



# Iron

## AT A GLANCE

### Introduction

Iron (Fe) is a key element in the metabolism of almost all living organisms.

In humans, iron is an essential component of hundreds of proteins and enzymes.

Much of the iron in the body is attached to a protein in red blood cells that carries oxygen to all of the tissues ('hemoglobin'). Extra iron is stored in the liver, bone marrow, spleen, and muscles.

### Health Functions

A sufficient intake of iron is important as it helps the body, as part of proteins (enzymes), to

- store and transport oxygen to all of the tissues
- produce energy
- protect cells against the damaging effects of free radicals
- protect itself against bacteria by producing free radicals as part of an immune response.

The European Food Safety Authority (EFSA), which provides scientific advice to assist policy makers, has confirmed that clear health benefits have been established for the dietary intake of iron in contributing to:

- normal formation of red blood cells and hemoglobin;
- normal oxygen transport in the body;
- normal energy-yielding metabolism;
- a normal function of the immune system;
- normal cognitive function;
- normal cell division.

### Disease Risk Reduction

#### **Impaired intellectual development in children**

Several possible mechanisms link iron deficiency anemia (low levels of iron in the blood) with poor mental development in children.

Studies have shown that compared to children without anemia, anemic children tend to move around and explore their environment less, which may lead to developmental delays, poor school achievement, and behavior problems.

However, it is difficult to separate the effects of iron deficiency anemia from other types of deprivation in such studies.

### **Lead toxicity**

A number of population studies have found iron deficiency to be associated with increased intestinal absorption of and blood levels of lead in young children.

The use of iron supplementation in lead poisoning should be reserved for those individuals who are truly iron deficient or who experience long-lasting lead exposure, such as continued residence in lead-exposed housing.

### **Pregnancy complications**

Population studies provide strong evidence of a relationship between severe anemia in pregnant women and adverse pregnancy outcomes, such as low birth weight, premature birth, and maternal mortality.

While iron deficiency can be a major contributory factor to severe anemia, evidence that iron deficiency anemia is a reason for poor pregnancy outcomes is still lacking.

### **Impaired immune function**

Sufficient iron is critical to several immune functions, including the development and division of white blood cells, and the generation of free radicals, which are used for killing infectious agents (e.g., bacteria).

Despite the critical functions of iron in the immune response, the relationship between iron deficiency and susceptibility to infection remains controversial.

Controlled studies are needed to determine the appropriate use of iron supplementation in regions where malaria is common, as well as in the presence of infectious diseases, such as HIV, tuberculosis, and typhoid.

## **Other Applications**

*Please note:*

*Any dietary or drug treatment with high-dosed micronutrients needs medical supervision.*

### **Anemia**

The most important use of iron supplements is to treat anemia (low levels of iron in the blood) caused by iron deficiency. Anemia can be caused by many conditions, including menstrual loss, pregnancy, blood donation, bleeding ulcers, surgery (before and after), and chronic diseases such as cancer and kidney failure.

Restless legs syndrome

Restless legs syndrome (RLS) is a neurological movement disorder that is often associated with sleep problems due to unpleasant sensations resulting in an irresistible urge to move the legs.

RLS occurs in some people with iron deficiency and some RLS patients benefit from iron supplementation.

## **Intake Recommendations**

In Europe, many health authorities recommend daily iron intakes of 9 mg for adult males, and 15–20 mg for females of reproductive age to compensate for menstrual iron losses. In pregnancy, the recommended intake is 30 mg/day because of the increased iron requirement.

## **Supply Situation**

The World Health Organization (WHO) considers iron deficiency to be the number one nutritional disorder in the world. As many as 80% of the world's population may be iron deficient, while 30% may have iron deficiency anemia.

## Deficiency

Significant deficiency in iron leads to anemia, resulting in diminished oxygen transport.

Anemia may be mild, moderate, or severe and may be caused by significant or prolonged blood loss such as that from a bleeding ulcer, menstruation, severe trauma, surgery, or a malignant tumor.

It can also be caused by an iron-poor diet, inefficient absorption of dietary iron, pregnancy, and the rapid growth that takes place during infancy, early childhood, and adolescence.

Pregnant women, young women during their reproductive years, and children tend to be at the highest risk of becoming deficient in iron.

The most common symptoms of anemia are weakness and fatigue.

Low levels of iron can lead to diminished exercise capacity, whether anemia is present or not.

## Sources

The best dietary sources of iron are liver and other organ meats, lean red meat, poultry, fish, and shellfish. Iron from these sources is readily absorbed in the intestines.

Other sources of iron include dried beans and peas, legumes, nuts and seeds, whole grains, dark molasses, and green leafy vegetables. However, iron from these sources must be accompanied by certain nutrients for proper absorption: vitamin C, for example, helps the absorption of this type of iron while calcium, bran, tea, and unprocessed whole grain products block its absorption.

## Safety

The most common side effect from iron supplements is stomach upset, including discomfort, nausea, diarrhea, constipation, and heartburn.

Severe iron overdose occurs when amounts of iron equivalent to 50–100 times greater than the recommended dietary dose are ingested. Such iron toxicity can lead to destruction of cells in the gastrointestinal tract, which can cause vomiting, bloody diarrhea, and even death.

Although not entirely clear, there may be an association between high iron stores and risk of heart disease, cancer, and Alzheimer's disease. Similarly, for those with inflammatory bowel disease (Crohn's disease and ulcerative colitis) the areas of the bowel that are inflamed appear to have higher amounts of iron. This is thought to be because iron can stimulate the damaging effects in the body of substances known as free radicals.

Iron overload disease, although most commonly an inherited condition called hemochromatosis, may occur in people who consume excessive amounts of iron over a long period of time. Symptoms include skin discoloration, diabetes, and liver damage, among other potential complications.

### **Tolerable upper intake level**

U.S. health authorities have established that taking up to 45 mg iron per day is safe. However, safety for amounts higher than 45 mg per day is not known.

**Drug interactions**

*Please note:*

*Because of the potential for interactions, dietary supplements should not be taken with medication without first talking to an experienced healthcare provider.*