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Patient education: Anemia caused by low iron in adults (Beyond the Basics)

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IRON DEFICIENCY ANEMIA OVERVIEW — Anemia can be caused by a number of different conditions, including heavy menstrual periods, cancer, and bleeding in the digestive tract, just to name a few. Iron deficiency anemia is a type of anemia that occurs when there is not enough iron to make the hemoglobin in red blood cells. The main causes of iron deficiency anemia in adults are bleeding and conditions that block iron absorption in the intestines.

Iron deficiency anemia can be mild or severe, and can be temporary or chronic. The condition is common in the United States, affecting 1 to 2 percent of adults. It is even more common in developing countries, due to deficiencies of iron in the diet.

This topic will review the signs and symptoms, potential causes, diagnostic tests, and treatment of iron deficiency anemia in adults.

WHAT IS ANEMIA? — Anemia is defined as a decreased number of red blood cells (RBCs), as measured by one of the following blood tests:

- Hemoglobin (Hgb) is the iron-containing molecule in RBCs that carries oxygen. Iron is a critical component of hemoglobin; without iron, hemoglobin cannot be formed and fewer RBCs are produced.
- Hematocrit (Hct) is the percent of a sample of blood made up of RBCs. The rest of the blood is mostly made up of a fluid called plasma.
- RBC count is the number of RBCs in a certain amount of whole blood (usually one microliter [one millionth of a liter]).

Iron deficiency anemia occurs when there is an insufficient amount of iron in the body to make hemoglobin. When the quantity of hemoglobin is reduced, fewer RBCs are formed, and the RBCs that are formed are smaller. When iron deficiency is severe, the person may develop symptoms.

ANEMIA SIGNS AND SYMPTOMS — Many people with iron deficiency anemia have no symptoms at all. Of those who do, the most common symptoms include:

- Weakness
- Headache
- Irritability
- Fatigue
- Difficulty exercising (due to shortness of breath, rapid heartbeat)
- Brittle nails
- Sore tongue
- Restless legs syndrome
- Pica (an abnormal craving to eat non-food items, such as clay or dirt, paper products, or starch [eg, cornstarch])
- Pagophagia (an abnormal craving to eat ice)

ANEMIA CAUSES — Two common causes of iron deficiency anemia are blood loss (most common) and decreased absorption of iron from food.

Blood loss — The source of blood loss may be obvious, such as in women who have heavy menstrual bleeding or multiple pregnancies, or a known bleeding ulcer. In other cases, the source of the blood loss is not visible, as in someone who has chronic bleeding in their gastrointestinal (GI) tract (eg, stomach, small intestine, colon). This may appear as diarrhea with black, tarry stools, or, if the blood loss is very slow, the stool may appear normal. Donating blood can also cause anemia, especially if it is done on a regular basis.

Decreased iron absorption — Normally, the body absorbs iron from food through the GI tract. If the GI tract is not functioning correctly, as is the case in people with certain conditions such as celiac disease, gastritis (stomach inflammation), gastric bypass surgery (eg, for weight loss), or other forms of weight loss surgery, an inadequate amount of iron may be absorbed, leading to iron deficiency anemia.

Other causes — A common cause of iron deficiency anemia in developing countries is a lack of foods that contain iron. However, this is rarely seen in adults in developed countries such as the United States because many foods have added iron (eg, breakfast cereal, bread, pasta). Iron is also available in some plant-based foods. (See ['Iron and diet'](#) below.)

Pregnant and postpartum women may develop iron deficiency anemia because of the increased iron requirements of the growing fetus and placenta and blood lost at the time of delivery.

ANEMIA DIAGNOSIS — A person may be diagnosed with iron deficiency anemia after blood testing done to evaluate symptoms or after testing done for another, unrelated reason. The initial workup generally involves a medical history, physical examination, and blood tests.

Complete blood count — A complete blood count (CBC) is a group of tests that includes a red blood cell (RBC) count, hemoglobin (Hgb), and hematocrit (Hct). It also includes the mean corpuscular volume (MCV, referring to RBC size), mean corpuscular hemoglobin (MCH, referring to the amount of hemoglobin per RBC), and others.

In people with iron deficiency anemia, the RBC count, Hgb, and Hct are lower than normal. The MCV and MCH are also usually lower than normal, indicating that the RBCs are smaller (called microcytic) and carry less Hgb than normal RBCs. In the early stages of iron deficiency, the MCV can be low even if anemia is not seen.

As part of the CBC, the shape, color, and size of the RBCs are also evaluated (either by a machine or by a person using a microscope). This information can help to determine the type of anemia.

Other blood tests — In many cases, iron deficiency anemia is suspected based upon the results of the medical history and the CBC. Further testing is used to confirm the diagnosis.

- Serum iron — Measures how much iron is circulating in the blood
- Total iron binding capacity (TIBC or transferrin) — Measures the amount of a protein (transferrin) in the blood that is capable of transporting iron to RBCs or body stores
- Transferrin saturation — Measures the percentage of iron-binding sites on transferrin that are occupied by iron
- Ferritin — Measures ferritin, a protein that stores iron in the liver and spleen

In a person with iron deficiency anemia, the serum iron, transferrin saturation, and ferritin are lower than normal and the TIBC may be higher than normal.

Search for source of blood and iron loss — Once the diagnosis of iron deficiency anemia is made in an adult, it is important to identify the cause of blood loss. The healthcare provider may ask questions about the following situations, which can increase the risk of developing iron deficiency anemia:

- For women, history of menstrual bleeding, pregnancy, delivery
- GI problems such as ulcer, *Helicobacter pylori* (*H. pylori*) infection, celiac disease
- Surgery on the GI tract (eg, gastric bypass for weight loss)
- Family or personal history of bleeding disorders
- Family or personal history of colon cancer
- Multiple blood donations

If the cause of blood loss is not obvious, there are additional tests that can be done. These include colonoscopy or upper endoscopy to look for areas of bleeding in the GI tract, and blood tests for certain conditions that interfere with iron absorption, such as celiac disease and *H. pylori* infection. Looking for bleeding in the colon is especially important in people over the age of 50. (See ["Patient education: Colonoscopy \(Beyond the Basics\)"](#) and ["Patient education: Upper endoscopy \(Beyond the Basics\)"](#) and ["Patient education: Helicobacter pylori infection and treatment \(Beyond the Basics\)"](#).)

ANEMIA TREATMENT — The first step in treating iron deficiency anemia is to determine the cause of the deficiency and correct it, so that iron does not continue to be lost, and any serious condition (for example, colon cancer) is treated as early as possible. After that, the treatment for iron deficiency anemia is to give iron. Iron supplements may be taken by mouth or given as one or more intravenous injections (also sometimes called "parenteral iron" or "IV iron"). Iron is needed to increase production of hemoglobin (Hgb) and also to rebuild the body's iron reserves.

Oral iron tablets are used in most people with iron deficiency anemia. Intravenous iron can be used for people whose GI tract is unable to adequately absorb iron or in those who are unable to tolerate oral iron.

A blood transfusion may be given if a person is actively bleeding and/or the person's Hgb or hematocrit (Hct) levels are very low.

Oral iron — Oral iron tablets are usually a safe, inexpensive, and effective treatment for people with iron deficiency. The following tips are recommended:

- Enteric coated (EC) iron tablets are not recommended because iron is best absorbed from the duodenum and jejunum (the first and middle parts of the small intestine). EC iron releases iron further down in the intestinal tract, where it is not as easily absorbed. In some cases, the EC iron tablet passes through the entire intestinal tract with the coating intact, meaning that none of the iron was absorbed.
- Certain foods and medicines can reduce the effectiveness of iron tablets. Iron tablets usually should not be taken with food, certain antibiotics, tea, coffee, calcium supplements, or milk. Iron should be taken one hour before or two hours after these items. If you take antacids, your iron tablets should be taken two hours before or four hours after the antacids.
- Iron tablets are best absorbed in an acidic environment; taking iron with one 250 mg vitamin C tablet or orange juice can enhance iron absorption.

Types of oral iron — There are several types of oral iron, and with the exception of the EC iron tablets mentioned above, they are all equally effective. The primary difference between the types is the amount of iron each product contains. For many products, the number of milligrams for the pill is different from the number of milligrams of actual iron molecules (called elemental iron):

- Ferrous fumarate — 106 mg elemental iron/tablet
- Ferrous sulfate — 65 mg elemental iron/tablet
- Ferrous sulfate liquid — 44 mg elemental iron/teaspoon (5 mL)
- Ferrous gluconate — 28 to 36 mg iron/tablet
- Polysaccharide iron complex – various doses available

In the past, iron pills were typically prescribed for daily use, often at multiple doses per day. More recent evidence suggests that taking oral iron every **other** day allows the body to absorb more iron in addition to reducing the risk of gastrointestinal side effects (see '[Side effects](#)' below). Your doctor or nurse can help you figure out the dosing schedule that is most appropriate for you.

Side effects — Some people experience a metallic taste, nausea, constipation, stomach upset, dark-colored stools, and/or vomiting after taking oral iron. Options for dealing with these side effects include:

- Take a smaller dose
- Take iron with food (even though this will reduce the amount of iron your body absorbs, it's still better than not taking it at all)
- Use a formulation with a lower elemental iron content (eg, ferrous gluconate instead of ferrous sulfate)
- Take the liquid form of ferrous sulfate and adjust the dose until symptoms are tolerable

Taking iron tablets will turn the stool a dark, almost black color. This is to be expected, and does NOT mean that the iron tablets are causing intestinal bleeding.

Children are at particular risk of iron poisoning, making it very important to store iron tablets out of the reach of children.

Duration of treatment — Treatment with oral iron is recommended for as long as it takes the hemoglobin (Hgb) and hematocrit (and usually the tests of iron stores) to return to normal. Typically this takes about six months.

If oral iron does not increase hemoglobin — On occasion, a person's Hgb will not improve despite treatment with oral iron. There are several possible reasons for this. The next step depends upon why the person's Hgb did not increase, which needs to be evaluated by a clinician. However, several points are worth keeping in mind:

- It is important that iron be taken as directed. Failing to take iron as prescribed is probably the most common cause of failure to respond.
- The type of iron preparation being taken is important. One should avoid any preparation that is labeled "slow release," or is enteric coated (EC), as these may prevent iron from being efficiently absorbed.
- Blood tests may be used to determine if the iron is not being absorbed properly due to another condition such as celiac disease or *Helicobacter pylori* infection.
- In some people, there may be another cause of anemia in addition to iron deficiency. In others, the diagnosis of iron deficiency may be incorrect.
- If there is ongoing bleeding that depletes iron stores faster than they are being replaced, it may appear that the oral iron is not working.
- For some people, changing to intravenous iron may be a good option.

Intravenous iron — Iron may be given by intravenous injection (parenterally, IV) in certain situations, such as in people who cannot tolerate the side effects of oral iron or whose GI tract cannot absorb an adequate amount of iron from pills. Examples include people with inflammatory bowel disease, kidney disease, and certain cancers. Intravenous iron is infused into a vein. This is done in a healthcare provider's office or hospital, where the person can be monitored. The length of time required for the infusion and the number of infusions needed depend on which intravenous iron product is used and the severity of iron deficiency.

Side effects — The intravenous iron used in the past (eg, high molecular weight iron dextran [brand name: Dexferrum]) had a risk of severe allergic reactions. However, the intravenous iron products used today have an exceedingly low risk of allergic or anaphylactic reactions (less than one tenth of one percent). Infusion reactions are more common, and may include temporary flushing, back pain, and other symptoms that usually go away when the infusion is slowed or stopped. Some patients with a history of rheumatoid arthritis may have an arthritis flare, which can be reduced or prevented by a short course of steroids.

The best ways to minimize these reactions include avoiding the use of antihistamines as "premedication" or treatment for minor symptoms, giving the infusion more slowly, or in some patients (eg, those with a history of multiple drug allergies) giving a steroid before the infusion. If you have back pain or joint pain at home after the infusion, nonsteroidal antiinflammatory drugs (NSAIDs) may be helpful. NSAIDs include ibuprofen (sample brand names: Advil, Motrin) and naproxen (sample brand name: Aleve).

Blood transfusion — Blood transfusion may be used in a person with anemia that is severe or causes symptoms.

Blood transfusion involves giving one or more units of packed red blood cells (PRBCs) into a vein. Each unit of PRBCs contains the RBCs from one unit of blood donated by a voluntary donor, with approximately 200 mg of iron and will raise the Hgb by about 1 g/dL.

Blood transfusions are generally reserved for people who have a low or unstable blood pressure due to bleeding, and/or if the person's organs (eg, brain, heart) are being deprived of oxygen as a result of severe anemia. Typical symptoms of this include chest pain and/or shortness of breath. A transfusion may also be recommended in select cases if the Hgb or hematocrit level is very low (eg, Hgb less than 7 g/dL or hematocrit less than 20 percent).

Blood transfusion is described in detail in a separate topic. (See "[Patient education: Blood donation and transfusion \(Beyond the Basics\)](#)".)

Side effects — There can be side effects of blood transfusion, with the most common being fever or itching. However, this only occurs in 0.1 to 1 percent of transfusions. More serious or even life-threatening allergic reactions or other complications can occur, although this is even less common.

The risk of infection with the hepatitis C virus or the virus causing AIDS is extremely low because of better screening of blood donors as well as improved laboratory testing. These infections occur only once for every two million transfusions.

Iron and diet — Although dietary iron is important in preventing iron deficiency, people with iron deficiency anemia need more iron than they can consume through their diet alone. In a 2000 calorie diet, there is only about 10 mg of elemental iron (compared to 65 mg in one 325 mg ferrous sulfate tablet). Therefore, increasing dietary iron alone is not usually recommended as a treatment for iron deficiency anemia, although it may be recommended in combination with iron therapy.

Dietary sources of iron are found in meat, grains, fruits, and vegetables ([table 1](#)). For people who do not eat meat, good plant sources of iron include whole or enriched breads or grains, iron-fortified cereals, legumes, green leafy vegetables, dried fruits, soy products, blackstrap molasses, bulgur, and wheat germ. To maximize absorption, iron-rich foods should not be consumed with coffee or tea. Taking vitamin C or drinking orange juice with high iron foods can further enhance absorption.

ANEMIA PREVENTION — People who have had iron deficiency anemia once may be at increased risk for developing it again, depending upon why they developed anemia originally. In these people, iron supplements may be recommended to maintain the body's iron stores.

However, iron supplements and multivitamins that contain iron should not be taken without consulting a healthcare provider due to the potential risk of iron overdose. Most men and postmenopausal women do **not** need supplemental iron unless they have an underlying illness that reduces iron absorption or causes bleeding.

WHERE TO GET MORE INFORMATION — Your healthcare provider is the best source of information for questions and concerns related to your medical problem.

This article will be updated as needed on our web site (www.uptodate.com/patients). Related topics for patients, as well as selected articles written for healthcare professionals, are also available. Some of the most relevant are listed below.

Patient level information — UpToDate offers two types of patient education materials.

The Basics — The Basics patient education pieces answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials.

[Patient education: Anemia caused by low iron \(The Basics\)](#)

[Patient education: Nutrition before and during pregnancy \(The Basics\)](#)

[Patient education: Blood donation \(giving blood\) \(The Basics\)](#)

[Patient education: Restless legs syndrome \(Willis-Ekbom disease\) \(The Basics\)](#)

[Patient education: Orthostatic hypotension \(The Basics\)](#)

[Patient education: Angiodysplasia of the GI tract \(The Basics\)](#)

[Patient education: Complete blood count \(CBC\) \(The Basics\)](#)

[Patient education: Medicines for chronic kidney disease \(The Basics\)](#)

Beyond the Basics — Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are best for patients who want in-depth information and are comfortable with some medical jargon.

[Patient education: Colon and rectal cancer screening \(Beyond the Basics\)](#)

[Patient education: Blood donation and transfusion \(Beyond the Basics\)](#)

Professional level information — Professional level articles are designed to keep doctors and other health professionals up-to-date on the latest medical findings. These articles are thorough, long, and complex, and they contain multiple references to the research on which they are based. Professional level articles are best for people who are comfortable with a lot of medical terminology and who want to read the same materials their doctors are reading.

[Anemia of chronic disease/inflammation](#)

[Anemia in adults due to decreased red blood cell production](#)

[Approach to the adult patient with anemia](#)

[The approach to the patient who refuses blood transfusion](#)

[Causes and diagnosis of iron deficiency and iron deficiency anemia in adults](#)

[Hematologic complications of malignancy: Anemia and bleeding](#)

[Hematologic manifestations of HIV infection: Anemia](#)

[Immunologic transfusion reactions](#)

[Indications and hemoglobin thresholds for red blood cell transfusion in the adult](#)

[Iron requirements and iron deficiency in adolescents](#)

[Blood donor screening: Laboratory testing](#)

[Leukoreduction to prevent complications of blood transfusion](#)

[Role of erythropoiesis-stimulating agents in the treatment of anemia in patients with cancer](#)

[Transfusion-associated circulatory overload \(TACO\)](#)

[Transfusion-associated graft-versus-host disease](#)

[Hemolytic transfusion reactions](#)

[Transfusion-related acute lung injury \(TRALI\)](#)

[Transfusion-transmitted bacterial infection](#)

[Treatment of iron deficiency anemia in adults](#)

[Red blood cell transfusion in adults: Storage, specialized modifications, and infusion parameters](#)

The following organizations also provide reliable health information.

- National Library of Medicine

(www.nlm.nih.gov/medlineplus/ency/article/000584.htm)

- National Heart, Lung, and Blood Institute

(www.nhlbi.nih.gov/health/dci/Diseases/ida/ida_diagnosis.html)

- Center for Disease Control and Prevention

(www.cdc.gov/nccdphp/dnpa/nutrition/nutrition_for_everyone/basics/iron.htm)

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GRAPHICS

Dietary sources of iron

Food	Approximate measure	Iron (mg)
High iron sources		
Cream of Wheat (quick or instant)*	1/2 cup	7.8
Kidney, beef [¶]	2 oz (60 g)	5.3
Liver, beef [¶]	2 oz (60 g)	5.8
Liver, calf [¶]	2 oz (60 g)	9.0
Liver, chicken [¶]	2 oz (60 g)	6.0
Liverwurst [¶]	2 oz (60 g)	3.6
Prune juice	1/2 cup	5.1
Spinach	1/2 cup	3.2
Moderate iron sources		
All-Bran cereal	1/2 cup	2.9
Almonds, dried unblanched	1/2 cup	3.0
Dried beans and peas		
Baked beans, no pork	1/4 cup	1.5
Blackeye peas, cooked	1/4 cup	0.8
Chick peas, dry	1/4 cup	3.5
Great northern beans, cooked	1/4 cup	1.3
Green peas, cooked	1/4 cup	1.4
Lentils, dry	1/4 cup	3.4
Lima beans, cooked	1/4 cup	1.3
Navy beans, cooked	1/4 cup	1.3
Red beans, dry	1/4 cup	3.5
Soybeans, cooked	1/4 cup	1.4
White beans, dry	1/4 cup	3.9
Beef, cooked	2 oz (60 g)	2-3 ^Δ
Ham, cooked	2 oz (60 g)	1.3
Lamb, cooked	2 oz (60 g)	1.9
Peaches, dried	1/4 cup	2.4
Peanuts, roasted without skins	3 1/2 oz (100 g)	3.2
Pork, cooked	2 oz (60 g)	2-3 [◇]
Prunes, dried	2 large	1.1
Scallops	2 oz (60 g)	1.6
Turkey, cooked	2 oz (60 g)	1.7
Approximate iron content of children's favorite foods		
Hamburger, small	1	3.0
Large	1	5.2
Big Mac	1	4.3
Quarter Pounder	1	5.1
Spaghetti with meatballs	1 cup	3.3
Frankfurter and beans	1 cup	4.8

Pork and beans	1 cup	5.9
Raisins [§]	5/8 cup	3.5
Cereals, fortified	1 serving	4.5-17.8
Nuts [§]	1 cup	5.0-7.0
Seeds, sunflower [§]	3 1/2 oz (100 g)	7.1
Chile con carne	1 cup	3.6
Beef burrito or tostado	1 medium	3.4-4.6
Cheese pizza	2 slices	3.0
Cheese pizza with beef	2 slices	4.8
White bread	1 piece	0.7

* Or other fortified cereals which contain 10 mg of iron per ounce or 100 percent RDA per serving.

¶ As organ meats are generally high in cholesterol, these iron-rich foods should be eaten in moderation.

Δ Depending on cut, the greatest amounts of iron are generally found in the chuck, flank, and bottom round cuts of beef.

◇ Depending on cut, the greatest amounts of iron are generally found in the loin, sirloin, tenderloin, and picnic shoulder cuts of pork.

§ Raisins, nuts, and seeds are not generally recommended for children under age three because of risk of choking.

Data from: Walker WA, Watkins JB (Eds), Nutrition in Pediatrics, 2nd ed, BC Decker, Inc, London 1997.

Graphic 73962 Version 6.0