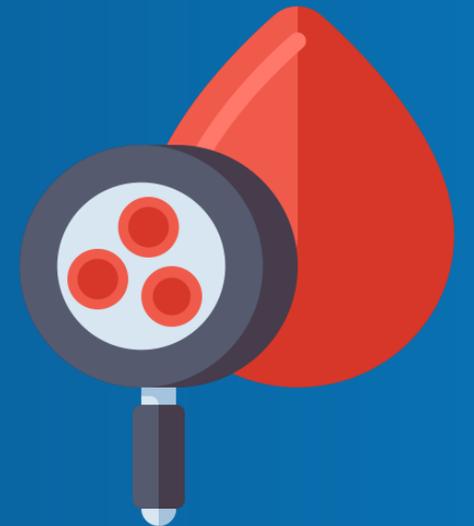
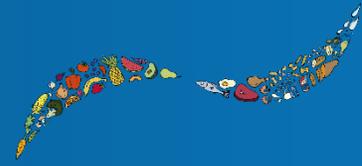


# KEY MICRONUTRIENT IRON

Iron is an important micronutrient consumed in our diet. One of its key roles is in the transport of oxygen around our body and therefore it's central to successful endurance performance.



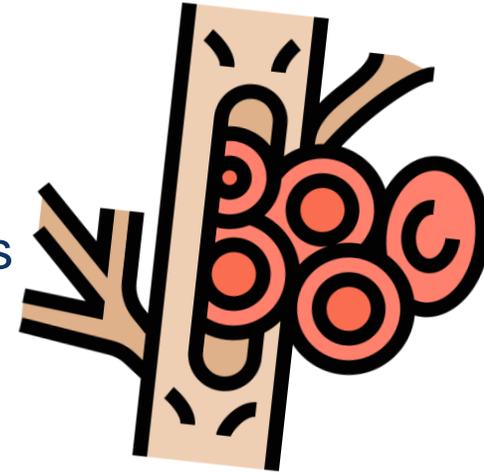
# IRON – WHAT & WHY...



Iron is a mineral consumed from a variety of sources in our diet.

It participates in several **biochemical reactions** involved in oxidative energy production (*aerobic system*).

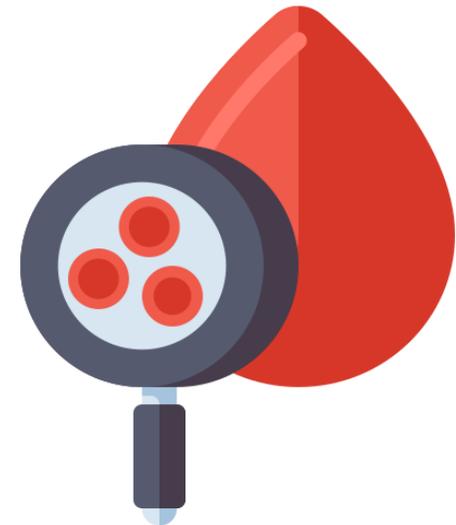
But its major role is as an oxygen carrier in **haemoglobin**. Haemoglobin is the protein inside red blood cells that **carries oxygen** in the blood and contains iron at its centre. Up to four oxygen molecules can bind to each red blood cell and when the oxygen is bound to iron this gives the cell its characteristic red colour.



Most of the iron in our body is stored as haemoglobin in our blood (60-70%) with a small amount stored in muscle (10%) and the remainder in the liver and bone marrow.

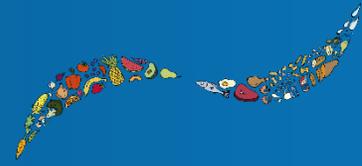
In the **bone marrow** iron is needed for erythropoiesis, this is the **production of new red blood cells** which is a major adaptation to endurance training.

**More red blood cells = more oxygen available to the muscles.**



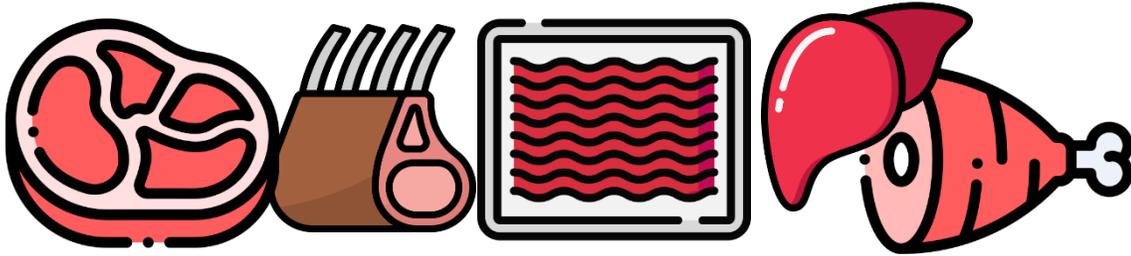
Clearly iron is of significant interest to swimmers – firstly to help ensure **sufficient oxygen delivery** but then in **maintaining the energy release** needed to support endurance exercise.

# IRON – WHERE FROM?

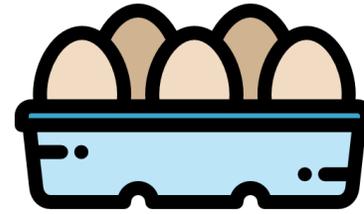


Dietary iron exists in two forms, haem and non-haem.

**Haem** iron is the type found in the haemoglobin of animal foods, it is in good supply and is relatively easily absorbed (*high bioavailability*).



*Red Meats (beef, pork, lamb) and offal meats (liver & kidney)*



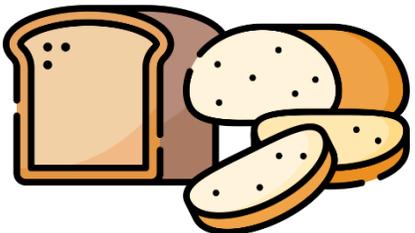
*Eggs*



*Some seafood but especially mussels and sardines*

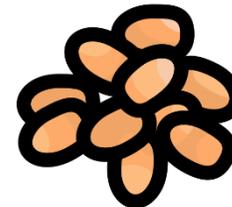
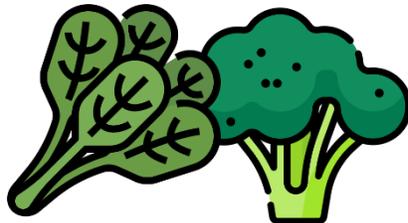
**Non-haem** iron is found in plant foods but its content is much more variable and it is far harder for our body to absorb (*low bioavailability*).

*Bread products made with fortified flour*



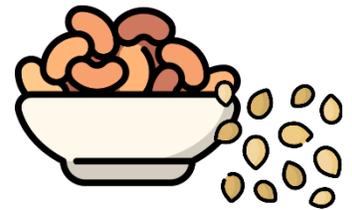
*Cereals fortified with iron*

*Green veg – especially spinach and broccoli*



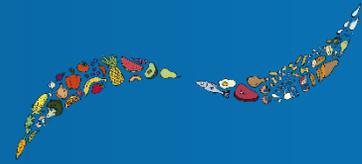
*Chickpeas, kidney and baked beans*

*Dried fruit – especially apricots and figs*



*Cashews, almonds, sesame and sunflower seeds*

# HOW MUCH IRON??



Our **iron needs vary** throughout our lifespan. We lose around 1mg per day via **urine, faeces** and **sweat** and females also lose around 20mg/month via **menstruation**.

**Athletes** iron needs will be **higher** than that of the general population (*perhaps 1.3-1.7 times higher*) due to **increased iron requirements** (e.g. for red blood cell production) and **increased iron losses** (e.g. from increased sweat loss). Average daily iron recommendations for swimmers have not been established.

## Daily Iron Needs

<b>MALES 11-18yrs</b>	11.3mg/day
<b>MALES &gt;19yrs</b>	8.7mg/day
<b>FEMALES 11-50yrs</b>	14.8mg/day
<b>FEMALES &gt;50yrs</b>	8.7mg/day

*Note that requirements for athletes will be higher than these due to increased requirement and losses*

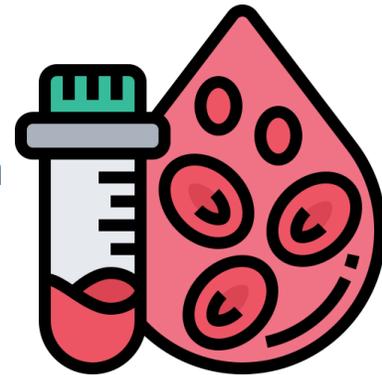
Iron status can be established from a blood test. The marker for iron storage is called **ferritin**.

British Swimming uses the following ferritin scores to help diagnose iron status\*:

<40ug/L = Depleted iron stores

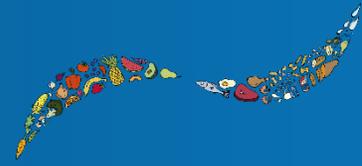
40-80ug/L = Modest iron stores

>80ug/L = Replete iron stores

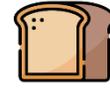
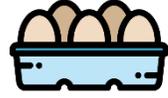


**\* Iron status should not be interpreted without the support of a medical professional**

# IRON IN FOOD



## HAEM IRON



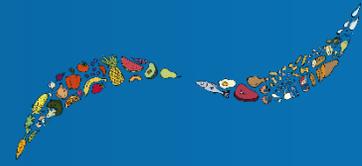
## NON-HAEM IRON



FOOD	PER 100g	PER SERVING
<b>Steak</b>	3.6mg	6.1mg
<b>Beef Mince</b>	2.7mg	3.4mg
<b>Pork Chop</b>	0.7mg	1.4mg
<b>Lamb Leg</b>	1.8mg	1.9mg
<b>Lambs Liver</b>	7.7mg	6.5mg
<b>Eggs</b>	1.9mg	3.5mg
<b>Mussels</b>	3.3gm	3.3mg
<b>Sardines</b>	2.3mg	2.3mg

FOOD	PER 100g	PER SERVING
<b>Baked Beans</b>	1.4mg	2.9mg
<b>Chickpeas</b>	1.5mg	2.3mg
<b>Kidney Beans</b>	2mg	3mg
<b>Wholemeal Bread</b>	2.4mg	1.8mg
<b>Fortified Cereal</b>	11.8mg	5.9mg
<b>Cashew Nuts</b>	6.2mg	3.1mg
<b>Sesame Seeds</b>	10.4mg	2.3mg
<b>Spinach</b>	1.9mg	1.5mg

# IRON ISSUES...



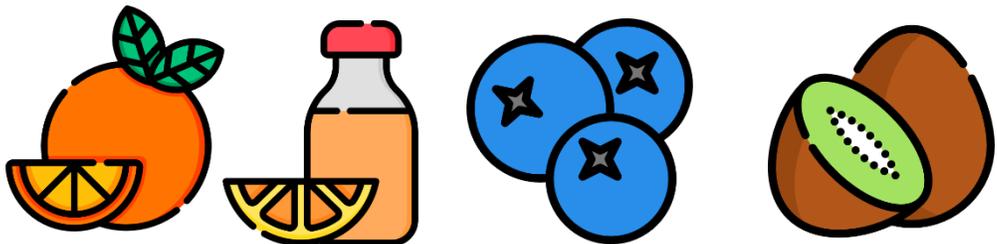
As mentioned, iron requirements are greater for athletes than the general population and iron absorption depends on the source. So, there are some athletes who are at **greater risk of low iron** status than others:

- **Vegetarians, vegans** and anyone who restricts iron-rich animal foods
- **Females** who experience greater iron loss due to **menstrual** bleeding
- Athletes undertaking a very **high volume of aerobic training** (e.g. distance swimmers) or training at **altitude**

## Iron Absorption

It's important not only to consume enough iron, but also ensure that you **absorb** enough of the iron you consume.

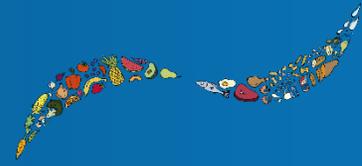
Eating Vitamin C rich foods with iron-rich foods enhances iron absorption



Consuming tea, coffee and high-fibre foods with iron-rich foods reduces iron absorption



# IRON ISSUES...



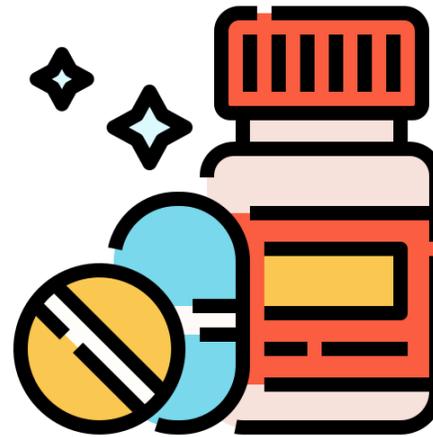
Iron deficiency can **impair** capacity to undertake **aerobic training**, and **decrease work rate** and **energy efficiency**. Severe iron deficiency (*anaemia*) will also impair aerobic capacity and  $VO_{2max}$ .

The symptoms of iron deficiency are **tiredness**, **lack of energy** and **shortness of breath** – this will become more obvious during exercise.

Fortunately, in most cases, low iron status can be **restored** over time through corrective **dietary action**.

## High Iron Diet

- *Wholemeal toast with a glass of orange juice for breakfast*
- *Dried apricots and almonds with a glass of milk as a post-training snack*
- *Eggs on toast with a side of spinach for lunch*
- *Fortified cereal as a pre-training snack*
- *Chilli (beef or bean) with rice and broccoli for tea*
- *Yoghurt with berries for a pre-bed snack*
- **Total Iron Score: 25.3mg**



In some cases it may be advisable to supplement with iron in addition to dietary advice. This is to promote a more rapid restoration of iron stores or for individuals who struggle to consume sufficient dietary iron.

**Iron supplementation should not be commenced without the advice of a medical professional**