



Electrolyte Capsules & Dispensers

Review: The Importance of Potassium Supplementation in Endurance Training and Racing

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Introduction:

Potassium is the primary electrolyte located inside the body's cells (intracellular) and stored in muscle fibers along with glycogen. It plays a critical role by helping transport glucose into the muscle cell. Potassium also interacts with both sodium and chloride to control fluid and electrolyte balance and assists in the conduction of nerve impulses. When glycogen breaks down to supply energy for your workouts, muscle cells are depleted of potassium. As a result, there is a greater concentration of potassium in your blood and greater quantities are lost in sweat and urine. Potassium deficiency symptoms are nausea, slower reflexes, vomiting, muscle weakness, muscle spasms, cramping, and rapid heart rate.

Human Electrolyte Content

	Extracellular (mmol/L)	Sweat (mmol/L)	Intracellular (mmol/L)
Sodium	137-144	20-80	10
Potassium	3.5-4.9	4.0-8.0	148
Calcium	4.4-5.2	3.0-4.0	0-2.0
Magnesium	1.5-2.1	1.0-4.0	30-40
Chloride	100-108	30-70	2

From Maughan and Shirreffs, 1998. Fluid and electrolyte loss and replacement in exercise. In Oxford textbook of sports medicine, 2nd Edition. Edited by Harris, Williams, Stanish, and Micheli. New York: Oxford University Press, pp. 97-113

Potassium Biology and Measurement:

Potassium is the principal intracellular cation, with a concentration of about 145 mEq/L, as compared with a normal value of 3.5 - 5.0 mEq/L in extracellular fluid, including blood. More than 98% of the body's potassium is intracellular; measuring it from a blood sample is relatively insensitive, with small fluctuations in the blood corresponding to very large changes in the total bodily reservoir of potassium.

The electrochemical gradient of potassium between intracellular and extracellular space is essential for nerve function; in particular, potassium is needed to repolarize the cell membrane to a resting state after an action potential has passed. This means that the presence of potassium is critical to "reset" the nerve for the next activity. Decreased potassium levels in the extracellular space will



Electrolyte Capsules & Dispensers

cause hyper-polarization of the resting membrane potential. As a result, a greater than normal stimulus is required for depolarization of the membrane in order to initiate an action potential. Simply, this means that lack of potassium will slow down or halt nerve and muscle action.

Potassium Loss:

Potassium, as with other electrolytes including sodium, calcium and magnesium, is lost primarily in urine and sweat. Based on an average loss of 4-8 mmol/L sweat, this converts to a loss of 100-200 mg potassium per hour for an average adult during activity. Observations in humans (Knochel, 1978; Knochel, 1982) have shown that potassium deficiency induced by a variety of mechanisms can be responsible for muscle injury. Findings that potentially serious potassium deficiency occurs during training in a hot climate infers that the associated muscle injury could be partially explained by potassium deficiency. Simply, this means that activity increases loss of potassium, and this loss has the potential to cause injury to muscle tissue. Potassium deficiency symptoms are nausea, slower reflexes, vomiting, muscle weakness, muscle spasms, cramping, and rapid heart rate.

Supplementation:

External supplementation of potassium is a viable means to replenish lost potassium. A quantity of 75-150 mg/hr is an adequate replenishment amount for an average adult. Even though 100-200 mg are lost in sweat alone (not counting internal muscle and cell use), if replaced all at once, optimal sodium balance is altered. In addition, too much potassium is hard on the stomach and can cause severe stomach distress. Note that potassium should be replaced along with sodium, calcium and magnesium, all importantly lost in sweat. SaltStick Caps contribute 63 mg of usable potassium per capsule, with a suggested dose of 1 capsule per 30-60 minutes.

Too Much Potassium?

Replenishing lost potassium during and after exercise is important, but athletes should be aware that hyperkalemia (high serum potassium levels) can cause electrical impulse disturbance, irregular heartbeat, and possibly death. Individuals should never take potassium supplements in large doses (beyond normal supplementation) without the advice of a physician.

It is worth noting that hyperkalemia can also result when a large amount of potassium is suddenly released from the cells as a result from crush injuries (involving the destruction of large amounts of muscle tissue) or severe burns. The rapid movement of potassium from the cells into the bloodstream can overwhelm the kidneys and result in hyperkalemia. This type of release is not characteristic of endurance events.

As athletes are not "typical" in their nutrient needs, the national dietary guidelines established for average adults often do not apply to athletes, workers, soldiers, and other physically active individuals.



Electrolyte Capsules & Dispensers

Practical Tips for Athletes:

- During training, record your body weight before and after practice or training sessions. Weight loss indicates the need to drink more during future practices. Weight gain is a sign that you drank too much.
- Weigh yourself each morning after urinating. If your body weight is ~ 0.5 kg or more lower than the previous morning, you may be dehydrated and need to increase fluid intake during the day.
- Another way to check your hydration status is to monitor the color of your urine the first time you urinate in the morning. If the color is more like apple juice than lemonade, drink more during the day.
- Drink 500 mL of water, fruit juice, or sports drink 2 hours before practice or training sessions. During practice, drink at regular intervals. If you lose weight during practice, drink 600 -750 ml for 0.5 kg of weight loss if rapid rehydration is needed.
- Take advantage of opportunities to drink throughout the day, especially with meals and snacks.
- Salt your food to taste. Replacing sodium and other electrolytes is essential for rapid and complete rehydration.
- Anytime you are sweating, rather than drinking water only, consume a sports drink with adequate electrolyte content or drink water along with solid electrolyte capsules to improve hydration and provide energy.

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Electrolyte Capsules & Dispensers

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Electrolyte Capsules & Dispensers

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