Nutritional considerations for dietitians

Iron

A more sustainable diet does not necessarily have to exclude red meat or dairy altogether – therefore meat and dairy nutrient intakes need not be compromised.

This information sheet provides some additional information on nutritional considerations which dietitians may take into account. References and information sources are available as a separate download from www.bda.uk.com/onebluedot.

Iron is critical for foetal brain development and cognition, the immune system as well as preventing iron-deficiency anaemia.[1] Low iron stores (low serum ferritin concentrations) and low iron intakes have been an unresolved issue for teenage girls and young women in Westernised countries whilst iron deficiency anaemia (low haemoglobin levels) remains relatively low.[2,3]

Iron deficiency anaemia in the UK affects 4-9% of 1.5 - 64 year olds. There is a higher prevalence in the over 65 year olds but this is often a consequence of chronic disease, presence of inflammatory markers and / or reduced red blood cell production.[4] In contrast, low iron stores are more common especially in teenage girls (24% with low ferritin levels) and women of childbearing age (12% with low ferritin levels).[5]

	% below the threshold[5]			
	Hb g/L (indicative of iron deficiency anaemia)		Ferritin mcg/L (indicative of iron stores)	
	Male	Female	Male	Female
2-3 year olds	1%	4%	9%	9%
4-6 year olds	1%	9%	2%	24%
7-10 year olds	1%	8%	2%	12%
11-18 year olds	19%	15%	0%	3%

Elderly blood readings of low haemoglobin alongside normal ferritin levels are often reflective of inflammatory or chronic disease status.

Intakes

In the UK mean iron intakes remain below recommendations across all age groups.[5] Irrespective of meat intake, the government now recommends that menstruating females should take an iron supplement to ensure iron requirements are met.[6] However, this has been questioned by some

experts who highlight that iron and zinc supplements are associated with reduced non-haem iron absorption and can therefore be counterproductive in the absence of iron-deficiency anaemia.[7,8]

	% population below Lower Reference Nutrient Intake (LRNI) for Iron[5]	
	Male	Female
2-3 year olds	10%	
4-6 year olds	0%	3%
7-10 year olds		
11-18 year olds	12%	54%
19-64 year olds	2%	27%
65-74 year olds	0%	8%
75 years +	2%	12%

	DRV for Iron mg[6]	
	Male	Female
2-3 year olds	6.9	
4-6 year olds	6.1	
7-10 year olds	8.7	
11-18 year olds	11.3	14.8
19-64 year olds	8.7	14.8 <50yr 8.7 >50yr
65-74 year olds	8.7	
75 years +	8.7	

The main source of iron in UK diets across all age groups is cereal foods (41-55% of total iron intake) and meat (12-21% contribution). The significant iron contribution from cereals is reflective of the UK regulation that white and brown flours milled in the UK have to be fortified with iron (as well as thiamin, nicotinic acid and calcium).[9] Despite a lower iron contribution from meat, it is well established that iron from meat is significantly more bioavailable than iron from plant sources.[2,3,8,10]

For sustainable eating, simply reducing red meat consumption to recommendations (70g per day[2] – rather than complete omission) will result in significant environmental benefits[11-18] and would not compromise iron status.[2,12,17,19]

If, however, someone wishes to omit meat altogether from the diet, once again, the evidence is clear that as long as the diet is balanced, there is no reason why iron status should not be sufficient. Research repeatedly shows that compared to omnivores, non-meat eaters tend to have

higher total iron intakes,[20-24] and despite significantly lower iron stores they remain within the normal range and iron deficiency anaemia prevalence is similar.[3,25-28]

Iron absorption and bioavailability is highly influenced by iron status and the presence of iron enhancers and inhibitors in the diet.

Dietary and endogenous influencers of iron status[2,3,7,8,29]

Iron absorption and bioavailability is highly influenced by iron status and the presence of iron enhancers and inhibitors in the diet. Iron status is tightly regulated[28] and non-haem iron absorption is significantly increased when iron status is low and / or when iron requirements are elevated.[2,3,8,28]

Dietary iron inhibitors

- Iron in plant foods is in the form of **non-haem iron** which is not as bioavailable as haem iron. Non-haem iron needs to be converted to haem iron (Fe2+) endogenously or with the addition of vitamin C in the diet before it can be utilised.
- Plants foods are high in **phytates** which are one of the biggest inhibitors of non-haem iron. However, food preparation techniques such as boiling, soaking, fermentation, germination, milling and heat processes can reduce phytate content significantly and improve non-haem iron bioavailability. Furthermore, clinical evidence indicates that the body can adapt to long-term habitual consumption of high phytate diets by more efficient utilisation of the iron absorbed and reduced excretion rates.[8,28,30]
- **Polyphenols and tannins** found in tea, coffee, some vegetables such as spinach and some cereals will bind to non-haem iron making it insoluble and unavailable for absorption. The effect can be mitigated by ensuing high polyphenol and tannin foods and drinks are consumed away from iron rich meals and snacks.
- **Calcium**. Calcium is a divalent metal which competes with iron in the gut. Calcium consumption alongside non-heam iron foods has been shown to reduce bioavailability.
- High dose iron and zinc **oral dietary supplements** whether taken with or away from meals will reduce dietary iron absorption and their recommendation should be considered carefully especially when iron deficiency anaemia is not present.

Non-haem dietary iron enhancers

Individuals with lower iron status will be more receptive to dietary iron enhancers.

- **Inclusion of some meat, poultry or fish**. Although the mechanism has yet to be identified, it is well established that the presence of some flesh proteins enhances iron

absorption. Therefore, the sustainable dietary recommendations to reduce rather than omit meat altogether will go a long-way to help optimise iron intakes and status.

- **Vitamin C / Ascorbic Acid** remains the biggest enhancer of non-haem iron absorption and should be included with all iron-containing meals and snacks.
- **Vitamin A** and Carotene have also been associated with improved non-haem iron absorption.
- **Enhancers mitigating the effect of phytates**.
  - Promoting plant-based diets for the long term and future generations. There is evidence to demonstrate that habitual consumption of high phytate diets does result in a more efficient utilisation of absorbed iron by the body and reduced rates of excretion.[8,28,30] This also helps explain why vegetarians and vegans do not have higher rates of anaemia than omnivores and maintain iron stores within normal ranges be it at significant lower levels than meat eaters.[3,7,25]
  - Fermentation of high phytate foods. Fermentation of plant foods results in the breakdown of phytic acids. Therefore fermented soya products such as tempeh and miso and yeast leavened bread (microbial fermentation) will enhance the bioavailability of iron.
  - Soaking of legumes and beans will diffuse phytic acid into the water.
  - Sprouting of beans and legumes enhances the activity of naturally occurring phytase enzymes in plants. Some studies demonstrating a reduction in phytates by up to 50%.[7,10]
  - High temperature food preparation e.g. canning can reduce phytic acid content of legumes and beans, however, the effect is highly variable.
  - Milling and refined cereal. For the majority of cereals e.g. wheat, rice and rye, phytates are present on the outer layers, therefore extraction of the outer layer e.g. production of white flour significantly lowers phytates but at the same time reduces the iron content.

The One Blue Dot 'Practical guide for dietitians: other source of iron' sheet gives information on DRV for iron and key sources.

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