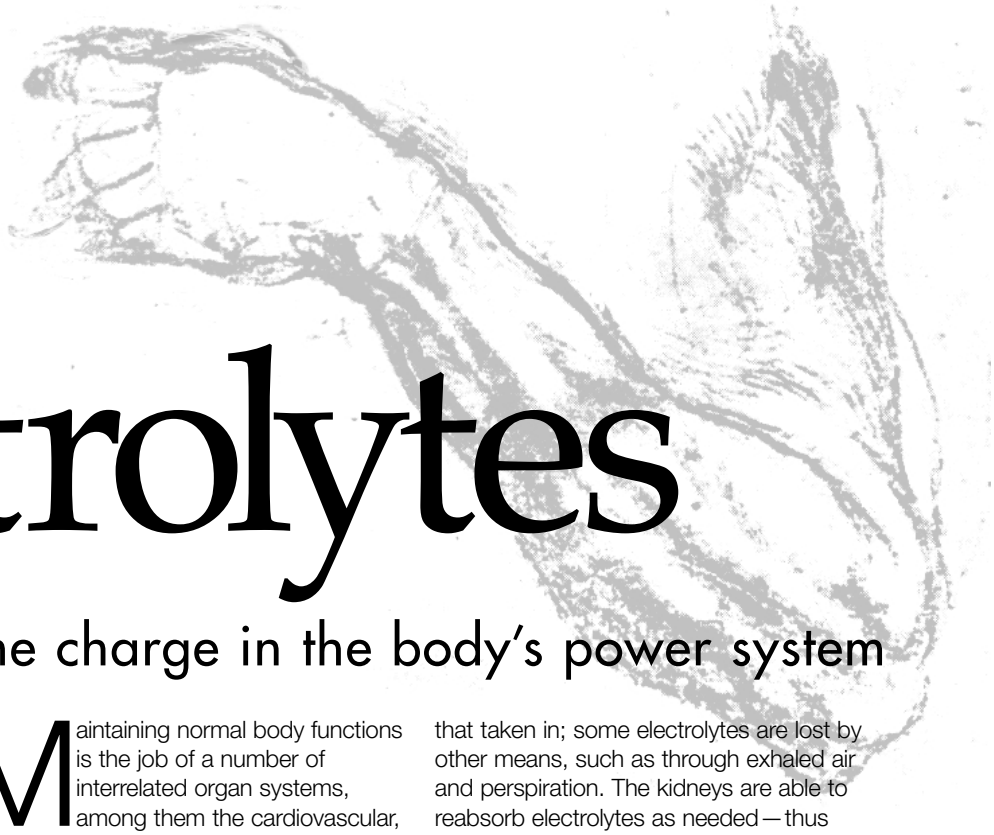

electrolytes

the charge in the body's power system

By Annabel Hecht

Maintaining normal body functions is the job of a number of interrelated organ systems, among them the cardiovascular, the respiratory, the nervous, and the digestive systems. All of these systems largely function without our conscious input.

Essential to their functioning is another system of sorts, which might be thought of as the body's electrical system. This system is found in the fluids that bathe all the body's cells and in the fluid of the cells themselves. It consists of chemical compounds called electrolytes that, when dissolved in the fluids, separate into electrically charged particles called ions. It is the electrical charge held by these ions that enables them to play their indispensable roles in transmitting nerve impulses, contracting muscles, keeping a proper level of fluids in the body, and controlling the acid-alkaline balance in these fluids.

Some of the electrolytes have a positive charge; they are called cations (pronounced kat' ī uns). Others are negatively charged and are called anions (an' ī uns). The major cations are potassium, magnesium, sodium, and calcium. Chloride is a major anion.

Electrolytes are distributed unevenly between the intracellular fluid (within the cells) and the extracellular fluid (outside the cells, including the blood). Potassium and magnesium, for example, are found mainly within cells; sodium and chloride predominate in the fluid outside the cells.

Electrolytes come from the food we eat. They are absorbed by the intestines, and after they have served their purpose they are excreted by the kidneys. The amount that leaves the body daily is about equal to that taken in; some electrolytes are lost by other means, such as through exhaled air and perspiration. The kidneys are able to reabsorb electrolytes as needed—thus they play an important role in keeping just the right level of electrolytes for the body's needs. But this delicate balance can be upset in a number of ways, interfering with the essential work of the electrolytes.

For example, when a person is stricken by any number of diseases or becomes dehydrated through diarrhea, excessive perspiration, or vomiting, it is often noted that among the complications is electrolyte imbalance. Even though this term is frequently used, it takes a bit of explaining—what electrolytes are, what they do, and how they get out of kilter—to understand the importance of the body's "electrical system."

Potassium

As the principal cation in the intracellular fluid, potassium has many important functions, including activating enzymes, processing and storing carbohydrates, and helping to transmit nerve impulses to the heart and skeletal muscles. Deficits of potassium thus can have major consequences.

A most important cause of potassium loss is the use of potent diuretics such as the thiazides. These drugs, used widely to treat hypertension and heart disease, rid the body of excess water and sodium. Unfortunately, this causes increased excretion of potassium as well.

Potassium can also be lost through excessive perspiration, repeated enemas, trauma (such as severe burns), uncontrolled diabetes, and diseases of the intestinal tract, as well as operations to correct them. Even a form of kidney disease caused by the use of outdated

tetracycline or eating too much licorice can result in loss of this important substance.

People who suffer from poor nutrition, those using very low-calorie diet products, and victims of anorexia nervosa or acute alcoholism also may have low potassium levels because they are not taking in enough of the mineral.

Symptoms of potassium loss include a weak pulse, faint heart sounds, falling blood pressure, and generalized weakness. Severe loss of potassium can lead to death.

Too much potassium is not a good thing, either. An excess may cause diarrhea, irritability, muscle cramps and pain. High levels of potassium can be brought on by kidney failure or consuming excessive amounts of food.

Sodium

The principal cation in the extracellular fluid is sodium, which is a major factor in maintaining proper fluid balance in the body. Too little sodium is often associated with dehydration; too much can lead to edema (swelling).

A low sodium level in the body may result from excessive sweating, the use of certain diuretics, or diarrhea. Fatigue, muscle weakness, apprehension, and convulsions are among the symptoms of excessive sodium loss.

Sodium concentrations can increase when a person doesn't drink enough water, especially in hot weather, or if kidney function is impaired. Dry, sticky mucous membranes, flushed skin, elevated body temperature, lack of tears, and thirst are among the symptoms of sodium excess. Too much sodium in the diet is also linked to the development of high blood pressure in susceptible individuals.

Restoring Balance

Bringing electrolytes back into balance involves replacing what has been lost, eliminating those substances that are creating an excess, or correcting the underlying problem causing the imbalance, such as kidney disease.

In mild cases of electrolyte loss, such as that experienced by an athlete after a hot, sweaty game, all that is needed is plenty of water to replace fluids. Any sodium that is lost can usually be replaced by adding salt to food before and after exercise. In general, salt tablets should not be used to replace minor sodium loss. There are a number of sports drinks on the market that provide extra electrolytes. However, these preparations can cause intestinal cramps because the fluid tends to be retained in the stomach and intestines.

Other electrolytes that are lost during exercise—potassium and magnesium—also can be replaced through dietary sources. Bananas are often mentioned as a good source of potassium, but they are not the only one. Apricots, dates, figs, oranges, avocados, prunes and raisins also rank high among potassium-rich foods. Many salt substitutes contain potassium chloride, a source of two electrolytes. Green leafy vegetables and whole grains are good sources of magnesium and potassium.

For those taking diuretics, a diet high in potassium, or potassium in tablet or capsule form, or a diuretic that does not cause the excretion of potassium (called "potassium-sparing") may be prescribed.

Under an FDA regulation, tablets or capsules with less than 100 milligrams in a milliliter (about a quarter teaspoon) are considered dietary supplements. However, preparations with higher levels of potassium are considered drugs and must carry a warning label stating that the product can cause small bowel lesions.

Milk and other dairy products and canned sardines or salmon with bones are good dietary sources of calcium. Calcium is also available as a dietary supplement. High levels of calcium in the body may be relieved by decreasing intakes of this mineral or of Vitamin D.

When sodium intake is too high, the solution is to cut back on the amount that's eaten. Many processed foods are labeled as to salt (or sodium content). In addition, some products are available in low-sodium varieties and are so identified on the labels.

For severe cases of electrolyte loss, there are a number of replacement fluids containing various amounts of different electrolytes. Since they are given intravenously, such fluids are administered in a hospital. Electrolyte replacement solutions are regulated by FDA as drugs and must be manufactured according to good manufacturing regulations.

Most people will never have to face electrolyte replacement. Eating a well-balanced diet and drinking plenty of water in hot weather or when undertaking strenuous exercise should provide most people with all the fluid and electrolytes they need.

Occasionally, however, even healthy people think they need extra vitamins or minerals. Because each person's dietary needs are different, it is always a good idea to check with a doctor before taking any kind of dietary supplement.

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FDA Consumer / July-August 1986

Disease states or conditions for which electrolyte testing is appropriate:

Dehydration	High blood pressure	Kidney disease	Intestinal disease	Cystic fibrosis
Excessive perspiration	Viral infections	Pulmonary disease	Cardiac arrest	Sports medicine
Patients of poor nutrition	Overuse of antacids	Diabetes	Pancreatitis	Drowning
Vomiting	Overuse of laxatives	Arterial sclerosis	Alcoholism	Lupus erythematosus
Diarrhea	Repeated enemas	Muscular dysfunction	Anorexia	Liver dysfunctions
Geriatric maintenance	Monitoring diuretic therapy	Severe burns	Bulimia	Hypercalcemia