Iron

Fact Sheet for Health Professionals

This is a fact sheet intended for health professionals. For a general overview, see our consumer fact sheet.

Introduction

Iron is a mineral that is naturally present in many foods, added to some food products, and available as a dietary supplement. Iron is an essential component of hemoglobin, an erythrocyte (red blood cell) protein that transfers oxygen from the lungs to the tissues [1]. As a component of myoglobin, another protein that provides oxygen, iron supports muscle metabolism and healthy connective tissue [2]. Iron is also necessary for physical growth, neurological development, cellular functioning, and the synthesis of some hormones [2,3].

Dietary iron has two main forms: heme and nonheme [1]. Plants and iron-fortified foods contain nonheme iron only, whereas meat, seafood, and poultry contain both heme and nonheme iron [2]. Heme iron, which forms when iron combines with protoporphyrin IX, contributes about 10% to 15% of total iron intakes in western populations [3-5].

Most of the 3 to 4 grams (g) of elemental iron that is present in adults is found in hemoglobin [2]. Much of the remaining iron is stored in the form of ferritin or hemosiderin (a degradation product of ferritin) in the liver, spleen, and bone marrow, or it is located in the myoglobin of muscle tissue [1,5]. Transferrin is the main protein in blood that binds to iron and transports it throughout the body.

Humans typically lose only small amounts of iron in urine, feces, sweat, and shed skin cells. Losses are greater in menstruating women because of blood loss. Hepcidin, a circulating peptide hormone, is the key regulator of both iron absorption and the distribution of iron throughout the body, including in plasma [1,2,6].

Assessing iron status

Hemoglobin and hematocrit are the most commonly used measures to screen patients for iron deficiency, although they are neither sensitive nor specific. Serum ferritin concentration, which is a measure of the body's iron stores, is also used, but it can be affected by inflammation. Often, health care providers will use multiple measurements to diagnose iron deficiency. They may also consider a patient's dietary and supplemental iron intakes and how those compare to intake recommendations.

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Recommended Intakes

The Food and Nutrition Board at the National Academies of Sciences, Engineering, and Medicine has established Recommended Dietary Allowances and Adequate Intakes for iron. These values range from 8 to 27 mg for adults and from 0.27 to 27 mg for infants, children, and adolescents, depending on age and life stage. People who follow vegetarian diets need more iron than those who include animal products in their diet due to the decreased bioavailability of nonheme iron from plant-based foods.

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Sources of Iron

Food

Lean meat and seafood are the richest dietary sources of heme iron, while nuts, beans, and vegetables contain nonheme iron. Wheat and other flours are often fortified with iron, making bread, cereal, and other grain products good dietary sources of nonheme iron as well. Heme iron has better bioavailability than nonheme iron; in addition, consuming other dietary components with nonheme iron, such as ascorbic acid and phytate, can significantly affect the bioavailability of nonheme iron.

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Dietary supplements

Ferrous and ferric iron salts are the most common forms of iron found in dietary supplements, although other forms are also used. The various forms of iron contain different amounts of elemental iron, and certain forms may be more likely to cause gastrointestinal side effects at high doses. In addition, experts recommend taking calcium and iron supplements at different times to avoid potential interference with the absorption of iron.

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Iron Intakes and Status

While most people in the United States obtain adequate amounts of iron from their diets, certain factors, such as age, sex, race, and socioeconomic status, can put people at a higher risk of iron deficiency. At the other end of the spectrum, some people, including individuals with hereditary hemochromatosis, are at risk of obtaining excess iron.

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Iron Deficiency

There are several stages of iron depletion and deficiency; iron deficiency anemia occurs when the body's iron stores are exhausted, and hematocrit and levels of hemoglobin decline. People with iron deficiency anemia may experience gastrointestinal disturbances, weakness, fatigue, and difficulty concentrating. The condition may also impair cognitive function, immune function, and body temperature regulation. People with iron deficiency often have other nutrient deficiencies, which can cause other types of anemia or affect the severity of anemia.

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Groups at Risk of Iron Inadequacy

Certain groups of people are more likely than others to have inadequate iron intakes, including pregnant women, infants and young children, women with heavy menstrual bleeding, and frequent blood donors. People with certain conditions, such as cancer, gastrointestinal disorders, and heart failure, may also have inadequate iron intakes.

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Iron and Health

This section focuses on the role of iron in IDA in pregnant women, infants, and toddlers as well as in anemia of chronic disease.

Iron deficiency anemia in pregnant women

Iron supplementation has been shown to reduce the risk of iron deficiency anemia in pregnant women and the risk of certain adverse effects in their infants. Accordingly, some professional societies and public health organizations recommend anemia screening and iron supplementation for pregnant women, but not all groups agree that the evidence is sufficient to recommend routine screening and supplementation for asymptomatic pregnant women.

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Iron deficiency anemia in infants and toddlers

In infants, iron deficiency anemia can cause adverse cognitive and psychological effects that are potentially irreversible. Studies indicate that iron supplementation or fortification of foods with iron can reduce the risk of iron deficiency in infants and young children, but guidelines from professional societies and public health organizations vary for this population.

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Anemia of chronic disease

Anemia of chronic disease is caused by certain inflammatory, infectious, and neoplastic diseases that disrupt iron homeostasis and limit the amount of iron that is available for erythropoiesis. Treating anemia of chronic disease is usually a matter of treating the underlying disease, but in some cases, patients may receive iron supplementation or erythropoiesis-stimulating agents. However, using iron supplementation to treat this condition remains controversial due to the risk of infection and cardiovascular events.

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Health Risks from Excessive Iron

The risk of iron overload from dietary sources of iron is low among adults who have normal intestinal function, but high doses of iron supplements can cause a range of gastrointestinal effects. With extremely high doses, these effects can be severe, including corrosive necrosis of the intestine, multisystem organ failure, and even death. The tolerable upper intake level for iron is 45 mg for adults and ranges from 40 mg to 45 mg for infants, children, and adolescents, depending on age.

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Interactions with Medications

Iron supplements may interact with medications, including levodopa and levothyroxine. In addition, proton pump inhibitors can potentially reduce iron absorption.

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Iron and Healthful Diets

In general, a person’s nutritional needs should be met primarily through the diet, including fortified foods. Dietary supplements may be useful in cases where it is not possible to meet the needs for specific nutrients through food alone, especially during certain life stages. The Dietary Guidelines for Americans offers a general description of healthy dietary patterns.

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