



## ELECTROLYTE REPLACEMENT THEORY

By: Steve Born

The final ingredient for proper fueling during exercise has to resolve electrolyte issues. Electrolyte replacement during exercise is a necessary procedure that is also highly individual. This is because everyone's body is different, their sport is different, training duration and intensities are different, and weather conditions are different.

### WHAT ARE ELECTROLYTES AND WHY DO I NEED THEM?

Electrolytes are chemical substances used in the formations of electrically charged particles (ions) in body fluids. Electrolytes are used to create electrical energy necessary for many body functions including transmission of nerves impulses and muscle contractions. In simple terms, many normal bodily functions are dependent on these substances. As important as the fuel you consume and the water you drink during exercise is a consistent replenishment of electrolytes. Normal body functions, not to mention performance, are severely compromised if adequate levels of electrolytes are not present, especially in the heat and/or when exercise goes beyond the two-hour mark.

### WHY CAN'T I JUST USE SALT TABLETS?

Many athletes have suffered needlessly with swollen hands and feet from water retention due to ingestion of salt tablets or electrolyte products too high in sodium during prolonged exercise in the heat. Too much sodium is counterproductive as it interferes with or neutralizes the complex body mechanics involved in re-circulating and monitoring proper blood sodium levels. Sweat losses generate large losses in sodium and chloride, which are re-circulated by a positive feedback loop monitored closely through hormonal receptors throughout the body. In other words, the body has very effective mechanisms to regulate and re-circulate sodium and potassium. Rapid replacement of sodium neutralizes the body's hormonal defenses, allowing water replenishing to dilute sodium content. High sodium electrolyte supplement is temporal and contradictory to natural physiological serum electrolyte control. One reason salt tablets were eliminated from professional athletic training kits is that shortly after a sodium-depleted athlete would slug a few salt tablets; stomach cramps would bend them over double.

Salt stains on jerseys and shorts are NOT an indication that the athlete is sodium depleted. Rather it is the body excreting excess amounts due to an over abundance in the body (which is why dumping more sodium in the system is extremely counterproductive). What is required is a low-sodium approach to electrolyte replacement that emphasizes a balance of essential minerals that cooperatively enhance the body's natural hormone and enzyme mechanics. In essence, we want to work with our body, not against it.

The truth is that the human body needs very minute amounts of sodium to function normally. We need only 250 mg of sodium each day, athletes maybe 500 mg, which is easily supplied by natural, unprocessed foods. However, the average American consumes approximately 6000 to 7000 mg per day. The average athlete stores at least 8,000 mg of dietary sodium in tissues and has these stores available during exercise. Most athletes perform successfully using from 80-300 mg. sodium per hour in prolonged endurance events. Sodium is necessary but not by itself and not in mega-dose quantities.

### WHAT MAKES ENDUROLYTES DIFFERENT? AREN'T ALL PRODUCTS SIMILAR?



## Coach-Athlete Q&A

A look at some coach-replies to common questions by topic.

It would have been easy to formulate a product that matched one of the many perspiration analysis studies, then explain to athletes that they were simply replacing what they lost. Some products may do just that. Unfortunately, there's a problem with this because individual sweat-loss differences vary greatly and the human body does not and cannot efficiently replace what it spends during exercise activity at any intensity above walking pace. Electrolytes lost are not replaced by electrolytes consumed.

The body replaces only between 35-45% of what it loses during exercise. If we try to replace all the fluids at once, we end up with dilutional hyponatremia (overly diluted blood sodium levels) or water-intoxication. If we attempt to replace all the fuels that we spend, the stomach will back up in total rebellion, and refueling will come to a grinding halt. And, if we try to replace all the electrolytes we lose in equal amounts, a number of hormonal triggers may create all sorts of problems such as gastric stress, edema, or muscle spasm and cramping. If you want to see your effort come to a complete halt, forget to take in electrolytes or take in too many electrolytes from an unbalanced formula and watch it happen! Dr. Bill Misner, Ph.D. says, regarding proper electrolyte replacement, "Give it 35-45% even though it cries aloud for 110%."

### **SO WHAT IS THE ANSWER? HOW CAN I EFFECTIVELY REPLENISH ELECTROLYTES?**

The solution for proper electrolyte replacement during endurance exercise is to do it gradually and in a way that does not override normal body mechanics. Electrolyte intake needs to be below systemic detection, yet provide support to systemic depression. This simply means that you have to take in enough to support body functions while also preventing heat related issues such as cramping. But it also meant that electrolyte intake can't be too much as to overwhelm the body and what it can handle. Put another way, when consuming electrolytes, it has to be done in a way that falls under the "radar detection system" of the body while still providing optimal support.

The ENDUROLYTE formula was designed to counter the effects of hyperthermia and enhance endurance performance, especially beyond the 3-hour mark. The levels of each nutrient contained ENDUROLYTES are enough to aid the body in electrolyte loss while going undetected by the hormones which regulate normal body mechanisms. There are certain parameters we believe an electrolyte product needs to be within. And because the body has a meticulous way of mediating sodium and/or fluid retention and excretion, going above or below those parameters will result in performance-inhibiting effects.

ENDUROLYTES is not formulated to reflect the amounts of electrolyte loss in sweat. Why? Because each human being is different and has a different electrolyte pattern. The differences in an athlete's size and fitness, as well as the rate of pace and during exercise, and of course the humidity and heat effect can mean up to a 100% difference when one athlete's sweat rate is compared to another's. In the purest sense, ENDUROLYTES is not so much an electrolyte replacement product but is better described as an "ELECTROLYTE STRESS SUPPORT FORMULA." They help the body perform better under the demands of exercise, especially in heat, without overriding normal body mechanics. They work with the body, not against it.

### **WHAT ARE CHELATED MINERALS AND WHY DOES ENDUROLYTES CONTAIN THEM?**

Chelation is the pharmaceutical process of bonding each mineral to an amino acid. This bonding makes it easier to digest and assimilate each mineral for proper utilization in the body. Chelated minerals are the form most often recommended because they provide greater absorption than their non-chelated counterparts. For example, magnesium is absorbed 87 percent when chelated, but only absorbed 16 percent when taken in an inorganic, non-chelated form.



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One nutrition scientist wrote, "Estimates of normal mineral absorption average 10%; however absorption of chelated minerals may be as high as 60%..."

### WHAT DO ENDUROLYTES CONTAIN? WHY DO THEY CONTAIN THESE NUTRIENTS? WHAT IS THE RATIONALE FOR THE DOSE USED IN THE FORMULA?

**CALCIUM** is the most abundant mineral in the human body (about 2.85 pounds in the average person). When blood volumes run low, the body extracts it from the bones, but this may take more time than competition allows. A constant blood calcium level is required for a normal rhythmic heartbeat, healthy nerve transmission, and strong muscle contractions. A deficiency in blood calcium levels during endurance events may produce high blood pressure, muscle cramps and weakness. During exercise, energy is produced by the conversion of fatty acids and amino acids with enzymes, which are calcium-dependant. Because fatty acids are such an important fuel during endurance exercise, providing 60-65% of your energy needs when exercise goes beyond two hours in length, having adequate calcium available to efficiently convert them into energy is crucial. 150-300 mg/hr is an adequate dose of calcium to maintain the aforementioned proper body functions.

**MAGNESIUM** accompanies calcium in an ideal ratio of 1:2. When calcium flows into working muscle cells, the muscle contracts, then, when calcium leaves and magnesium replaces it, the muscle relaxes. Deficiency of magnesium contributes to muscle cramps, tremors, sleep disturbances, and in some cases, convulsive disorders. Many enzymatic reactions necessary for fuel conversion to muscular energy occur in the presence of adequate magnesium. Simply put, if the body doesn't have a sufficient supply of magnesium, energy production is compromised. 75-150 mg/hr adequately replenishes magnesium even though 100 mg is lost in sweat alone each hour (with much more used up by the muscles).

**POTASSIUM** is the chief cation (positively charged ion) within all muscle cells, necessary for maintaining the lowest optimal concentration and balance of sodium. Potassium deficiency symptoms are nausea, vomiting, muscle weakness, muscle spasms, cramping, and rapid heart rate. 75-150 mg/hr is an adequate replenishment amount. Even though 100-200 mg are lost in sweat alone (not counting internal muscle and cell use), if we try to replace it all at once, optimal sodium balance is altered. In addition, too much potassium is hard on the stomach and can cause severe stomach distress.

**SODIUM** is the chief cation (positively charged ion) outside the cell. American dietary practices cause the average person to carry 8000 mg. excess sodium in the extra-cellular tissues. During endurance events, 3-4 hours are necessary to deplete the "excess" of this mineral. Deficiency may begin to occur after 4 hours, which may produce symptoms of abnormal heartbeat, muscle twitching, and hypoventilation. However, if sodium is replaced at the same rate as depletion it overrides all the mechanisms involving Aldosterone, a hormone, which causes the body to conserve electrolytes. If you want to throw a wrench into your body's very intricate way of regulating electrolyte balance, if you want to see your hands, feet, wrists, ankles and other body parts retain water and swell up, indiscriminately dumping copious amounts of sodium in your system can make this a real possibility. We highly recommend a more gentle approach and advocate the use of 120-240 mg/hr of sodium against rate of loss ranging from 1800-3500 mg. per hour.

**CHLORIDE** is the relative anion (negatively charged ion) which must accompany sodium in the extra-cellular tissues. This mineral is absolutely necessary in maintaining the osmotic tension in both blood and extra-cellular fluids. It's a somewhat complicated process but to put it in the simplest terms, think of osmotic tension as being the proper balance and



consistency of body fluids and electrolytes. We believe 180-360 mg/hr as part of the sodium chloride (a.k.a.: sodium) mixture is an adequate replacement amount without overriding the functions of aldosterone in regulating and conserving proper sodium and electrolyte levels.

**MANGANESE** is included in ENDUROLTYES as it necessary in trace amounts for optimal muscle cell enzyme reactions for conversion of fatty acids and protein into energy. Again, fatty acids and protein are an important, even crucial part of the endurance athlete's fuel supply, so while manganese is not technically an electrolyte, its importance cannot be overstated. Research also shows that manganese deficiency plays a vital role in blood sugar regulation, free radical build up from intense exercise, and nerve function disorders, especially in older athletes. 5-10 mg./hr will help resolve these issues and is another reason why it is included in ENDUROLTYES.

**PYDROXINE HCL** (vitamin B-6) is a coenzyme that performs in 60 enzymatic reactions involving metabolism of carbohydrates, fats, and protein. We include this water-soluble B vitamin in ENDUROLTYES because of its active role in maintaining sodium-potassium balance.

**L-TYROSINE** is an amino acid, which has been added because when blood plasma deficiencies occur during extreme endurance events, low thyroid and low adrenal production result. The lack of performance of adrenal and thyroid glands due to endurance-exercise-induced L-tyrosine depletion hinders the proper rate of metabolism. A deficiency in blood serum L-tyrosine amino acid first appears as depression, later anger, then despondency which degenerates into total despair. If any of these has ever happened to you during a long training bout or race, it may be due to low thyroid and adrenal production and can be easily avoided by the intake of supplemental L-tyrosine at 50-100 mg/hr.

Testing ENDUROLTYES during training will help you, the endurance athlete, find the proper dose for your personal biochemistry and enable you to achieve the optimum level of performance during the longest of events, no matter what the temperature may be.

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