Electrolytes and Hydration

Key Points:

- Electrolytes are vital to physiologic function and athletic performance
- High or low levels of electrolytes are detrimental to performance and health
- A majority of foods and beverages contain an overabundance of sodium and low potassium in relation to the standard American diet

The term 'electrolyte' is a medical word for the electrically charged minerals in the body. Electrolytes are vital to health, and act as chemical messengers in the body carrying electrical impulses from the nerves to control all tissue function and movement. An imbalance of any of the electrolytes can lead to serious disruptions in physiologic function. Many bodily processes are highly dependent on them, primarily heart and nerve function, muscle coordination and control, and maintenance of the body's fluid levels.

Electrolytes are found throughout body tissues. Blood, plasma (the acellular portion of blood) and the fluid that bathes the cells are high in sodium (Na^+) and chloride (Cl^-), which is similar to common table salt, otherwise known as sodium chloride (Na^+Cl^-). In other areas of the body (cells that make up organs), the electrolytes potassium (K^+), chloride (Cl^-), calcium (Ca^+), and magnesium ($Mg2^+$) are prevalent.

Electrolyte levels are tightly controlled by several hormones and by the kidneys, which are primarily responsible for retaining and removing electrolytes when necessary and keeping them in a constant state of balance. An electrolyte imbalance can lead to serious health issues, including eventual death if not corrected. The most common imbalances occur with sodium and potassium. An excessive blood level of sodium is known as hypernatremia while an insufficient level is known as hyponatremia. Excessive blood levels of potassium are known as hyperkalemia, and insufficient levels are known as hypokalemia.

<u>Sodium</u>

Key Points:

- Sodium is found in high amounts in the typical diet
- Too much sodium leads to increased thirst
- Extra amounts of sodium are rarely necessary

Sodium is highly important for the regulation of fluid levels outside of the cells in the body. It is an essential factor in hydration as it 'holds' water in the cells. While sodium is highly important as an electrolyte, it is found at excessively high levels in many foods and drinks. The minimum physiological requirement for sodium is 500 milligrams per day. In the meantime, the average American diet contains roughly 3000 to 5000 milligrams of sodium per day, far exceeding the minimal requirement. For optimal health, it is recommended that one consume less than 2400 milligrams per day. Excessive intake of sodium is associated with hypertension (high blood pressure) and swelling in the tissues.[1] Additionally, high sodium levels are associated with osteoporosis (thinning of the bones) due to sodium's effect on increasing urinary loss of calcium.[2]

Despite the widespread prevalence of sodium in the diet, many sports drinks continue to add high amounts of sodium into their formulation. This is done primarily for flavor enhancement, rather than for the claim that people need extra amounts of sodium, which is incorrect.

Hypernatremia
Defined as excessive blood levels of sodium, hypernatremia is a common occurrence due to the high amounts of sodium found in foods and beverages. Too much sodium may lead to increased thirst, leading to the intake of more water resulting in swelling in the hands, feet and face. Hypernatremia also contributes to high blood pressure (the sodium pulls more water into the bloodstream, raising the pressure in the cardiovascular system).

Hyponatremia
Low blood sodium levels, known as hyponatremia, occurs when the blood volume is diluted with excessive water. This can occur when an athlete replaces lost fluid with plain water. Hyponatremia has become a widespread concern, as the message to drink plenty of fluids is prevalent in the athletic community. Hyponatremia can cause swelling, wheezing, nausea and vomiting, dizziness, and coma or death if untreated. Consumption of a sodium-containing beverage rather than plain water will prevent this condition.

<u>Potassium</u>
Key Points:

- Potassium is an important electrolyte that works alongside sodium in the body
- Potassium is typically found in low amounts in the standard diet
- Potassium needs to be replaced during and after exercise

Potassium is integral to maintaining the body's fluid balance with sodium. Along with sodium, it is one of the main electrolytes that are consistently lost in sweat. Potassium is the most abundant electrolyte found inside the cells of the body, and is essential for many physiologic processes including nerve impulse transmission, heart and skeletal muscle contraction, and processing of carbohydrates (energy production).[3]

The daily recommended allowance of potassium is roughly 3.5 grams per day. Potassium is found in many fresh fruits and vegetables. The potassium found in vegetables is often lost in steaming and other forms of processing The standard American diet contains roughly 2000 to 6000 milligrams of potassium per day; levels tend to be lower in people who sweat heavily, take certain prescription drugs, drink coffee and/or alcohol and consume a high-salt diet. Also, people that follow low-calorie or fad diets, off-again, on-again dieting regimens or those that consume diet pills, diuretics (blood pressure medications) or laxatives may be susceptible to low levels of potassium.

Potassium is typically found in low levels in many sports beverages, and has a taste similar to sodium. Levels of potassium that are either very high (hyperkalemia) or very low (hypokalemia) can be life threatening.

Hypokalemia

Low levels of potassium may occur for a number of reasons; those listed above are typical causes. The most common symptoms of hypokalemia are fatigue and weakness. Other signs are low blood pressure and decreased heart rate. Advanced cases of hypokalemia can result in irregular heart rhythms (dysrhythmia) and if untreated, death.

Hyperkalemia
Elevated potassium levels occur more rarely; typically this happens in people who have reduced kidney function, protein-breakdown diseases, or severe infections. Some medications may predispose a person to hyperkalemia as well.

Summary
Electrolytes are vital to physiologic function, and to athletic performance at a higher level. The body constantly maintains electrolytes, as variations in either high or low levels are detrimental to performance and health. The majority of sports beverages contain an overabundance of sodium and low potassium in relation to the standard American diet.

---

[i] O'Shaughnessy KM, Karet FE. Salt Handling and Hypertension. Annu Rev Nutr. 2006 Feb 28

[ii] Carbone LD, Barrow KD, Bush AJ, Boatright MD, Michelson JA, Pitts KA, Pintea VN, Kang AH, Watsky MA. Effects of a low sodium diet on bone metabolism. J Bone Miner Metab. 2005;23(6):506-13.

[iii] McKevoy GK, ed. AHFS Drug Information. Bethesda, MD: American Society of Health-System Pharmacists, 1998.

Research compiled by Dr. Jason Barker, N.D

Dr. Jason Barker holds a doctorate in naturopathic medicine and a bachelor's degree in exercise and sport science. In addition to maintaining a private practice, Dr. Barker serves as a consultant to those in the nutraceutical and sports medicine industry. He is a published author and has lectured internationally on nutraceutical applications in medicine.

Gleukos Key Points:

Gleukos sports performance beverage provides the optimal amount of electrolytes for the active person, with 175 milligrams of potassium and 40 milligrams of sodium.

1. Gleukos contains 175 milligrams of potassium per serving, an amount that is typically three times that found in other beverages because the diet and exercise regimens of athletes require extra potassium. A single serving of Gleukos contains 1.5 times the amount of potassium than the standard over the counter potassium-replacement tablets do, making it a convenient way to maintain potassium stores in working athletes, while also providing hydration.
2. With 40 milligrams, Gleukos contains approximately half the sodium than other "sports" drinks, providing more hydration and electrolyte enhancement rather than going overboard with excessive amounts of a nutrient that is already found widely in the diet.