

Red meat and iron

Iron is essential for the formation of haemoglobin in red blood cells and is also an essential component in many biochemical pathways. For example, it is a component of the enzyme system that detoxifies and removes foreign compounds from the body. It also plays an important role in the immune system and is required for normal energy metabolism. Iron is present in the muscle protein, myoglobin, and is stored to some extent in organs such as the liver (this store is an important source of iron for the first six months of an infant's life because the amount of iron in milk is small).

The healthy adult body contains 3-4g of iron, more than half of which is in the form of haemoglobin. Absorption of dietary iron is regulated tightly, the main regulator being hepcidin, which is made primarily in hepatocytes in response to liver iron levels, inflammation, hypoxia and anaemia¹ (Muñoz & Garcia-Erce, 2009).

Dietary Iron

Red meat has a significant role to play in ensuring optimal iron status. This is because the majority of iron present in red meat is haem iron, which is particularly well absorbed and relatively unaffected by other dietary components.

Dietary iron exists in two forms, haem iron from animal sources and non-haem iron from cereals, fruit, pulses and vegetables. Approximately 15-35% of haem iron is absorbed in the intestine, compared with less than 10% of non-haem iron² (BNF, 1995). Dietary components such as flavonoids in tea and some forms of fibre (phytates) can reduce non-haem iron absorption. In contrast, absorption can be improved by vitamin C and foods such as meat, poultry, fish, citrus fruits, fruit juices, green leafy vegetables and salad. Scientists have not yet identified the mechanism for the enhancing effect of meat on non-haem iron absorption³ (SACN, 2010).

In terms of the overall diet, meat and meat products provide 17% of total dietary iron intake in the UK⁴ (Henderson et al., 2003).

Iron-Deficiency Anaemia

Iron deficiency is a worldwide problem, even in developed countries. Iron is one of the three most important fortificants. If food provides insufficient iron to replace the body's losses, stores are gradually depleted and eventually iron-deficiency anaemia results. Iron deprivation reduces the ability of blood to transport oxygen around the body with many detrimental effects, particularly in terms of cardiovascular, respiratory, neural and muscular function. In children, iron-deficiency anaemia can delay and sometimes permanently impair, mental and motor development. Iron is, therefore, incredibly important in the diet of babies and children.

The National Diet and Nutrition Survey (NDNS)

In the UK, average daily iron intakes from food (NDNS 2000-01) are around 13mg for men and 10mg for women. These values exceed the Reference Nutrient Intake (RNI) for men but are below RNI for women. The RNI is a nutrient level that is sufficient for almost all the population.

Between 25-40% of women aged 19-49 years have iron intakes from food below the Lower Reference Nutrient Intake (LRNI). This is a nutrient level that is likely to meet the needs of less than 3% of the population. The requirements for iron are higher in women of reproductive age (because of menstrual losses) than in men and are also higher in adolescents than in adults. In the NDNS, 44-48% of girls aged 11-18 years have iron intakes below the LRNI, while 12-24% of children aged 1½ - 3½ had intakes below the LRNI⁴ (Henderson et al, 2003).

Turning to iron status (levels of blood), population groups with haemoglobin concentrations below WHO cut-offs for anaemia are adults aged 65 years and over, living in institutions (39% of women; 52% of men), free-living adults aged 75 years and over (13-38%), and girls aged 4-6 years (15% based on 115g/litre cut-off; 9% based on 110 g/litre cut-off). For adults aged 19-64 years, the prevalence of anaemia is higher in women (8%) compared with men (3%)⁵ (Henderson et al, 2003).

Reference Nutrient Intakes (RNIs) for iron for children and adults:

Children	0-3 months (formula fed)	1.7mg/day
	4-6 months	4.3mg/day
	7-12 months	7.8mg/day
	1-3 years	6.9mg/day
	4-6years	6.1mg/day
	7-10 years	8.7mg/day
Males:	11-18 years	11.3mg/day
	> 19 years	8.7mg/day
Females	11-50 years	14.8mg/day
	> 50 years	8.7mg/day

At-Risk Groups

Health professionals need to be vigilant with regard to low iron status and anaemia in vulnerable groups 'at risk'. These include toddlers, girls and women of reproductive age, and adults aged over 65 years. These patients can benefit from appropriate advice from health professional including on how to increase iron intakes and use of suitable iron supplements if required. Iron supplementation should not be offered routinely to all pregnant women but should be considered for those women with haemoglobin concentrations below 110g/litre in the first trimester and 105g/litre at 28 weeks.

Dietary Advice

A public health approach to increasing iron intakes via a healthy balanced diet, including a variety of iron-containing foods is important for helping people to achieve an optimal iron status. Such an approach is more important than focusing on particular dietary inhibitors or enhancers of the bioavailability of iron or the use of iron-fortified foods⁴ (SACN, 2009).

Food Sources of Iron

Total iron content of selected foods (edible portion) McCance & Widdowson

	mg/100g		mg/100g
Calves liver, fried	12.2	Chocolate, plain	2.3
Cocoa powder	10.5	Eggs, chicken boiled	1.9
Cornflakes, fortified	7.9	Cubed lamb, grilled	1.8
Lambs liver, fried	7.7	Bread, white	1.6
Pork liver pate	6.4	Chocolate, milk	1.4
Lentils, green dried, boiled	3.5	Pork spare ribs, grilled	1.4
Apricots, semi-dried, as eaten	3.4	Lean pork tenderloin, grilled	1.3
Lean leg of lamb, roast	3.1	Lean pork leg, roasted	1.2
Sardines, in tomato sauce	2.9	Pork sausages, roasted	1.1
Lean braised beef	2.7	Broccoli, boiled	1.0
Red kidney beans, dried, boiled	2.5	Chicken, roast meat only, average	0.8
Lean beef rump steak, grilled	2.5	Salmon	0.8
Lean topside, roasted	2.5	Back bacon rashers, grilled	0.7
Beef burgers, grilled	2.5	Bananas	0.3
Soy sauce	2.4	Cod, fillet, baked	0.1
Bread, wholemeal	2.4		

Contribution of Red Meat to Iron Intake

In terms of the overall diet, meat and meat products provide 17% of total dietary iron intakes in the UK⁶ (Henderson et al, 2003). A scientific paper, which evaluated associations between meat consumption (both red and processed) and iron intakes/status among British adults reported that people consuming less than 90g/day of red meat are three times more likely to have a low iron status than people consuming more than this. The researchers concluded that reducing meat intakes below present levels could have a negative impact on iron status. Because of the higher bioavailability of haem iron, compared with than non-haem iron, meat consumers tend to maintain a better iron status than people who do not consume meat.

Please visit www.meatandhealth.com for more information.

References

- 1 Muñoz MVI, García-Erce JA (2009). An update on iron physiology. *World Gastroenterol.* **15**(37): 4617-4626.
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- 4 Henderson L, Gregory J, et al. (2003). *The National Diet and Nutrition Survey: Adults Aged 19-64 Years*. Volume 2 Energy, protein, carbohydrate, fat and alcohol intake. London, The Stationery Office.
- 5 Henderson L, Irving K, et al. (2003). *The National Diet and Nutrition Survey: Adults Aged 19-64 Years*. Volume 3 Vitamin and mineral intake and urinary analytes. London, The Stationery Office.
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