

White paper on the need for broad spectrum trace minerals in aerospace environments.

A car battery runs because of electrolytes. The health of your body depends on electrolytes too. Each cell has electrical properties and electric potential much like that of a battery. The electron and electrical force facilitates life. This electrical force is transmitted through the nervous system through chemical neurotransmitters which are made from and stimulated by electrolytes and macro (trace) minerals

When humans think of electrolytes, they immediately visualize rehydrating the body after a sweaty workout with a solution that is predominately sodium and potassium. The sports drink market is huge. But, when we think of rehydration, do we want to drink Gatorade or Vitamin Water to keep our electrical system running? Most commercial answers for dehydration focus on the primary minerals sodium and potassium. What is overlooked is the supplemental need for a *multi*-electrolyte solution that provides a total complement of electrolyte-forming trace-minerals that are essential for our brain to run at full capacity and our cells to provide the life force for our sustenance.

Technically, electrolytes that generate a negative charge are called anions and those producing a positive charge are known as cations. This electrical charge makes cell function normally. Electrolytes operate in the extracellular fluid compartments (ECF) and inside the cell intracellular fluid compartments (ICF). Each individual electrolyte differs in concentration of charge, but the electrolyte totals balance to achieve a neutral electrical charge – electroneutrality. When one electrolyte moves out of the cells another moves in to replace it. Electrolytes have different concentrations in both ECF and ICF compartments and have different responsibilities to maintain impulse transportation and cell membrane excitability.¹ If the electrolytes are deficient this balance will be upset and cellular communication will suffer. The balance of electrolytes is constantly shifting due to fluctuating fluid levels in the body.

Electrolytes are important because they are what the cells (especially nerve, heart, muscle) use to maintain voltages across their cell membranes and to carry electrical impulses (nerve impulses, muscle contractions) across themselves and to other cells. The kidneys work to keep the electrolyte concentrations in the blood constant despite changes in the body. If lost, these electrolytes must be replaced to keep the electrolyte concentrations of your body fluids constant. Each cell is a biological battery! The force between the inside and outside cell wall is a liquid pressure that's sustained by electrolytes—without the right electrolytes in correct ratios, cells can't maintain this inner-outer pressure, they weaken and become vulnerable to parasites.

Replenishing the electrolyte solutions inside and outside your cells creates the balance necessary for water to move through the cells. Water moving through the cells not only delivers nutrients and removes wastes... moving water creates energy. We overlook what kind of water we drink assuming that water contains everything the body needs to replenish lost elements. Unfortunately, most tap water is filtered before it gets to the tap removing many of the good minerals along with the undesirable substances and usually contains chlorine. So, you choose instead drink bottled water or what comes from that expensive filter you installed. Funny thing about this is that the life-giving trace minerals have most likely also been removed from the very filtering process that cleans up the water.

Each cell in the body has electrical properties and electric potential much like that of a battery. The electron and electrical force facilitates life. The movement of electrons and electrically charged particles are essential for even the most basic cellular processes. All physiological processes in the body are mediated by electrical force. DNA replication, movement of essential vitamins and minerals in and out of cells, muscle contraction, and nervous system signals all require electric force to make them happen. A study on dogs showed the effect of pH on the electrophysiology of the animal. The effects of changes in extracellular pH and intracellular pH on voltage-dependent K_v currents in smooth muscle cells isolated from canine pulmonary artery were studied. This study revealed that extracellular acidification

¹ <http://www.gopetsamerica.com/medical-terms/electrolytes.aspx>

(pH 6.4-7.0) reduced Kv currents, produced a positive voltage shift in steady-state activation and reduced maximum Kv conductance (gK). Extracellular alkalization (pH8.0-8.4) increased Kv currents, produced a small negative voltage shift in steady-state activation, and increased gK.²

Cellular voltage differs with the pH of water. Alkaline water donates electrons which facilitate the transfer of energy. Acidic conditions actually steal electrons. Without electrons circulating around the nucleus we lose our “spark.” You don’t just make cellular electricity out of thin air. We insulate ourselves from the earth by wearing shoes removing the ability to absorb electrons from the ground.. Raw foods also provide electrons, but the biggest source is from water. Fresh unfiltered water from a stream or deep well is an electron attractor. Chlorine and fluoride added to tap water is actually an electron stealer. Drinking water is essential to attracting electrons. Bottled (most need to be filtered by law) water is and electron stealer. Reverse osmosis and distilled water are electron stealers (low pH). The reason being is the filtering process removes the trace-minerals, thereby diluting the existing minerals in the body and causing deficiencies and reducing voltage. This compromises the body’s ability to utilize vitamins, digest food and “spark” the brain.

Minerals act as on off switches in the body. Each one has a cause and effect on physiology. Minerals also are the basis for creating neurochemicals that control the brain’s synaptic process and emotions. Deficiencies can cause interruptions in cognitive processing resulting in inadequate thought process and a breakdown of judgment. Minerals once were plentiful in food. Unfortunately modern farming methods create mineral-deficient soil and therefore, mineral-deficient food. Any beneficial minerals that do survive repeated tilling and fertilizing (without remineralization) are too large to form electrolytes. The body utilizes the essence of this mineral but they are unable to get through the blood-brain barrier to support neural function. It is essential that the smallest form of mineral is ingested as well – ionic or crystalloid (further broken down ionic that can pass through a semi-permeable membrane).

Electrolyte-forming minerals are those that carry chemical messages in the brain and nervous system through neurotransmitters. These are made from and stimulated by electrolytes and macro (trace) minerals, amino acids, choline and other nutritional factors. With a short supply of these electron donating trace-minerals, messages from the brain to the body will be scrambled resulting in sickness and the body’s inability to fight disease. In addition, pilots who are in short supply of these neural supporters will become statistics in the pilot error accident/incident category. The FAA does extensive studies on why aerospace personnel make errors and cite fatigue, diet and sleep interruption as major causes. They fall short on investigating the lack of neural support at the time of the mistake. This paper was written to bring this shortfall in scope to the forefront.

-Nina Anderson, ATP, ISSA Specialist in Performance Nutrition, FAASTeam Representative
www.fabulousflying.com

²Ahn DS, Hume JR. “pH regulation of voltage-dependent K⁺ channels in canine pulmonary arterial smooth muscle cells.” Pflugers Arch. 1997 Apr;433(6):758-65. Department of Physiology and Cell Biology/351, University of Nevada School of Medicine, Reno 89557-0046, USA.