Risiken erkennen – Gesundheit schützen

# Frequently Asked Questions and Answers about Iron in Food

BfR FAQs, 1 December 2008

Iron is an essential trace element that has to be absorbed from food. It is mainly found in meat although some kinds of fruit, vegetables, pulses and cereals are also excellent sources of iron. The human body needs iron to form haemoglobin and for oxygen transport. The iron status of the German population is good. However, children, adolescents during their growth phase, pregnant women and infants are risk groups for insufficient dietary intake. By contrast, some other groups in the population take in far more iron than is needed to cover their requirements.

For some years now a number of breakfast cereals have been fortified with iron in Germany. Some iron-containing food supplements are also for sale. As current scientific knowledge indicates that a persistently high intake of iron increases the risk of heart disease and cancer, the Federal Institute for Risk Assessment (BfR) advises against the fortification of foods with iron. Iron-containing food supplements should only be taken in the case of elevated iron requirements under medical supervision.

## What does the body need iron for?

Iron is an essential trace element. That means it is vital and has to be absorbed from food. It is involved in many metabolic pathways in the body. As the central atom in haemoglobin (red blood pigment) and myoglobin, it is responsible for the transport of oxygen. Furthermore, it plays an important role in cellular energy supply, DNA synthesis and defence against infections.

## How much iron do we need every day?

The required iron intake is based on daily iron losses via faeces, urine and sweat and amounts to approximately 1 mg per day. Women also lose blood during menstruation. During growth and pregnancy the required iron intake is higher.

However, dietary iron intake of the required amount of around 1 mg per day is not enough as only approximately 10-15% of dietary iron is actually available to the body. The German Nutrition Society (DGE) took this into account in its iron intake recommendations by recommending a daily intake of between 10 and 15 mg per day for adolescents and adults and of between 8 and 10 mg iron per day for children to cover the daily iron requirement of around 1 mg. A far higher intake is recommended for pregnant and breastfeeding women of 30 and 20 mg per day, respectively.

## Why do women need so much iron during pregnancy?

During pregnancy the required iron intake increases because the placenta and uterus must also be supplied with iron. Furthermore, the foetus develops its own iron store.

## Is iron stored in the body?

Iron that is not used to produce haemoglobin or other proteins is stored as ferritin and - when the ferritin store is full - as haemosiderin. The size of the store varies considerably. If necessary, iron can be rapidly mobilised from ferritin and used for haemoglobin synthesis.

## Iron is not always iron - what is the difference between iron of plant and animal origin?

Human beings can far more readily use iron from foods of animal origin (heme iron) than from fruit and vegetables (non-heme iron). Iron of plant origin is normally present in a fixed

bound and trivalent form ($Fe^{3+}$). Before it can be absorbed by the human body, it must be converted into a soluble form and reduced to bivalent iron ($Fe^{2+}$). Heme iron in meat, poultry and fish is present as bivalent iron. In the human organism it is absorbed roughly two to three times more efficiently through a specific intake path in the intestines.

**Which factors inhibit or promote iron intake?**
Iron intake from food of plant origin is influenced by various factors. Iron is normally bound to other substances which inhibit intake like, for instance, lignin, oxalic acid, phytate and phosphate which are found in cereals, rice and pulses. We also know that the tannin in black tea, coffee and red wine, calcium salts and some medicines inhibit intake, too. By contrast, vitamin C, organic acids like citric acid or lactic acid and the amino acids methionine and cysteine (degradation products of animal protein) promote the intake of iron of plant origin.

The intake of heme iron from meat, poultry and fish is scarcely influenced at all by other food ingredients.

In general, the composition of overall diet seems to be more important for the level of iron conversion in the body than the form in which iron occurs in certain foods. Furthermore, iron intake is determined by individual needs and storage status. If there is a low iron requirement or if the iron stores are sufficiently filled, then dietary iron intake falls.

**Which foods are good sources of iron?**
Almost every food contains iron although normally in very small amounts. Meat is the best source of iron because iron from meat is most readily available for the body.

Some foods of plant origin are also rich in iron, e.g. beetroot, pulses and wholemeal cereals. However, their contribution to daily intake is lower because iron from foods of plant origin can be less readily used by the body. In Germany the main sources of iron are bread, meat and sausage products.

**What is the iron status of the population?**
The latest food consumption surveys show that boys and men in all age groups have a more than sufficient iron intake. This is due to the high level of meat consumption by these groups. As iron from meat (heme iron) can be used far more readily by the body than iron from fruit and vegetables, these groups not only take in large amounts but also absorb readily available iron. By contrast, girls and women under the age of 50 do not meet the recommended intake whereas older women after menopause have a good iron status.

Generally speaking, failure to meet the recommended intake does not necessarily mean the presence of a deficiency. To determine whether a person is suffering from a deficiency or not, blood samples must be taken to establish iron status and the existing stores.

**What should people on a vegetarian diet bear in mind?**
Vegetarians should ensure that they absorb enough dietary vitamin C und organic acids (citric acid, lactic acid) as they, in turn, increase the uptake of iron from foods of plant origin. If possible, they should consume wholemeal cereals (cereal products, in the case of bread, if possible sour dough bread). Furthermore, specific preparation techniques help to improve iron intake from foods of plant origin, e.g. the soaking or germination of cereals and pulses as this can reduce the level of the phytates that inhibit iron intake.

**Are vegetarians more prone to an iron deficiency than the rest of the population?**
Anyone on a vegetarian diet can achieve a similarly high or even higher iron intake than people who eat meat. The precondition for this is the careful selection of foods that are rich in iron. The main sources in a vegetarian diet are vegetables, fruit, cereals, nuts, seeds and soya. Studies undertaken up to now show that vegetarians on a balanced diet do not suffer more than the average population from an iron deficiency. This is probably because the body is able to more efficiently use dietary iron when the stores are low.

However, pregnant and breastfeeding women who have considerably higher iron requirements will scarcely be able to achieve the recommended intake of 20-30 mg per day without eating meat (or fish). In this situation it may make sense, after consulting a doctor, to take additional iron in the form of tablets.

**What are the signs of iron deficiency?**
A distinction is made between varying stages of iron deficiency:

In the first stage the iron reserves are merely depleted (reduction of serum ferritin). Health and body functions are not impaired. In Germany around 10% of women and 3% of men are affected.

When not enough iron is available to form sufficient amounts of haemoglobin (red blood dye), this condition is described as a functional iron deficiency and initial damage can occur. This may manifest as inflammation of the corners of the mouth, the elevated risk of cardiac disease, disrupted hair and nail growth as well as broken, dry and rough skin. The most severe form is iron deficiency anaemia. Less than 1% percent of the population suffers from this in Germany.

Deficiency symptoms may also point to other health problems. A blood test should determine whether an individual has a sufficient iron intake or not. Iron tablets should only be taken after consulting a doctor and in line with his recommendations.

**Who are the risk groups for inadequate iron intake?**
Children and adolescents in the growth phase, women of child-bearing age, pregnant women and vegetarians are the risk groups for inadequate iron intake because they either have elevated requirements or because their diet will lead to an intake which is lower than the recommended level.

**Can dietary iron intake lead to excessive intake?**
As a consequence of the extremely effective regulation of iron intake in the body, there is not normally any overloading of the tissue with dietary iron. This does not apply to alcoholics or people suffering from a genetic disease (haemochromatosis).

However, discussions have been underway for some years that high iron intakes - particular in the form of heme iron from red meat - may elevate the risk of chronic diseases like coronary heart disease and cancer. Even if definitive scientific evidence has not been furnished, excessive iron intake should be avoided. In particular, it should be borne in mind that foods fortified with iron or food supplements are additional sources of iron which lead to some groups in the population absorbing far more iron than is needed.

**Is it possible to overdose on iron-containing tablets (food supplements)?**
In extreme cases - e.g. in children - acute intoxications may occur with symptoms like vomiting, diarrhoea, fever, blood-clotting disorders but also kidney and liver damage. In adults the

long-term intake of (high doses of) iron-containing food may lead to chronic excessive iron intake. Based on the scientific knowledge currently available, it cannot be ruled out that a high iron intake or high iron storage caused by the uncontrolled, long-term intake of food supplements with iron raises the risks of heart disease and cancer amongst other things.

Iron should, therefore, only be taken as a food supplement in the case of a diagnosed deficiency after consulting a doctor.

**Are there risk groups for excessive iron intake?**
Individuals with an iron storage disease and associated iron overload are particularly affected by the growing use of iron in food and food supplements.

Furthermore, based on the current level of knowledge, men and women during the menopause are particularly at risk from the onset of chronic diseases like coronary heart disease and cancer which are linked among other things to excessive iron intake.

**Is BfR in favour of the supplementation of foods with iron?**
According to German food law, iron could only be added in the past to food for technological purposes, for instance to change the characteristics or processing properties of a food. Manufacturers who wanted to place iron-enriched products with a nutritional claim on the market, had to apply for an exemption. Exemptions were only granted for the iron fortification of breakfast cereals. In some cases they contain high levels of iron and are consumed daily by around one-quarter of children and adolescents. Pursuant to EU legislation iron may be used since 2004 in food supplements and since 2006 to fortify foods. Maximum levels for use in individual products are still under discussion.

In the case of the uncontrolled fortification of food it cannot be ruled out that groups of the population with an adequate supply will have iron intakes well in excess of the recommended levels that are linked to an elevated risk of heart disease and cancer. In the opinion of BfR, findings on the potential risks that may be associated with a high iron intake should be taken seriously until such time as findings to the contrary are available. BfR is, therefore, against the fortification of foods with iron. A comprehensive opinion on this subject can be accessed on the BfR website under the following link:

http://www.bfr.bund.de/cm/238/use_of_minerals_in_foods.pdf (Use of Minerals in Foods - 01-2006)