant-nourisson/recom/index-eng.php#a7>.

Refer to Guideline: Children and Adolescents

What are the different types of iron in food?¹

There are two different types of iron found in food: heme and nonheme iron.

Heme iron is only found in animal products like meat, fish and poultry. Heme iron makes up only 7% to 12% of dietary iron. It is well absorbed by the body and is not greatly influenced by other dietary factors.

Nonheme iron is found in animal products and plant-based foods such as vegetables and fruits, whole-grain breads or pasta, and fortified foods. Most dietary iron is nonheme. Nonheme iron is not as well absorbed by the body as heme iron. The absorption of nonheme iron by the body is greatly influenced by dietary factors (see next question).

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What dietary factors influence nonheme iron absorption?¹

The amount of nonheme iron an individual can absorb may be enhanced or inhibited by several dietary factors.

Iron **enhancers** increase the amount of nonheme iron absorbed from food. Iron enhancers include:

- Ascorbic acid from vitamin C-rich foods such as oranges, lemons, grapefruit and their juices, cantaloupe, honeydew, kiwi fruit, berries, juices fortified with vitamin C, broccoli, cabbage, cauliflower, kale, peppers, potatoes, and tomatoes. Ascorbic acid releases nonheme iron that is bound to inhibitors (see inhibitors section below). Eat vitamin C-rich foods with foods higher in inhibitors like phytates and tannins.¹
- Foods with heme iron such as meat, fish, and poultry.

Iron **inhibitors** decrease the amount of nonheme iron absorbed from food. Iron inhibitors include:

- Phytates: found in foods such as legumes (soybeans, black beans, lentils, split peas) and unrefined grains and rice. The absorption of iron from these foods is very low (about one percent). Iron absorption from high-phytate foods is enhanced when they are eaten with vitamin C-rich foods.
- Polyphenols: found in tea, red wine, and many grain products. If vitamin C is consumed with polyphenols the inhibitory effect of the polyphenols is reduced.
- Vegetable protein sources. Protein from legumes may inhibit iron absorption independent of the effect of phytates.⁹
- Calcium: found in milk products such as fluid milk, cheese, yogurt and ice cream and calcium supplements. Calcium inhibits the absorption of both heme and nonheme iron.
- Taking supplements with large doses of some inorganic elements such as zinc, manganese, and copper can also interfere with nonheme iron absorption.¹⁰

Refer to Guideline: Vegetarian Eating

How can an individual ensure they are getting enough iron in their diet?

- Eat a variety of foods from each of the four food groups of Canada's Food Guide.
- Choose foods that contain iron, such as fortified grain products like cereal and pasta, red meats, nuts, beans, seeds, dried fruits and tofu.
- Cook foods in cast-iron cookware to increase the amount of iron in foods.^{11,12}
- Drink tea or coffee between meals rather than with meals. Tea and coffee have polyphenols that can reduce iron absorption.^{1,13}
- Eat vitamin C-rich vegetables and fruit at each meal, or eat high iron foods with good sources of vitamin C.¹

Choose the following sources of iron more often: beef, clams, enriched cold or hot cereals, fish, liver*, mussels, chicken, pork, shrimp, turkey, and lamb.

Other sources of iron: asparagus, enriched breads and pastas, chard, spinach, chickpeas, dried figs, lentils, soybeans, molasses, tofu, and the grains amaranth and quinoa.

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*Liver is high in vitamin A. One Food Guide Serving (2.5 oz/75 g, cooked) of most types of liver has more than the Upper Level of vitamin A for women of childbearing age.⁷ Pregnant women, and women who are concerned about vitamin A intake, should discuss safe amounts of liver intake with their health care provider.

Refer to Guidelines: Vegetarian Eating; Pregnancy

Can an individual get too much iron?¹

Yes, an individual can consume too much iron from food or supplements.

Too much iron can cause:

- Gastrointestinal side effects (constipation, nausea, vomiting and diarrhea)
- Acute toxicity (vomiting and diarrhea followed by cardiovascular, central nervous system, kidney, liver and hematological effects)
- Secondary overload (increased iron stores due to parenteral iron administration, frequent blood transfusions, or hematological dysfunction).
- Reduced zinc absorption when supplemental iron is not taken with food

Children and youth (aged 0 to 13 years) should not consume more than the upper limit of 40 mg per day of iron, unless recommended by their physician. Children and youth should not take iron supplements unless recommended by a physician.

Adults and adolescents (age 14 and older, including pregnant and breastfeeding women) should not consume more than the upper limit of 45 mg per day of iron, unless recommended by their physician. Adults and adolescents should not take iron supplements unless recommended by a physician.

Individuals at increased risk of excess iron intake include those with hereditary hemochromatosis; chronic alcoholism, alcoholic cirrhosis and other liver diseases; iron-loading abnormalities (thalassemias); congenital atransferrinemia (absence of transferrin); aceruloplasminemia (genetic disorder). The Upper Limits for iron intake do not apply to these conditions.¹⁴ If individuals with these conditions consume close to the upper limits they may get too much iron and experience the adverse effects listed above.

What about iron supplements?

Most individuals can meet iron requirements by following Canada's Food Guide and by regularly including higher iron foods in their diet.

Individuals should take iron supplements, especially single nutrient (iron only) supplements, **only** if recommended by a physician. Single nutrient iron supplements may have higher dosages which should be monitored by a healthcare provider.

If a physician has recommended iron supplements, individuals should talk to the physician, a pharmacist or another healthcare provider about what type of supplements to take, and when to take them.

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- Iron supplements are available in two forms: ferrous and ferric. Ferrous supplements are best absorbed.⁶
- Individuals and healthcare givers should note how much elemental iron (the iron that is available for absorption) is in the supplement.
- Iron absorption decreases with increasing doses. Therefore, daily supplements should be spread over two or three evenly spaced doses.⁶
- Generally, individuals should not take iron supplements in daily doses nearing or exceeding their Tolerable Upper Intake Level (UL).¹⁵

When taken without food, iron supplements may decrease zinc absorption.¹⁶ However, this does not occur when iron supplements are taken with food.^{1,6}

Iron can be toxic to children if consumed in excess of a healthcare provider's recommended dosage. All vitamin and/or mineral supplements that contain iron should be kept out of children's reach.

Are there any handouts on iron I can use with my clients?
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Refer to approved provincial Alberta Health Services iron handouts to support patient education. For more information, contact Nutrition.Resources@albertahealthservices.ca

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