



FACT SHEET

Iron depletion in athletes

Elite and recreational athletes involved in regular intensive training programs can quickly deplete iron stores and are at risk of developing iron deficiency anaemia, a condition where there are not enough red blood cells. These athletes, and in particular, female and adolescent athletes, have higher iron requirements than non-athletes. Dietary iron recommendations are 1.3 to 1.7 times higher for athletes than non-athletes and 1.8 times higher for vegetarians than meat eaters. Meeting these high iron requirements through diet is often difficult, especially in those athletes that follow vegetarian-style diets, very high carbohydrate diets, low energy diets or avoid red meat – a good source of iron.

Recent evidence suggests that even early iron depletion or low levels of iron in the tissues can reduce oxygen uptake into cells which reduces performance capacity, particularly aerobic activity. If untreated, iron depletion even in the early stages can quickly develop into iron deficiency anaemia. Anaemia can make you feel very lethargic and incapable of any effort in training, and takes months to recover and return to full training capacity.

What does iron do in the body?

- Iron is needed to make new red blood cells.
- Iron is part of haemoglobin, a protein in the blood that carries oxygen to all the cells in your body. The brain has a big demand for oxygen. Without enough iron in your system, you will find it hard to concentrate and feel tired and irritable.
- Iron is important in maintaining energy release needed to support aerobic and endurance activity.

Signs and symptoms of iron depletion

If you are feeling really flat and tired and unable to train as hard as usual, you could have iron depletion or even anaemia. Other symptoms can include poor appetite, increased incidence and duration of colds and infections, elevated resting pulse rate, and being pale. These symptoms alone do not necessarily confirm iron depletion. Often there are no symptoms, or the symptoms are vague and easily confused with those of overtraining or an infection (eg glandular fever). Sometimes these symptoms are just the result of the 'normal' fatigue associated with training. Taking iron supplements when you feel tired and run down will not help unless you have been diagnosed with iron depletion.

Why are athletes at risk of iron depletion?

A combination of one or more of the reasons following explains why athletes are at high risk of iron depletion compared to non-athletes.

High physiological demands and requirements for iron associated with physical activity

- Hard training stimulates an increase in the number of red blood cells and small blood vessels, increasing the physiological demand for iron. Iron requirements are highest for endurance athletes training at high intensity.
- Growth increases iron requirements because of the corresponding increase in red blood cells and blood vessels.

Inadequate consumption of dietary iron

- Low intake of cereal grains (breakfast cereal and bread) and meats (particularly red meat or vegetarian-style diet (no meat or fish), or very low energy intakes - make it difficult to consume enough dietary iron.

High iron loss, mostly from blood loss

- Blood loss through injury, blood nose and menstruation.
- Blood loss has been reported from the digestive tract and through the urine after extreme events (eg marathon).
- 'Foot strike' damage to red blood cells in the feet associated with running on hard surfaces with poor quality shoes leads to iron loss.
- Heavy sweating – iron is lost in sweat.

How do I know if I really have iron depletion?

If fatigue persists and training capacity is reduced, see a Sports Dietitian to see if you are at risk of iron depletion or see a Doctor for a blood test. Routinely, your doctor will measure the common markers for iron status in your blood (e.g. haemoglobin, ferritin, transferrin) to determine the extent of the iron depletion. (The most definitive marker for diagnosing iron status is transferrin receptor, a relatively new test that is not yet available from your local pathology laboratory).

How is iron depletion treated?

Treatment involves dietary intervention to increase the intake and absorption of iron from food. You might need iron supplements if your iron levels are very low. In a person with much depleted iron stores, changing diet alone will take too long to correct the problem. Some doctors give iron injections but supplements are preferred.

What are the best sources of iron?

A large amount of iron in food is unavailable for absorption. The most readily absorbed form of iron in food called haem iron comes from animal protein. The iron from plant foods – the non-haem form, although rich in iron is poorly absorbed because of the presence of naturally-occurring substances in the foods. (See Table 1 for a list of iron-rich foods.) The amount of iron absorbed depends on what you eat and how you combine these iron-rich foods at the same meal.

Haem iron is found in the muscle meat of animal foods (eg beef, lamb, liver, fish and seafood, pork and poultry). Around 15 to 35% of this iron is absorbed. Lean red meat contains three times as much iron as chicken or fish, making it one of the richest sources of iron. These foods also contain some non-haem iron.

Non-haem iron predominates in plant-based foods. Rich sources include food from cereal grains (bread mainly) and commercial breakfast cereals which are usually iron-fortified. Legumes like lentils, some green vegetables, dried fruits, and nuts are also good sources. Absorption of non-haem iron from these foods is substantially lower than haem iron at 2 to 15%.

How do I combine foods to improve iron absorption?

Some components in food interfere with or enhance iron absorption when eaten together in the same meal. The non-haem iron from plant sources is susceptible to these interfering components. Absorption can be increased by up to four times by combining an iron-rich non-haem food source with meat or a Vitamin C-rich food in the same meal. In contrast, tea and coffee decrease iron absorption from iron-rich non-haem foods (eg bread and breakfast cereal) when consumed at the same time.

Table 1 Iron-rich foods

	Serving size	Amount of total iron per serve (mg/serve)
Foods containing haem iron (animal sources)		
Lean, grilled beef rump steak	1 small serve (100g)	3.8
Lean, grilled trim lamb steak	1 small serve (100g)	3.2
Egg, (whole, poached)	60g	1.7
Lean pork & ham, cooked	½ cup (100g)	1.5
Tuna, dark flesh, cooked	½ cup (100g)	1.1
Lean, grilled chicken (<i>no skin</i>)	1 small breast (100g)	0.8
Fish, white flesh, cooked	1 small piece (100g)	0.4
Foods containing non-haem iron (plant sources)		
Commercial breakfast cereal (<i>iron-enriched</i>)	average serve (60g)	4.2-6.6
Milo™, Sport Sustagen™	3 heaped teaspoons	6
Bread (<i>with added iron</i>)	2 sandwich slices (60g)	4
Bread (<i>wholemeal, mixed grain</i>)	2 sandwich slices (60g)	2.8
Nuts (cashews, almonds)	50g	1.6-3.8
Baked beans in tomato sauce	1 cup (275g)	4.4
Orange juice (<i>with added vitamin C and iron</i>)	1 cup (250mL)	1.5
Pasta, cooked	1 cup	1.0
Rice, cooked	1 cup	0.7
Green vegetables (<i>broccoli, cauliflower, cabbage, beans, peas, spinach</i>)	½ cup (120g)	0.5 - 2
Dried fruit (prunes, apricots)	5-6 (50g)	0.6

Source: NUTABB 2006, AUSNUT 2007; Manufacturer's food labels

Dietary tips for preventing and treating iron depletion

- Increase total consumption of iron-rich foods. This is especially important for athletes eating very little food.
- Choose a variety of iron-rich foods everyday.

- Eat lean red meat, poultry or fish and seafood preferably daily (e.g. in sandwiches or at an evening meal).
- Eat lean red meat (e.g. beef, veal, lamb) at least three to four times a week.
- If vegetarian, ensure food choices are iron-rich (e.g. eat baked beans, lentils and breakfast cereals regularly) and combine with Vitamin C-rich foods. (Good sources of vitamin C include citrus fruit, fruit juice, strawberries, kiwifruit, broccoli, cabbage, cauliflower and capsicum).
- Eat iron-enriched breakfast cereals regularly. Porridge and muesli are very nutritious but are not iron-enriched.
- Avoid consuming strong tea or coffee when you eat breakfast cereal or sandwiches because the tannic acid in tea and coffee binds to iron which inhibits its absorption.

Should I take iron supplements without a diagnosis of iron depletion?

No. You may absorb too much iron. Regular and inappropriate use of iron supplements can induce zinc and copper deficiency. Some people may have a genetic disorder called haemochromatosis which allows excess iron to be absorbed – an abnormal situation. This iron overload disorder affects around 1 in 300 Caucasians. In this condition, too much iron in the cells and tissues can cause irreversible damage and a high risk of cancer and heart disease, unless treated early. Always ask your doctor to check your iron status first before you take iron supplements.

Can you eat too much iron?

It is impossible for a healthy, normal person to absorb too much iron from their diet, unless he or she has haemochromatosis (see above).

Summary Points

- Iron depletion is common in athletes and can develop quickly into the advanced condition of anaemia.
- Inadequate iron intake is often reported in vegetarians, adolescent girls and women athletes.
- Athletes have high iron requirements and losses from hard training, especially endurance athletes.
- Lean red meat, one of the most readily absorbed sources of iron, should be consumed 3 to 4 times a week.
- Vegetarians need to eat iron-rich foods each day, such as iron-fortified breakfast cereal, nuts and legumes, and combine with foods high in vitamin C.
- People with the iron storage disorder, haemochromatosis, should never use iron supplements.
- If you are rapidly growing, not eating properly, feel tired and run down, and training hard nearly every day, see your doctor to check for iron depletion.