The 3 hormones that regulate your electrolyte levels

Hormones are key to understanding the hydration process, and what to do when that process breaks down.



Every endurance athlete knows the blissful feeling of satisfaction that arrives after a long or hard workout. Equally, many of us have experienced the jittery, panicked state that results from consuming too much coffee on an empty stomach. When we have a big reward in our immediate future, we feel excitement; when we look at a difficult task, we feel dread. These

feelings, which are a universal part of human physiology, are regulated by chemical compounds known as hormones.

The simplest description of hormones is that of the "chemical messenger." Various glands, including the thyroid, pancreas and pituitary gland, produce hormones, which travel through the bloodstream and prompt changes in other parts of the body. For example, the hormone insulin regulates the amount of sugar in the blood, while dopamine and serotonin work to make us feel excited and relaxed, respectively. Cortisol wakes us up in the morning, while melatonin puts us to sleep at night.

Similarly, hormones also regulate the body's electrolytes levels, keeping an appropriate balance of sodium, calcium and potassium in the blood. Sometimes, however — due to diet, medications or chronic disease — the body can experience an over- or under-abundance of these hormones, which has detrimental effects on electrolyte balances.

In this blog post, we have provided an overview of the three major hormones that regulate electrolyte levels, as well as common causes for their misalignment.

Aldosterone

Aldosterone is a steroid responsible for managing the balance of sodium, potassium and water in the blood. Blood pressure is regulated not by the absolute amounts of these three elements, but by their *relative* amounts, meaning that when the concentration of one increases, the concentration of the others must also increase to maintain a balance.

Essentially, aldosterone works like this: When blood sodium levels become too low (or when potassium levels become too high), the body releases aldosterone to encourage the reabsorption of sodium back into the bloodstream. Aldosterone also prompts the sweat glands to **reduce the sodium content** in perspiration. This returns the balance of sodium relative to potassium and helps the body maintain a normal blood pressure.

When things go wrong:

Addison's Disease: Addison's disease results when the adrenal glands are damaged, which hampers the body's ability to produce aldosterone. This means that Addison's disease patients cannot reabsorb sufficient amounts of sodium, and they experience dangerously-low sodium levels. Thus, patients with Addison's disease often experience very strong salt cravings.

• **How it's treated:** Most patients with Addison's disease take hormone supplements to replace the missing aldosterone.

Diabetes, Type 1: Type 1 Diabetes occurs when a person's body attacks the insulin-producing cells in the pancreas, meaning a patient is unable to produce insulin. In addition to regulating blood sugar, insulin is important to the process of producing aldosterone. Therefore, when insulin levels fall (or are completely non-existent), aldosterone similarly falls and the body cannot reabsorb sodium when necessary.

• How it's treated: Type 1 Diabetes patients must receive insulin hormone through injection or other methods.

Ketogenic diet: The **ketogenic diet** involves extreme restriction of carbohydrates and protein, so that the majority of calories consumed come from fats. The end goal is to force the body to fuel itself with fat instead of glucose as a way to

promote an efficient fat-burning metabolism. However, glucose is a necessary step in producing insulin: It is the act of glucose entering the blood that triggers the body to produce insulin in the first place. By limiting carbohydrates to 25 to 50 grams per day, these individuals rarely consume significant amounts of glucose, and thus rarely trigger the body's production of insulin. As noted in the section above, without insulin, the body does not produce enough aldosterone, which can cause lightheadedness, nausea or fatigue in ketogenic diet adherents.

• How it's treated: Ketogenic dieters are encouraged to consume very high amounts of sodium, up to two to four grams (2000-4000 mg) of sodium per day, to counteract the low levels of sodium absorption.

Antidiuretic hormone

If aldosterone is the "sodium-absorption hormone," antidiuretic hormone is its arch-enemy. Coming into play when there is *too much* sodium in the blood, antidiuretic hormone encourages the body to reabsorb water, which filters out the excess sodium and returns the sodium-to-water balance to normal levels. Conversely, when a person becomes overhydrated, the body reduces its production of antidiuretic hormone, and water is filtered from the bloodstream through the kidneys and eventually excreted from the body.

When things go wrong:

A night of heavy drinking: One of the effects of alcohol is the unnecessary reduction in antidiuretic hormone, which is why a night of heavy drinking leads to frequent urination. However, given that the reduction is abnormal, this results in dehydration if the drinker does not take steps to consume water in addition to alcohol. Additionally, alcohol promotes the secretion of aldosterone, which as we noted above, increases sodium absorption. Thus, after a night of heavy drinking, a person will be left with water levels that are too low, and sodium levels that are too high when compared with potassium. This situation manifests itself through symptoms that include headaches, fatigue, nausea and dizziness ... colloquially known as the hangover.

• How it's treated: If you wake up with a hangover, there is little you can do except take steps to rehydrate and wait. Consuming some additional sodium (an electrolyte product such as SaltStick Caps) will assist your body rehydrate

more quickly. To prevent (or at least reduce) hangover symptoms entirely, while consuming alcohol, be sure to consume water at the same time. Experts recommend one glass of water for every one drink. While this will result in even more trips to the bathroom during your night out, the next morning will include far less misery.

Stress: Many scientific studies, such as **this one from 2014**, have found that physiological and/or psychological stress prompts the body to release antidiuretic hormone. Similar to alcohol consumption, this results in abnormal levels of the hormone, but this time, the levels are *too high*. The resulting absorption of water into the bloodstream causes blood volume to increase, which presses against the walls of the blood vessels. This condition is known as high-blood pressure, and its why your mother told you to "calm down, or you'll send your blood pressure through the roof."

• How it's treated: We are inundated these days with antidotes to stress, which range from meditation to the intake of ancient herbs. In the end, the only solution to stress is a healthy diet and a more relaxed lifestyle (And a bit of exercise! ... And perhaps the intake of salt.)

Parathyroid hormone

Produced by the thyroid gland, parathyroid hormone regulates calcium levels in the blood. Calcium, another key electrolyte, is responsible for skeletal health, cardiovascular activity, muscular contraction and the sweating process. Too much or too little of the mineral can have negative side effects.

Parathyroid hormone (or PTH) is to calcium what aldosterone is to sodium. When there is too little calcium in the blood, the body releases PTH, which prompts the reabsorption of calcium into the bloodstream. When calcium levels become sufficient, the body then stops releasing PTH so calcium can be filtered by the kidneys.

When things go wrong:

Certain types of cancer: Cancer of the parathyroid can cause an overabundance of parathyroid hormone, but this type of cancer is extremely rare. More commonly, certain cancers, such as breast cancer and lung cancer, release

parathyroid hormone-related protein (or PTHrP), which has similar effects to PTH. An abundance of PTHrP can cause unnaturally-high levels of calcium in the blood, leading to loss of appetite, fatigue and depression. In fact, it is these symptoms of hypercalcemia that can sometimes lead to a cancer diagnosis, as about 10 to 20 percent of cancer patients develop the condition.

• How its treated: Treatment of hypercalcemia caused by PTHrP includes a mix of hydration practices, that can sometimes include dialysis.

Conclusion

While chronic medical conditions such as Addison's disease or cancer cannot be self-treated, we *do* have the ability to manage things like stress, diet and alcohol consumption. By understanding these factors' impact on our hormones, we also gain a better understanding of how the body regulates electrolyte levels. This will, in turn, allow us to ensure we fuel the body with everything it needs for optimal performance.

Remember that *while hormones regulate electrolyte levels, there must first be a sufficient supply of electrolytes in the body*. During the course of exercise (or other stressful events such as the flu, food poisoning or long-distance travel), the body's supply of water and electrolytes becomes depleted. This supply must be replaced or the hormonal system cannot do its job, and performance breaks down.

If you want to learn more about how SaltStick helps replace electrolytes lost through sweat, please go **here**. **NOTE:** Pegasus Elite Triathlon Team and The Wheelhouse have endorsed SaltStick as the electrolyte replacement of choice due to the strident research and precise balance of electrolytes. SaltStick in 2 different sizes and SaltStick chews are available at The Wheelhouse.

Disclaimer: Contact your physician before starting any exercise program or if you are taking any medication. Individuals with high blood pressure should also consult their physician prior to taking an electrolyte supplement. Overdose of electrolytes is possible, with symptoms such as vomiting and feeling ill, and care should be taken not to overdose on any electrolyte supplement.