

Diet and Anaemia

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Aims of the session

- Discuss dietary sources of iron, B12 and folate
- Discuss considerations for absorption
- Review current evidence
- Practical tips

Dietary iron – Haem sources

- Found in animal tissue only – haemoglobin and myoglobin proteins
- Offal - liver/kidney
- Red meat – beef/lamb/pork
- Chicken
- Fish

Dietary Iron – Non-haem sources

- Composed of free ferric (Fe^{3+}) or ferrous (Fe^{2+}) ions bound to salts, ligands or plant-storage proteins as opposed to heamoglobin/myoglobin
- Beans/pulses
- Vegetables – spinach/kale/broccoli
- Fruits – dried figs/apricots/prunes
- Tofu
- Eggs
- Nuts – Brazil/cashews/pine nuts
- Fortified products – cereals, white bread
- Brown rice, wholegrain bread

Recommended intakes

Adolescent males (11-18) =
11.3mg/day

Adult males (19+) =
8.7mg/day

Females 11-50 (pre-
menopause) = 14.8mg/day

Adult females (post-
menopause) = 8.7mg/day

Iron availability in foods

- 75g Black Pudding = 9.2mg iron
- 80g Lamb kidney = 8.9mg iron
- 100g Chicken breast = 0.4mg iron
- 25g Cockles = 7mg iron
- 1 tin Pilchards in tomato sauce = 5.3mg iron
- ½ tin Tuna = 1.1mg iron
- 30g Bran Flakes = 7.2mg iron
- 50g Muesli = 2.9mg iron
- 150g Brown rice = 0.7mg iron
- 80g Lentils = 2.8mg iron
- 90g Chickpeas = 1.3mg iron
- 90g Kale = 1.8mg iron
- 100g Peas = 0.7mg iron
- 80g Dried Figs = 3.3mg iron
- 60g Tofu = 2.1mg iron
- 40g Pine nuts = 2.2mg iron

Iron absorption – what helps?

Vitamin C (Ascorbic Acid)

Increases the absorption of ferrous ions (Fe^{3+}) and ferric ions (Fe^{2+})

The reducing properties of vitamin C allows the iron to be soluble in a wide range of pHs

Supports absorption through iron transporters in the small intestine

?Vitamin D – some studies have shown vitamin D may also increase iron absorption

Vitamin A and Carotene have also been associated with improved non-haem iron absorption.

Iron absorption – what inhibits?

- Phytates (phytic acid)
- Bind to non-haem iron sources in the digestive tract, forming an insoluble compound
- Plant foods are high in phytates!
- HOWEVER clinical evidence indicates that the body can adapt to long term habitual consumption of high phytate diets
- Fermentation -results in the breakdown of phytic acid - fermented soya products
- Soaking beans/pulses - diffuses phytic acid into the water.
- Sprouting of beans/pulses enhances the activity of naturally occurring phytase enzymes in plants.
- High temperature food preparation e.g. canning
- Milling and refined cereal – phytates are present in the outer layers of cereals

Iron absorption – what inhibits?

Calcium

Calcium is a divalent metal which competes with iron in the gut

Calcium consumption alongside iron foods has been shown to reduce bioavailability

They use similar metal transport channels in the gut

Large amounts of calcium can interfere with the transfer of iron across the cell membrane

Affects both haem and non-haem iron

Iron absorption – what inhibits?

Polyphenols

Found in tea, coffee, dark chocolate, some vegetables such (spinach!) and some cereals

Binds to non-haem iron making it insoluble and unavailable for absorption

Other considerations

Coeliac disease

Inflammatory
bowel disease

Restrictive diets

What does the evidence say?

- Systematic review of randomised controlled trials, Skolmowska et al, 2022
- The majority of dietary interventions are effective in the treatment of iron-deficiency anaemia
- Most effective strategy is increasing dietary iron and vitamin C at the same time
- Vitamin C can be extremely effective, however, a proper ascorbic acid-to-iron molar ratio of about 2:1 is necessary to increase iron bioavailability
- Vitamin D may also increase iron absorption - by downregulating pro-inflammatory cytokines and hepcidin, or possibly involving the expression of 1,25-hydroxyvitamin D receptors which induces both increases and matures erythroid progenitor cells. However, more studies should be conducted to confirm observations
- Decreasing phytate supply did not result in improving iron status in women with suboptimal iron stores

What does the evidence say?

- Overview of systematic reviews - da Silva Lopes et al, 2021
- Foods prepared in iron pots – mixed results
- Iron fortification of food resulted in an increase in Hb levels and reduced the risk of anaemia by 41% and iron deficiency by 52% compared with control
- Multi-micronutrient fortification compared with placebo or no intervention showed in an increase in Hb levels and reduced the risk of anaemia.
- Wheat or maize flour fortified with iron plus other vitamins and minerals versus unfortified wheat or maize flours showed no effect on Hb levels/anaemia
- Rice fortification with iron resulted in an increase in Hb levels and decreased the risk of anaemia and ID compared with unfortified rice or no intervention.
- Fortified soy sauce, salts, condiments and noodles in a Chinese population and found increase Hb levels and reduced the risk of anaemia
- Iron supplementation versus placebo or control increased Hb levels
- Iron supplementation in children with anaemia increased Hb levels compared with those receiving dietary interventions.
- No difference in Hb levels between the groups comparing vitamin D supplementation with placebo.

Practical tips to improve iron absorption

Include vitamin C with all iron-containing meals and snacks (yellow/red peppers, small glass orange juice, lemon dressing, kiwifruit, blackcurrants)

Avoid high polyphenol foods and drinks with iron rich meals and snacks

Take calcium supplements or high calcium foods away from main meals

Boiling, soaking, fermentation, germination, milling and heat processes can improve non-haem iron bioavailability.

Encourage a varied diet with iron-rich foods within meals and snacks

Vitamin B12

Necessary for making red blood cells and DNA

It keeps nerve cells healthy and helps to release energy from food

Needed to prevent megaloblastic anaemia

Intrinsic factor is secreted in the stomach by parietal cells, which binds to B12 and protects it from being broken down

Absorbed at the Ileum

It is only found naturally in meat, eggs and dairy products, although some plant foods are now fortified

High folate levels can mask deficiency!

Causes of B12 Deficiency

Diet

Gastric surgery

Certain Medications

Inflammatory bowel disease

Pernicious Anaemia

Feeding tubes past the stomach

Dietary sources of B12

Red meat -
beef, lamb,
pork

Fish - tuna,
salmon, cod,
mackerel

Shellfish -
clams, crabs

Eggs

White meats

Dairy
products

Yeast extract
(marmite)

Fortified
breakfast
cereals

Fortified tofu

Fortified
plant-based
milks

Food with B12	Micrograms of B12 per Serving
Beef liver	70.7 mcg
Clams	17 mcg
Fortified nutritional yeast	8.3–24 mcg
Salmon	2.6 mcg
Nonfat plain Greek yogurt	1.3 mcg
Egg	0.5 mcg

Advice for vegetarians/vegans

- Vitamin B12 status should be monitored
- Take an oral dietary supplement of at least 10mcg per day (and no more than 2mg per day)
- Aim to eat foods fortified with Vitamin B12 at least 3 times a day
- Vitamin B12 fortified plant foods: yeast extract, fortified plant-based drinks and alternatives to yogurt and most fortified breakfast cereals.

Foods fortified with vitamin B12	Vitamin B12 per serve mcg
Small bowl (30g) of fortified breakfast cereal served with 150ml of fortified plant-based drink	1.1
150g serving of a fortified soya alternative to yogurt (plain or fruit)	0.6
Marmite or yeast spread on two toast (~4g)	0.6
Total daily vitamin B12	2.3

Food	Serving size household	Serving size g	Vitamin B12 mcg /serving
Fortified plant-based alternatives to milk ⁵	A glass	200ml	0.8
Fortified soya alternative to yogurt ⁶	Average	150g	0.6
Fortified yeast extract	Spread on 2 toast	4g	0.6
Most fortified breakfast cereals (check the label)	Small bowl	30g	0.5-1.0

Animal protein comparisons:

70g serving of beef = 1.4 – 2.1mcg Vitamin B12

200ml semi skimmed milk = 1.8mcg Vitamin B12

What does the evidence say?

Behringer et. al, 2025 – Comprehensive review

It may be beneficial to screen for B12 deficiency in at-risk populations, such as the elderly, those with GI disorders, or individuals following strict vegetarian or vegan diets.

Earlier detection and treatment could help prevent long-term neurologic and hematologic complications.

Considerations - paper is a literature review and not a clinical trial, so it relies heavily on previously published data. Harder to control for bias across studies or account for population-specific differences.

Highlights the need for more large-scale, comparative studies such as meta-analyses that explore different forms of B12 supplementation in various groups, especially those with chronic illness or genetic variants affecting metabolism.

What does the evidence say?

- Niklewicz et al, 2024
- Systematic review and meta-analysis
- Looked at whether adherence to a vegan diet is associated with an elevated risk of functional vitamin B12 deficiency compared to vegetarian or omnivorous diets.
- The use of vitamin B12 supplements among vegans contributes to significant improvements in all biomarker concentrations compared to their unsupplemented counterparts.
- There is a need for improved strategies to redress poor vitamin B12 status with appropriate B12 supplementation use among those adhering to vegetarian and vegan diets.

Folate

- Folate (vitamin B9)
- Responsible for formation of healthy red blood cells, together with vitamin B12
- Helps in the development of a healthy baby's spinal cord and brain – recommended to supplement in the first 12 weeks of pregnancy and prior to conception if possible.
- Folate is metabolised by bacteria in the GI tract
- Stored inside red blood cells
- Different variants of the MTHFR gene can affect blood levels and cause slower processing of synthetic folic acid
- Can mask B12 deficiency by correcting the large red blood cell anaemia (megaloblastic anaemia), caused by the low B12, without addressing the deficiency

Causes of folate deficiency

- Diet
- Alcohol
- Medication - Methotrexate, Antibiotics
- Diseases affecting the digestive tract – coeliac disease, IBD
- Pregnancy (increases demand)

Dietary sources of folate

- Brussel sprouts
- Broccoli
- Leafy green vegetables - kale, coriander, spring greens, spinach, cabbage
- Black-eyed/kidney beans and chickpeas
- Breakfast cereals fortified with folic acid
- Liver - avoid in pregnancy
- Fruits - oranges, banana, grapefruit, kiwi fruit
- Yeast, kidney and beef extracts
- Avoid over cooking vegetables as the folate nutrient is easily lost this way

References

- Hunt J. Bioavailability of iron, zinc, and other trace minerals from vegetarian diets. *Am J Clin Nutr.* 2003;78(Suppl 3):633S-9S.
- Hunt J, Roughead Z. Nonheme-iron absorption, fecal ferritin excretion, and blood indexes of iron status in women consuming controlled lactoovo-vegetarian diets for 8 wk. *Am J Clin Nutr.* 1999;69(5):944-52.
- Armah SM, Boy E, Chen D et al. Regular Consumption of a High-Phytate Diet Reduces the Inhibitory Effect of Phytate on Nonheme-Iron Absorption in Women with Suboptimal Iron Stores. *J Nutr.* 2015;145(8):1735-9.
- Beck K, Conlon C, Kruger R et al. Dietary determinants of and possible solutions to iron deficiency for young women living in industrialized countries: a review. *Nutrients.* 2014;6(9):3747-76.
- Gibson R, Donovan U, Heath A. Dietary strategies to improve the iron and zinc nutrition of young women following a vegetarian diet. *Plant Foods Hum Nutr.* 1997;51(1):1-6.
- Craig W, Mangels A. Position of the American Dietetic Association: vegetarian diets. *J Am Diet Assoc.* 2009;109(7):1266-82.
- One Blue Dot. Nutritional considerations for Dietitians: Iron. [Practical-guide-nutritional-considerations-re-IRON.pdf](#)
- Skolmowska, D., Głabska, D., Kołota, A., & Guzek, D. (2022). *Effectiveness of dietary interventions to treat iron-deficiency anemia in women: A systematic review of randomized controlled trials.* *Nutrients*, 14(13), Article 2724. <https://doi.org/10.3390/nu14132724>
- da Silva Lopes, K., Yamaji, N., Rahman, M. O., Suto, M., Takemoto, Y., Garcia-Casal, M. N., & Ota, E. (2021). *Nutrition-specific interventions for preventing and controlling anaemia throughout the life cycle: An overview of systematic reviews.* *Cochrane Database of Systematic Reviews*, 2021(9), Article CD013092. <https://doi.org/10.1002/14651858.CD013092.pub2>
- McCance & Widdowson 7th summary edition of the composition of foods plus the revised composition of food integrated data set (CoFids). *Patent Diet Plan7.* 2018.
- [Iron \(good sources of\) - Milton Keynes University Hospital](#)
- Niklewicz, A., Hannibal, L., Warren, M., & Ahmadi, K. R. (2024). *A systematic review and meta-analysis of functional vitamin B12 status among adult vegans.* *Nutrition Bulletin.* Advance online publication. <https://doi.org/10.1111/nbu.12712>
- [Practical-guide-other-sources-of-B12.pdf](#)
- Behringer, C. R., Kulkarni, A., & Weinstein, A. (2025). *Vitamin B12: A comprehensive review of natural vs synthetic forms of consumption and supplementation.* *Cureus*, 17(11), e96258. <https://doi.org/10.7759/cureus.96258>

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Questions?