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Since we have covered all three macronutrients and timing eating for optimal performance, this week's focus will be on a very important mineral not only for athletic success, but also for overall health and well-being. The topic of the week will be iron.

What is iron?

Iron is a trace mineral (mineral requiring an intake of less than 100mg/day and the total amount in the body is less than 5,000mg) that is essential for energy metabolism, oxygen transport, blood production, synthesizing collagen and neurotransmitters, and supporting a healthy immune system (University of California San Francisco, n.d.).

Iron is a vital component of two key proteins, hemoglobin and myoglobin. Hemoglobin is an oxygen-carrying protein in red blood cells that is responsible for transporting oxygen to tissues in the body (requiring iron to do so) and uses roughly two-thirds of the body's iron to complete its essential functions (Thompson, Manore, & Vaughan, 2014, p. 473). Myoglobin is another oxygen-carrying protein that uses iron to transport and store oxygen within the muscles and uses around 10% of the iron in the body (Thompson, Manore, & Vaughan, 2014, p. 473). Without iron or even sufficient amounts of it, the body cannot meet its needs to function properly at its baseline of maintaining health, let alone meet the demands of intense training day after day.

When it comes to getting enough iron, there are multiple factors that weigh into whether an individual is meeting their personal needs. Iron absorption is affected by current iron levels, the type of iron consumed, the acidity of stomach fluids, and what types of things are consumed in addition to the source of iron consumed (Thompson, Manore, & Vaughan, 2014, p. 474).

To start, the amount of iron a person absorbs can depend on how much iron their body has already stored. Someone with sufficient iron stores will not absorb as much as someone who has lower levels or is deficient. When talking about the type of iron consumed, it is usually referring to the two forms of iron: heme and non-heme iron. Heme iron is a part of hemoglobin and myoglobin and is more easily absorbed by the body than non-heme iron. Heme iron is only found in animal-based sources like fish, meat, and poultry (Thompson, Manore, & Vaughan, 2014, p. 475). Non-heme iron is iron that is not part of hemoglobin and myoglobin and is the only form of iron in plant-based foods but can also be found in animal sources (Thompson, Manore, & Vaughan, 2014, p. 475).

Typically, 15-35% of the heme iron consumed is absorbed by the body whereas only 2-20% of non-heme iron is absorbed (Thompson, Manore, & Vaughan, 2014, p. 476). Without going too much into the science of things, the difference between the two forms is in the charge on the iron atom and the body is better able to absorbe the heme (Fe^{2+}) form versus the non-heme (Fe^{3+}) form. As mentioned above, the acidity of the stomach fluids can influence how much iron is absorbed as well. This is because the more acidic a person's stomach environment is, the easier the Fe^{3+} form can be converted to the more absorbable Fe^{2+} form by being reduced (Thompson, Manore, & Vaughan, 2014, p. 476).

Lastly a huge determining factor as to whether enough iron will be taken up by the body is what is consumed in addition to the source of the iron. As mentioned before, heme iron is more easily absorbed than non-heme iron, but the addition of vitamin C containing foods can enhance the absorption of both types. On the other hand, consuming phytates (found in legumes, rice, & whole grains), polyphenols (found in oregano, red wine, tea, & coffee), calcium, zinc, and large amounts of fiber can inhibit iron absorption (Thompson, Manore, & Vaughan, 2014, p. 476).

So how can you ensure your body is being given the best chance to absorb as much iron as possible? Try to incorporate vitamin C-containing foods every time you eat, and/or if your doctor or dietician recommends you supplement with iron based on bloodwork results try washing the supplement down with a glass of OJ. Add meat to plant-based dishes such as salads, stir fries, soups, etc. (meat enhances the absorption of non-heme iron found in plants). Also try cooking more foods in cast-iron skillets because the food will absorb iron from the pan itself! Avoid drinking red wine, coffee, tea, and dairy/soy milk when consuming iron-rich food sources. Lastly, if you take a multi vitamin or supplement with calcium or zinc, try consuming these at opposite times of the day from your iron supplementation or meals containing iron-rich foods (Thompson, Manore, & Vaughan, 2014, p. 479).

Iron & athletes

Iron is crucial to the physical health and abilities of an athlete. As previously mentioned, iron is necessary for the body to transport oxygen to the muscles and tissues. All athletes and female athletes in particular are at higher risk of iron deficiency, for iron can be lost in blood and sweat. The best way to check your current iron status is to have bloodwork done to check your levels. Common tests doctors will order are serum iron and ferritin tests, as well as hemoglobin and hematocrit tests. Based off the results from these, doctors and registered dietitians can help determine the appropriate amounts of iron to be supplemented if supplementation is required. It is important not to just self-supplement without having a baseline to gauge off of, for iron toxicity can have serious consequences. Too much iron can build up and be stored in the liver, heart, and pancreas and can lead to serious health conditions such as scarring of these vital organ tissues, heart disease, and diabetes (Watson, 2011). On the contrary, not enough iron can also have serious consequences. There are three phases to iron deficiency:

Phase I: iron depletion

Iron stores decrease and circulating ferritin levels in the blood decrease as a result. Usually, symptoms are not present at this phase because hemoglobin levels have not yet been affected, but the reduction in iron levels can hinder the body's ability to produce energy during times of high demand (Thompson, Manore, & Vaughan, 2014, p. 480).

Phase II: iron-deficiency erythropoiesis

Symptoms such as reduced work capacity typically become present during this phase due to the body's decline in the ability to produce new heme and red blood cells as blood ferritin and iron concentrations continue to decline also resulting in the decreased transport of iron in the blood (Thompson, Manore, & Vaughan, 2014, p. 480-481).

Phase III: iron-deficiency anemia

During this final phase the production of normal, healthy red blood cells and the size of the cells decreases, and hemoglobin levels are too low, thus the ability for oxygen to be transported is greatly diminished. Symptoms typical of iron-deficiency anemia are pale skin, fatigue, reduced work performance, and weakened immune and cognitive functions (Thompson, Manore, & Vaughan, 2014, p. 481-482).

How much do you need?

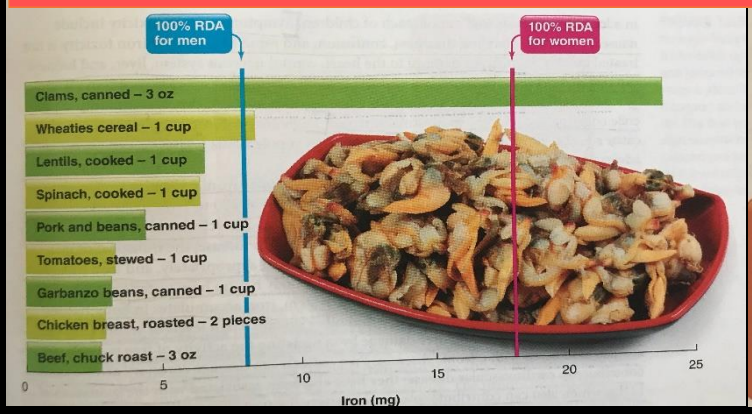
The recommended daily allowance (RDA) for iron is 18mg/day for women ages 19-50, 8 mg/day for men 19-50, and an upper limit set at 45 mg/day for everyone (Thompson, Manore, & Vaughan, 2014, p. 473). Athletes, especially those menstruating, participating in long endurance training/competitions, and heavy-sweaters will need to consume more than the RDA to meet their iron needs. They may need anywhere from 1.3-1.7 (up to 1.8 for vegetarians) times the RDA (Sports Dietitians Australia, 2009).

Here are few great resources covering the topics of iron for athletes (including pediatric athletes) and iron content of food choices per serving size!

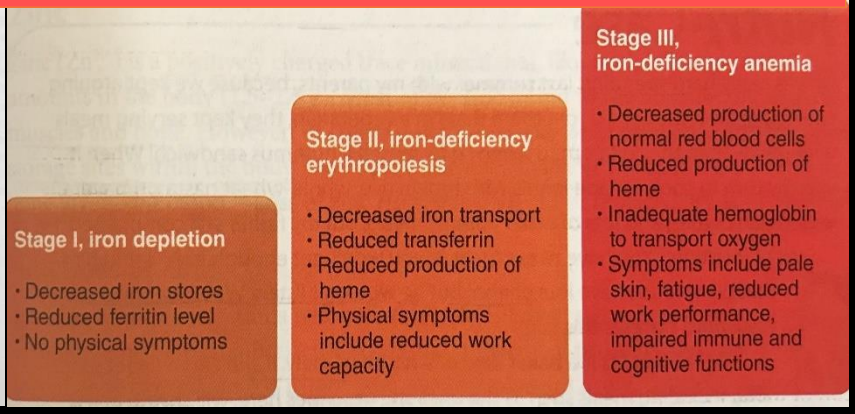
IMPORTANT NOTE:

As mentioned above, although iron is an essential mineral for the body, overdoing supplementation can have severe consequences…more is not better and having bloodwork done and consulting with a professional is crucial in ensuring you are supplementing with an appropriate and safe dose for yourself!! Do not just assume you can take the same amount of iron as someone of similar age, height, weight, gender, etc. Contact your doctor or primary care provider immediately if you experience any of the following symptoms when supplementing with iron: **stomach pain, nausea, vomiting, constipation, joint pain, irregular or rapid heart rhythm, muscle/joint stiffness, and/or other abnormal physical symptoms.** Overloading on iron can lead to organ damage/failure and can be fatal, so again please consult a professional before beginning supplementation.

Also, when getting your iron levels checked, ask your doctor to order a complete blood count (CBC) test along with a test for hemoglobin levels, ferritin, and hematocrit levels to give you the best gauge of where your current levels are. Here is a document explaining what a CBC test is and here is a document explaining iron blood tests.



Above: Common food sources of iron



Above: Stages of iron-deficiency & their characteristics

Cast-Iron Recipe Ideas

References (Information & Pictures):

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