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CLINICAL REVIEW:

Iron – elementary for life

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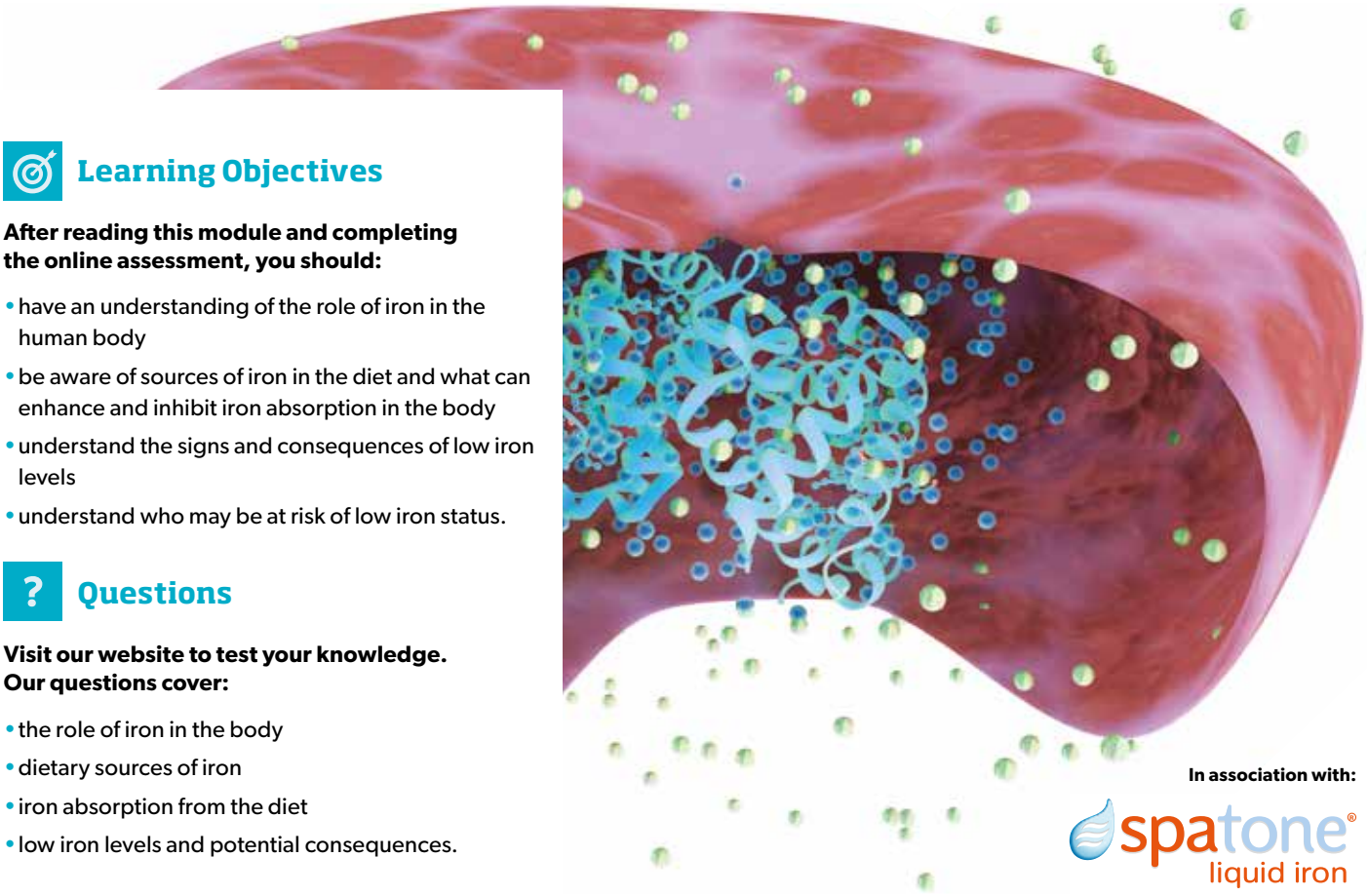

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Learning Objectives

After reading this module and completing the online assessment, you should:

- have an understanding of the role of iron in the human body
- be aware of sources of iron in the diet and what can enhance and inhibit iron absorption in the body
- understand the signs and consequences of low iron levels
- understand who may be at risk of low iron status.

Questions

Visit our website to test your knowledge. Our questions cover:

- the role of iron in the body
- dietary sources of iron
- iron absorption from the diet
- low iron levels and potential consequences.

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Iron's role in the body

Iron plays an important role in a range of metabolic processes in the human body.[1] For example, it is involved in the formation of red blood cells (haematopoiesis). Iron in its ferrous state (as Fe2+) is found in haemoglobin (haem gives red blood cells their characteristic red colour) and myoglobin. It binds to oxygen reversibly thus enabling oxygen transport in the body.[2]

Iron contributes to energy-yielding metabolism through its role in electron transport enzymes in mitochondria, which are essential for the oxidative production of cellular energy in the form of adenosine triphosphate (ATP).[2]

Iron also contributes to a normal function of the immune system and normal cognitive function.[2]

There are two main forms of dietary iron: haem iron found in haemoglobin and myoglobin, and non-haem iron found in animal and plant tissues as Fe2+ bound to insoluble proteins, phytates, oxalates and carbonates and as ferritin (the main protein that stores iron in the cells). Cereals, vegetables, nuts, eggs, fish and meat are among the richest sources of non-haem iron (see Box 1).[3,4]

The reference nutrient intake (ie the amount estimated to meet the needs of 97.5% of people in the group the value applies to) in the UK for iron for adult men and postmenopausal women is 8.7mg per day and 14.8mg per day for premenopausal women over the age of 11 years.[5]

Box 1: Dietary sources of iron[3,4]

- Red meat
- Fish
- Poultry
- Beans
- Nuts
- Dried fruit (eg apricots)
- Wholegrains (eg brown rice)
- Fortified breakfast cereals and breads[6]
- Soybean flour
- Eggs
- Dark-green leafy vegetables (eg watercress, curly kale)

Iron absorption, storage and metabolism

A healthy adult body contains 4–5g of iron: 65% of iron stores are found in haemoglobin and 30–35% in the liver.[7]

Around 90% of the body's iron requirements are met from recycling ageing red blood cells, and 90% of the iron used in the body each day goes into producing new red blood cells.[7] The other 10% of the body's iron requirement is absorbed from dietary sources and helps to compensate for bodily losses of about 1–2mg a day[8] of iron through bleeding, urination and loss of skin and mucous cells.[7]

Most of the iron from the diet is absorbed through the duodenum.[9] Dietary iron is mainly found in the non-haem Fe3+ form, which needs to be reduced to Fe2+ by a ferrireductase enzyme, before it can be absorbed through the gut.

Iron regulatory proteins and iron responsive elements effectively monitor iron levels in the body and regulate absorption, storage and export of iron to maintain the intracellular iron balance.[7] The key factor determining how much dietary iron is absorbed is an individual's iron status.[4] The body absorbs no more than it requires.

In general a greater proportion of dietary haem iron is absorbed than non-haem dietary iron. For example, on average around 25% of haem iron is absorbed from meals containing meat. However, the percentage absorbed can vary from 10% in individuals whose iron stores are replete to around 40% in those who stores are low. On average 5–15% of non-haem iron is absorbed from the diet: the form accounts for 90% of the iron ingested in an omnivorous Western diet.[10]

Enhancers and inhibitors of iron absorption

A variety of substances can enhance or inhibit the absorption of iron. Calcium, for example, has an inhibitory effect on haem and non-haem forms; meat and fish enhance the absorption of non-haem forms (see Box 2).[4,11] However, evidence suggests that an individual's iron status is not significantly influenced by dietary enhancers or inhibitors of iron absorption in those with normal iron levels.[4]

Box 2: Enhancers and inhibitors of iron absorption[4,11]

Enhancers

- Meat (for non-haem iron)
- Ascorbic acid (in fruit and vegetables)

Inhibitors

- Phytic acid (in wholegrain cereal, legumes, nuts and seeds)
- Soy protein (non-haem iron)
- Polyphenols (in tea and coffee; also red wine, cocoa and herbal teas)
- Calcium
- Proton pump inhibitors[9]
- Antacids[9]

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Low iron levels

According to the National Diet and Nutrition Survey (2014/15 – 2015/16) 54% of girls (11–18 years old) and 27% of women (19–64 years old) had low iron intakes and there was evidence of low iron stores (haemoglobin and plasma ferritin) in 9% of girls aged 11–18 years, 5% of women aged 19–64 years and 1% of women aged 65 years and older.[12]

Pregnant women, people with an active lifestyle, those who have a monotonous vegetarian diet, and people with menorrhagia may benefit from iron supplementation.

Iron is important for fetal growth and development. During pregnancy iron absorption from the diet increases: in one study mean absorption was 7% at week 12, 36% at week 24 and 66% at week 36. At 16–24 weeks after birth iron absorption from the diet was 11%.[13]

The National Institute for Health and Care Excellence recommends that iron supplements should not routinely be offered to pregnant women. However, those with haemoglobin levels outside the normal UK range for pregnancy (11g/100ml at first contact and 10.5g/100ml at 28 weeks) should be investigated and iron supplementation considered if indicated.[14]

There is some evidence that the iron status of athletes, particularly female athletes, may be lower than that of those who do not undertake regular exercise. For example, one study showed that iron depletion was significantly more prevalent among 111 habitual female runners compared with 65 inactive females. The researchers commented that iron deficiency in female athletes may be a result of a combination of factors such as 'insufficient dietary iron intake, menstruation, increased iron losses associated with haemolysis, sweating, gastrointestinal bleeding and exercise induced acute inflammation'.[15]

Heavy menstrual bleeding may lead to low iron levels, which may benefit from use of an iron supplement where clinically indicated.[16]

Although people who follow a vegetarian diet may have lower iron stores in their body (that applies particularly to females) there does not seem to be evidence that, in Western countries at least, iron deficiency anaemia is more prevalent among vegetarians than among their meat-eating counterparts.[11,17] However, poorly balanced vegan diets may mean individuals following them are at risk of iron absorption into the body below recommended levels.[11]

Growth spurts in adolescence, particularly among boys, increases the demand for iron. Use of endogenous iron and that from the diet during this time may result in blood ferritin levels falling below the usual range.[4]

Signs and consequences of low iron levels

Among other symptoms, fatigue may be linked to low iron levels.[18] If low iron levels are not addressed there may be a risk of anaemia developing resulting in consequences such as: fatigue, dyspnoea, headache, palpitations and pale skin.[19,20]

When to refer to a GP

People who report symptoms of anaemia – for example mild dyspnoea after exercise, headache, fatigue or cognitive dysfunction – should be advised to consult their GP.

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Female athletes may be at risk of iron deficiency

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Advertorial

Spatone®: Gentle natural iron-rich water in single-use sachets ideal for on-the-go!

Some people's lifestyles make it difficult to for them to get the iron they need through diet alone. Using an iron supplement can help these individuals meet their daily requirements, as iron is a vital mineral for many complex processes and functions in the body. Iron contributes to:

- Normal formation of red blood cells and haemoglobin
- Normal oxygen transport in the body
- Normal energy-yielding metabolism
- The reduction of tiredness and fatigue
- Normal function of the immune system
- Normal cognitive function

Spatone® is a gentle, naturally occurring iron-rich water: It is collected from a unique source in the Snowdonia National Park in Wales.

Spatone® has been shown to be a highly absorbable source of iron[1]: This means that less unabsorbed iron enters the intestinal tract. It is this unabsorbed iron which usually causes some of the unpleasant gastric effects typical of iron supplements, such as constipation and stomach irritation.

Taking Spatone® helps ensure one's daily absorbed iron intake: Spatone® is easily absorbed and is ideal for people who might not be getting enough iron from their diets.

Packed in convenient, easy-to-use individual sachets: Spatone's® single-serve sachets easily fit in a pocket or a bag, which means one can take Spatone® wherever life takes them.

What does Spatone contain?

- **Spatone® Original:** Naturally sourced iron-rich water.
- **Spatone® Apple:** Iron-rich water with vitamin C and a delicious apple taste.

Vitamin C increases the absorption of iron, that's why each sachet of Spatone Apple includes 100% of the NRV[2] of Vitamin C.

Spatone® has no gluten-containing ingredients.

How to take Spatone:

To use, simply take it straight from the sachet. In the case of Spatone® Original you can also dilute it in juice high in vitamin C to increase iron absorption. To get the most out of Spatone®, it is advised to take on an empty stomach. It's best to allow a 30-45 minute gap before eating or drinking.

Recommended dose:

- Adults & Children over 2 years: One sachet daily.
- Pregnant Women*: Two sachets daily.

Suitable for:

- All over 2 years old
- Active men and women
- Pregnant and post-natal women*
- Vegetarians
- Elderly

References:
1. Nelsons Nutritional Study - The Significant Impact of Spatone on Iron Levels, 2009 **2.** Nutrient Reference Value

Food supplements should not be used as a substitute for a balanced diet and a healthy lifestyle. *Pregnant or breast-feeding women are always advised to consult their doctor or midwife before taking Spatone®.

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