

ELECTROLYTES

The popularity and notoriety of sports and energy drinks has grown with increasing zeal over the last few decades. A primary thrust of advertising is that these drinks replace and replenish electrolytes that have been lost through sweat from heavy exercise. However, although these sports drinks are used on a massive scale, many consumers are not certain of what electrolytes are or what they do. This article will attempt to discuss the function of electrolytes in terms of the human body and health, where we can obtain them, and in what form they are best found and utilized.

Webster's Dictionary defines electrolytes as "any substance which in solution or in a liquid form is capable of conducting an electric current by the movement of its dissociated positive and negative ions."¹ An ion is an atom or molecule which has lost or gained one or more electrons, giving it a positive or negative electrical charge. A solution containing free ions thus becomes an electrically conductive medium. For example, a water solution may be a poor conductor of a low voltage current, but when a small amount of table salt is added and allowed to dissolve, the solution now becomes ionic and is a better conductor of electricity. The human body functions by utilizing these ionic qualities on a massive scale.

The primary ions of electrolytes and thus the most important are sodium (salt Na^+), potassium (K^+), calcium (Ca^{2+}), magnesium (Mg^{2+}), chloride (Cl^-), hydrogen phosphate (HPO_4^{2-}), and hydrogen carbonate (HCO_3^-). These basic electrolytes are absolutely necessary for hydration, proper muscle function and balance, normal heart rhythm and contraction, healthy nerve conduction, breathing, blood pH and brain function.

Humans require a complex electrolyte balance in order to function normally. Control of the electrolyte concentrations is important and carried out by a complex network of systems in the body. For example, without sufficient levels of the key electrolytes sodium and potassium, which provide a stronger medium of electrical conductivity, not only are muscle weakness or muscle cramping possible, but nerve conduction may be severely impaired or halted altogether.

Our bodies can lose electrolytes and thus become imbalanced in several ways. This occurs primarily through sweat, but also by anything that causes a fluid loss such as: diarrhea, vomiting, fever, chronic heart or kidney diseases, chronic endocrine diseases, eating disorders, medications such as those used to get rid of excess fluid in the body (diuretics) and bone disorders.

Electrolyte balance or homeostasis (a fluctuating health regulation within the body) is normally maintained by oral intake of electrolyte-containing substances, and is regulated by hormones, primarily the kidneys which help to flush out excess fluids and electrolytes.

Typically, during normal activity, the replenishment of electrolytes is not as important as after heavy exercise. "It is unnecessary to replace losses of sodium, potassium and other electrolytes during exercise since it is unlikely that a significant depletion of the body's stores of these minerals will occur during normal training. However, in extreme exercising conditions over 5 or

¹ Webster's New World Dictionary, Second College Edition, 1986, Prentice Hall Press, p. 450

6 hours (an Ironman or Ultramarathon for example) the consumption of a complex sports drink with electrolytes is recommended."²

Electrolyte drinks contain essential elements like sodium, potassium and magnesium. However, one of the drawbacks of these drinks is the sum of their ingredients. In addition to the typical electrolytes, the more popular drinks contain refined carbohydrates, chemicals and sweeteners, such as: sucrose syrup, glucose-fructose syrup, high fructose corn syrup, maltodextrin, citric acid, natural and artificial flavors, salt, sodium citrate, monopotassium phosphate, ester gum, sucrose acetate isobutyrate, and yellow 5, an artificial coloring agent.

Sucrose syrup and glucose-fructose syrup are more commonly known as sugar and occur in large quantities. For example, one popular sports drink contains 76 grams of sugar in each bottle. Because sports drinks typically contain very high levels of sugar, they are not recommended for regular use by children. Water is considered the only essential beverage for children during exercise. Dentists recommend that regular consumers of sports drinks observe precautions against tooth decay.

High fructose corn syrup, found in many electrolyte sports drinks has been linked to insulin resistance (diabetes), elevated triglyceride levels and obesity. High fructose corn syrup, unlike glucose, is almost entirely metabolized in the liver. Liver function shunts everything in order to metabolize the fructose and cannot perform it's normal duties of bile production for fat assimilation, production of blood proteins, conversion of excess glucose into glycogen for storage and energy, as well as clearing the blood of drugs and other poisonous substances.

Eating high fructose corn syrup results not only in lower insulin levels but also lower leptin levels (protein hormone that plays a key role in regulating energy intake and energy expenditure, including appetite and metabolism). This could increase the likelihood of weight gain. Refined fructose also depletes the body of minerals quickly and thus leads to faster exhaustion.

Another ingredient, sucrose, is a combination of glucose and fructose. We've already touched on the harmful effects of high fructose corn syrup. Glucose, on the other hand, is an ingredient that is found in the body naturally and is metabolized without much of a problem while providing needed energy. And, unlike high fructose corn syrup, glucose does not shut down the liver, allowing it to perform it's normal functions of cleansing the body and maintaining it.

In addition to the above ingredients, some electrolyte drinks are also labeled as energy drinks and contain large quantities of caffeine and/or stimulants. High amounts of caffeine may cause insomnia, nervousness, headache, and tachycardia. In cases of extreme over-consumption, death is possible.

A 2008 position statement issued by the National Federation of State High School Associations made the following recommendations about energy drink consumption by young athletes, "Water and appropriate sports drinks should be used for rehydration as outlined in the NFHS

² Elizabeth Quinn, Proper Hydration for Exercise - Water or Sports Drinks What and when athletes drink depends upon exercise duration and intensity, January 23, 2008 About.com

Document *Position Statement and Recommendations for Hydration to Minimize the Risk for Dehydration and Heat Illness.*³ The use of energy drinks for rehydration is therefore discouraged in young athletes.

It's easy to see how important it is to find an exceptional, liquid supplement that contains the right balance of electrolytes without the inclusion of synthetics, processed or man-made ingredients. What does one look for when choosing a good electrolyte drink?

As discussed, unless you are an elite athlete training for a marathon or triathlon, it is not necessary to consume the types of electrolyte drinks that are advertised so heavily. However, we have seen the necessity and health benefits of having the right amount and balance of electrolytes in order to maintain homeostasis in the body. A good liquid, supplement that contains a solid amount of electrolytes would be most helpful.

It's important to look for liquid supplements that are organic, contain electrolytes and minerals that come from live foods and include Fulvic Acid. Fulvic Acid is the result of the natural breakdown of organic plant matter and is absolutely necessary for proper utilization of minerals by the body. For example, minerals such as Calcium and Magnesium cannot be fully dissolved without the inclusion of Fulvic Acid. This is vital for full cellular absorption. Fulvic Acid is so powerful that one single molecule is capable of carrying 60 or more minerals and trace elements into the cells.⁴

Ideally, a supplement that contains electrolytes should be in carbon-bond organic form, contain a good supply of potassium, calcium, magnesium and sodium as well as added protein (amino acids), and antioxidants to help muscles recover from the stress and strain of longer workouts.

Additionally, your liquid electrolyte supplement should contain little or no refined sugars, artificial flavors, colors or preservatives. When these basic guidelines are followed, your chances of receiving the necessary electrolytes your body needs for proper function, increase dramatically.

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³ Casa DJ, Armstrong LE, Hillman SK, Montain SJ, Reiff RV, Rich BSE, Roberts WO, Stone JA. National Athletic Trainers' Association Position Statement: Fluid Replacement for Athletes. *Journal of Athletic Training.* 35(2):212-224, 2000.

⁴ Dissolves metals and minerals - Ong, H.L., Swanson, V.D., & Bisque, R.E. (1970) Natural organic acids as agents of chemical weathering (130-170). U.S. Geological Survey Professional Paper 700 c. Washington, DC: U.S. Geological Survey.