What is hemoglobin and why is it important for endurance athletes?

Hemoglobin (Hgb) is the protein in the blood that binds and carries oxygen. It is found in great numbers inside red blood cells (RBC). It can be thought of as a "tanker" that transports and delivers a vital substance (in this case oxygen) throughout the body, and in particular to the muscles. When muscles are actively contracting, they need even more oxygen than usual. So the more hemoglobin in the blood, effectively, the more tankers are delivering that important oxygen where it's needed most. Many athletes, and in particular endurance athletes, can benefit from maintaining healthy levels of hemoglobin in order to maximize oxygen carrying potential.

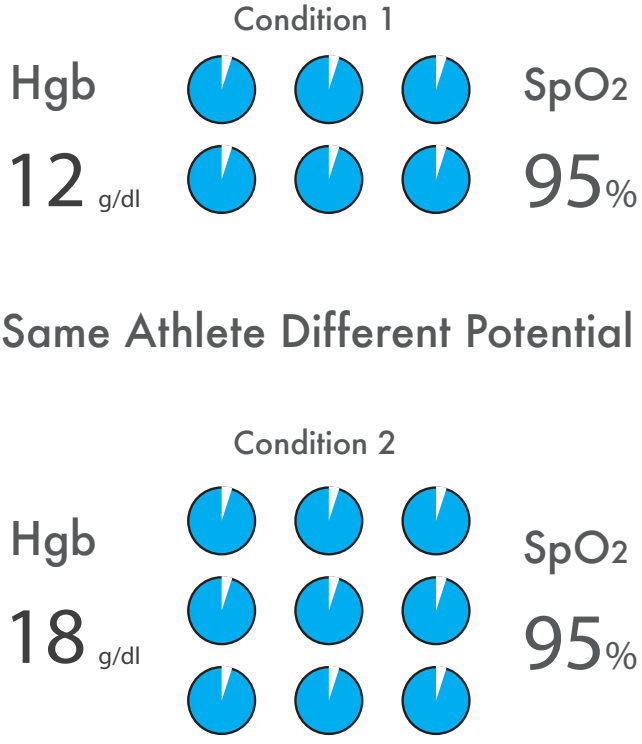
What is needed by the body to produce hemoglobin?

Hemoglobin is basically made up of proteins and iron. It is produced by the bone marrow and packaged into red blood cells that use it to transport and deliver oxygen throughout the body. In order for the body to maintain adequate hemoglobin and red blood cell production, four essential nutrients are needed: protein, iron, vitamin B_{12} and folate. Any dietary deficiency in these nutrients can impair hemoglobin and red blood cell production.

What is oxygen saturation, or SpO_2, and how is that different to measuring your hemoglobin levels?

Oxygen saturation (SpO_2), measured by a traditional pulse oximeter, refers to how saturated hemoglobin is with oxygen with 100% being the max. Using the tanker analogy from before, oxygen saturation can be thought of as how full the tankers (hemoglobin) are with the substance (oxygen) they are transporting. But it CAN'T tell you how many tankers are available. Therefore you could have a low hemoglobin level but still be close to an oxygen saturation of 100%. Just like you could have 6 tankers that are 95% full, vs 9 tankers that are 95% full both would be said to be 95% full, but one has 3 more tankers than the other so it would have the most storage and delivering capability. So in the human body, assuming the same oxygen saturation level, an athlete with a higher hemoglobin would have more oxygen in the body and more available for muscles. That is why measuring hemoglobin with Ember provides valuable insight into your oxygen carrying potential, which is not possible using only SpO_2 measured by a pulse oximeter.

Oxygen Transport Potential

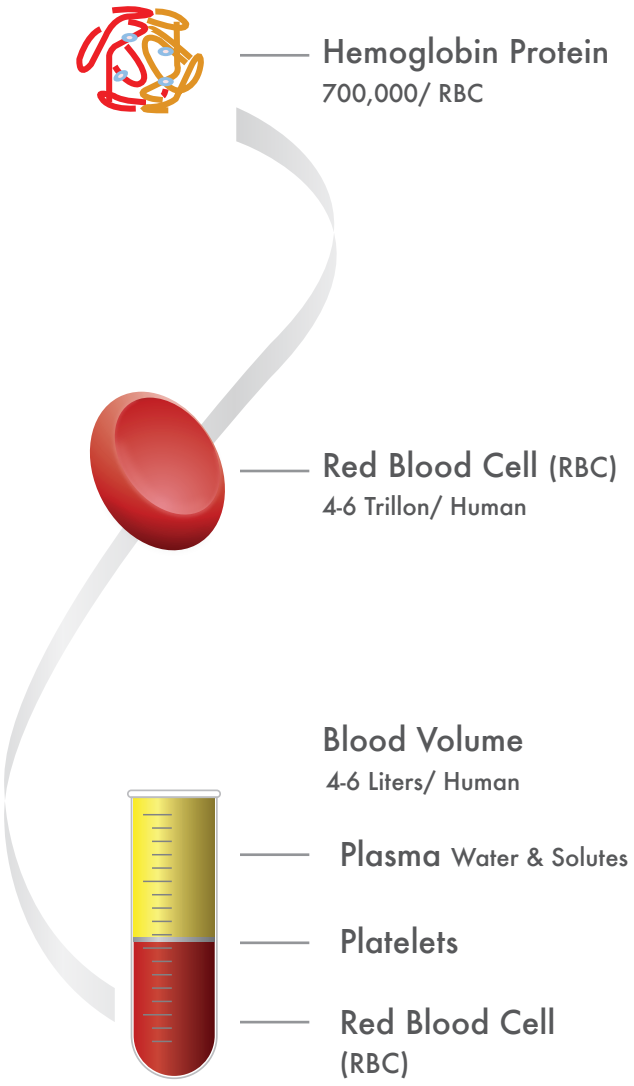


What is the difference between hemoglobin (Hgb) and Hematocrit (Hct)?

Hemoglobin is the protein found in red blood cells and is a measure expressed in grams of hemoglobin per deciliter of blood (g/dl). It is a direct measure of the oxygen carrying capacity of the blood.

Hematocrit, on the other hand, measures the percentage of blood that is composed of RBCs. Since RBCs are full of hemoglobin, and hemoglobin carries oxygen, hematocrit can give an indirect measure of the oxygen carrying capacity of the blood, though not as accurately as the direct measure of hemoglobin can.

Because both hemoglobin and hematocrit are values that are measured relative to the volume (amount) of blood, any changes in the blood volume, say from being dehydrated or overhydrated, can change their values. For example, if a person is dehydrated, the hematocrit and hemoglobin levels will read higher than when the person is in a normally hydrated state. Conversely, if a person is overhydrated, the hematocrit and hemoglobin levels will read lower than when the person is in a normally hydrated state.



Therefore it is recommended that hemoglobin, both invasive and non invasive, be measured in a consistent fashion: same time, position, posture and hydration levels.

References

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