Iron Deficiency

by Sharon Erdrich

Iron deficiency is the most prevalent single deficiency state worldwide.

Common to women and young children, iron deficiency robs people of energy and vitality, and diminishes the capability of individuals who are affected to perform physical labour, causing economic consequences; it also adversely affects growth and learning in children.

Iron deficiency is defined as decreased total iron body content. When it is sufficiently severe to cause a decrease in red blood cell production, the result is anaemia.

Why do we need iron?

Iron is essential for many metabolic processes. It is a vital component of heme – the molecule incorporated into haemoglobin in red blood cells and responsible for oxygen transportation in the body. Without adequate iron there is poor oxygen transportation, causing fatigue and poor brain function (memory and concentration). In addition, iron is required for the manufacture of DNA, and interacts with other body processes such as enzymes that make brain neurotransmitters. Iron also affects thyroid metabolism and iodine deficiency – iron supplementation improves the response to supplemental iodine.

Prevalence of iron deficiency

Iron has the dubious distinction of being the most common micro-nutrient deficiency in the world – some 500 to 600 million people, (approximately 15 per cent of the world's population) have iron deficiency anaemia. In New Zealand, iron deficiency is extremely common in preschool children – up to a quarter of those under the age of three years have iron-deficiency anaemia.

New Zealand RDIs for Iron (MOH 2004)

Population Group	Daily Requirement
Children	6-10mg depending on age and weight
Teenage males	11mg
Teenage females	15mg
Adult males	9mg
Adult pre-menopausal not pregnant or lactating	18mg
Pregnant women	27mg
Lactating women	10mg
Post-menopausal women	8mg

A recent study of New Zealand children showed the following rates of deficiency:

Age	Total	Maori	Pacific Is	NZ Euro	Other
6-23mths	14%	20%	17%	7%	27%
5-14yrs	2%				
15-18 yrs		26%	21%	11%	15%
Girls	18%				
Boys	2%				

Factors that increase the likelihood of iron deficiency

- Children
- Athletes
- The elderly
- Pre-term or low birth weight infants
- Women of child bearing age or who are pregnant
- Vegetarians – low intake of absorbable iron, plus typically, a high intake of iron-blocking nutrients
- Deficiencies of other micro-nutrients
- Chronic illness and anorexia
- Stomach conditions or medications that reduce gastric acid secretion
- Heavy menstrual bleeding – e.g. endometriosis, uterine fibroids
- Surgery or traumatic injury
- Conditions where there is frequent blood loss such as stomach or duodenal ulcer, ulcerative colitis, excessive blood donation
- Malabsorption (see below)
- Parasitic infections such as hookworm

Poor absorption may occur when there is some form of small bowel disease such as coeliac disease, inflammation or duodenal ulcer, or surgical excision of the small bowel.

Is all iron created equal?

No, it isn't. While some vegetables such as spinach are very high in iron, plants contain what is called non-heme iron, which is poorly absorbed (about 2-10 per cent) compared to animal sources which contain heme iron, which is far better absorbed – about 20-30 per cent. ⇨

Iron and the brain

As well as the important role iron has in ensuring adequate oxygen reaches the brain, iron is also stored in the brain, suggesting a high need by this organ. Iron is very important in the manufacture and action of some brain chemicals, and an interference with iron metabolism at an early age can result in irreversible damage to specific nerves, with consequences that may manifest themselves in adult life. There are strong relationships between iron deficiency anaemia in children and poor cognitive development, developmental delays, poor school achievement, as well as behaviour and social problems. It has been shown that if a child is iron deficient during the first two years of life, they subsequently have lower levels of achievement in school. Unless a severe anaemia develops or supplementation does not return iron levels and haemoglobin to normal levels within three months, the adverse affects are usually fully reversed.

Adolescents are another group with high levels of iron deficiency – as well as making them harder to get up in the morning, they simply won't learn as well.

Iron and lead

Iron deficiency may increase the risk of lead poisoning in children and a number of studies have found iron deficiency to be associated with increased blood lead levels in young children – iron deficiency actually increases the intestinal absorption of lead. Lead toxicity is a major cause of non-reversal brain damage in children.

Symptoms of iron deficiency

- Pallor: an easy way to check this is by gently pulling down the lower eyelid – the lining should be a dark pink-red colour, if it is pale this is a good indication of iron deficiency.
- Anorexia or decreased appetite.
- Irritability, difficulty concentrating.
- Lack of energy or fatigue (inactivity in young children).
- Children may have episodes of holding their breath.
- Eating non-food items (pica) – iron deficiency is associated with a number of forms of pica, pagophagia (ice eating) is one of the most common.
- Vertical ridges on the nails and/or 'spoon' nails (concave-shaped appearance).
- Rapid pulse.
- Reduced exercise tolerance, muscles fatigue easily.
- Breathlessness on mild exertion worsening to general breathlessness in more severe deficiency states.
- Restless Legs Syndrome occurs in some people with iron deficiency and some sufferers benefit from iron supplementation.

If serious or prolonged, iron deficiency can cause more symptoms

- Severe anaemia may induce angina (chest pain) and worsen the condition of people with chronic lung conditions. During pregnancy, it increases the risk of complications.
- In the mouth, the tongue may develop a glossy appearance and cracks may appear at the corners of the mouth.
- Cold intolerance develops in about 20 per cent of those with chronic iron deficiency anaemia which may be accompanied by pain or numbness and tingling.
- Possibly impaired immune function.
- Children may exhibit behavioural disturbances such as an attention deficit disorder.
- Impaired neurological development in infants with lowered IQ.
- Growth is impaired in infants with iron deficiency.

Almost all these manifestations improve following iron therapy.

How much do we need?

Throughout life, the need for iron fluctuates: a healthy, full-term, newborn infant has sufficient stores for the first six months, but requires regular iron intake thereafter. Growth during childhood and adolescence increases the need for iron as does menstruation, pregnancy and lactation.

When red blood cells are broken down, the iron content is recycled – this reduces the intake needed to about 1mg – but of course, more than that needs to be ingested to ensure the desired amount is absorbed.

Vegetarians need to take the lower absorbability of non-heme iron into consideration and increase their iron intake accordingly, thus the RDI for an adult male or post-menopausal vegetarian woman should be 14mg/day and a pre-menopausal woman is 33mg/day.

Where do we get it?

Good sources of iron are oysters, mussels, liver, lean red meat (especially beef), poultry, tuna, sardines, salmon, iron-fortified cereals and bread. Whole grains (millet, oats, rice), beans, peas, cashew nuts and sunflower seeds, dried fruit (prunes, apricots), and green leafy vegetables (broccoli, silver beet) are also good sources. While soy is fairly high in non-heme iron, the soy protein itself and the phytate content impairs its absorption. Cooking in cast iron cookware also provides additional iron – but again, it's not well absorbed.

Iron absorption

The more you need, the better will be your absorption – this is one of the body's very clever self-regulatory mechanisms designed to both minimise the risk of iron deficiency and prevent excessive iron levels, which can also be harmful. In typical Western diets, about one-third of dietary iron is heme iron which is preferentially absorbed over non-heme iron. In addition, there are several dietary components that reduce the absorbability of non-heme iron, e.g. bran, phytates (as found in unprocessed grains), phosphates (high in soft drinks), tannates (tea and coffee), oxalates (in spinach, rhubarb) and carbonates (especially in calcium supplements). While green tea does, to a small degree, impair iron absorption, green tea extracts are up to 50 times stronger in this effect. Such food items or ingredients can reduce iron absorption by as much as 40 per cent if consumed within an hour of the iron-containing food or supplement.

Iron absorption from legumes (soybeans, black beans, lentils, mung beans, or split pea soups) may be quite low, but all non-heme iron is better absorbed in the presence of either an animal tissue (meat, fish or poultry) or vitamin C. While cow's milk and human breast milk contain about the same amount of iron, around 50 per cent of iron in breast milk is absorbed compared to about 10 per cent of that found in cow's milk.

The chart below is based on an anticipated absorption of 10 per cent of a mixture of heme and non-heme iron. Persons consuming exclusively non-heme iron have a two- to three-fold higher requirement.

Food sources of iron

HEME

Food	Mg per serving
Chicken liver, cooked, 100g	12.8
Mussels, cooked 100g	11
Oysters, 100g	5.0
Beef, fillet steak 100g	4.2
Fish, hoki – smoked, poached 100g	3.5
Lamb, lean, grilled 100g	3.4
Turkey, dark meat, roasted, 100g	2.3
Chicken breast, 100g	1.9
Halibut, cooked, dry heat, 85g	0.9
Pork, loin, broiled, v	0.8
Tuna, white, canned in water, 85g	0.8
Shrimp, mixed species, cooked, 4 large	0.7
Salmon, canned with bones, 100g	1.7

NON-HEME

Food	Mg per serving
Soybeans, mature, boiled, 1 cup*	8.0
Lentils, boiled, 1 cup	6.6
Beans, kidney, mature, boiled, 1 cup	5.2
Beans, lima, large, mature, boiled, 1 cup	4.5
Beans, navy, mature, boiled, 1 cup	4.5
Beans, black, mature, boiled, 1 cup	3.6
Beans, pinto, mature, boiled, 1 cup	3.6
Molasses, blackstrap, 1 Tblsp	3.5
Tofu, raw, firm, 1/2 cup	3.4
Spinach, boiled, drained, 1/2 cup	3.2
Prune juice, 1 cup	3.0
Tahini, 2 Tblsp	2.7
Raisins, seedless, packed, 1/2 cup	1.5
Almonds 1/4 cup	1.5
Egg, average size	1.0
Whole wheat bread, 1 slice	0.9

* sources vary on this – from around 4mg to 9mg

Vitamin C is a strong promoter of iron absorption and is probably the single most significant nutrient to improve absorption of both types of iron, but non-heme iron in particular.

In most other species iron absorption is enhanced because they excrete moderate quantities of vitamin C in intestinal secretions, something humans are unable to do. It's really important to consume the vitamin C with the iron-containing food. In practice this means that people who eat fresh salad and fruit (cooking and storage reduces vitamin C levels in food) with their meals will absorb far more iron than if they eat the fruit as a snack later.

Iron supplements

The first rule of thumb is don't take them unless you've been tested and have a deficiency. Iron is poorly absorbed and high dose supplements can impair zinc absorption. The standard prescription iron tablet is 325mg of iron sulphate, containing about 60mg of iron. Common side-effects are gastrointestinal irritation, nausea, vomiting and diarrhoea or constipation. Stools will often appear darker in colour. Iron-containing liquids can temporarily stain teeth, but diluting the liquid helps to prevent this. Zinc depletion will cause another range of symptoms. Non-prescription iron supplements have varying rates of absorption depending on the form, but are less likely to impair zinc absorption or to cause other side-effects and are thus better tolerated. Severe iron deficiency or people with impaired absorption may need iron injections. Avoid taking calcium supplements at the same time as iron – take the iron in the morning and the calcium at night. Do take vitamin C with every iron tablet and don't take antacids. Keep iron supplements out of reach of children – iron poisoning is fairly common in children. Avoid tea if you are iron deficient. Give it time – it may take six to 10 weeks before you start feeling significantly better after starting iron supplements.

Is more better?

Can you have too much of a good thing? Absolutely! Just as not enough iron is detrimental, too much is not good either. Iron is very prone to oxidation (just think of those exposed metal patches on the car) and oxidation in the body promotes the formation of free radicals – small particles that can do big damage. For this reason and the possibility of causing iron overload, it is not advisable to supplement with iron unless a blood test has confirmed low iron levels or stores. A blood test taken when you have an acute illness is not one to go on as the body hides away circulating iron and the marker for stored iron (ferritin) goes up at this time.

There is a small percentage of the population who have genetic conditions such as thalassemia or haemochromatosis where iron can build up and cause significant damage, particularly to the liver. These people need strategies to block iron uptake and protect them from the damage of circulating iron. Medical management involves regular blood-letting and a prescription of generous servings of black tea! A naturopath will have a good selection of protective herbs available.

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