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AVOIDING MUSCLE CRAMPING AND HEAT ILLNESS

During exercise, the body preferentially directs intravascular (internal) fluids to the:

- Brain for nutrition and oxygen delivery
- Heart and lungs for blood circulation and gas exchange
- Peripheral (outer) sweat glands and blood vessels for temperature regulation
- Working muscles for nutrition and oxygen delivery

More than a 2% level of hypohydration (or dehydration) can cause a decrease in sweat rate and sweating onset. Severe hypohydration (greater than 5%) threatens the ability to maintain normal body temperature, exercise intensity, and vital organ function.



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Hypohydration reduces heat tolerance and the time to exhaustion during exercise. It is also a contributing factor in the onset of heat exhaustion and exertional heat stroke due to impairments in the body's ability to regulate internal temperature as well as cardiovascular compromise. Hypohydration contributes to many conditions (heat illness and cardiac dysfunction) that can reduce exercise performance and safety.

In addition, hypohydration (not drinking enough fluid to match fluid losses) is thought to contribute to the onset of exercise-associated muscle cramps. Proposed causes also include electrolyte imbalances, neuromuscular fatigue, or any combination of these factors.

As a general rule, athletes participating in physical activity lasting less than one hour likely require no substances other than water, provided they have fueled and hydrated appropriately leading up to the workout or competition.

Athletes participating in exercise sessions lasting longer than one hour, or including intense intervals, may benefit from adding carbohydrates or electrolytes (or both) to rehydration fluids, especially in extreme environments. Endurance athletes may benefit by adding fluids containing carbohydrates and electrolytes during extended training bouts and competitions.



Electrolytes

Electrolytes are an essential part of hydration for athletes, specifically sodium and potassium. The average person loses three times the amount of sodium in sweat compared to potassium, and salty sweaters can lose even more. Here are some ways to ensure electrolyte consumption supports the exercise:

Add electrolyte rich foods to meals and snacks:

- **Sodium-rich foods:**
 - » Add salt to eggs and veggies
 - » Snack on salty foods like salted nuts, whole grain crackers, pretzels, etc.
 - » Consume salty foods at meals like tomato sauces, soups, pickles, etc.
 - » Drink sports drinks containing sodium during workouts and competitions over an hour long and/or in hot and humid environments
- **Potassium-rich foods:**
 - » Fruits and vegetables like bananas, strawberries, potatoes, sweet potatoes, avocado, etc.
 - » Beans
 - » Dairy foods like milk and yogurt

The general electrolyte recommendation is to consume 1 gm sodium/1 L fluid or 1000 mg sodium/32 oz fluid

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Heat Stroke

Exertional heat stroke is an elevated core temperature, usually above 104° F. Exertional heat stroke occurs when the temperature regulation system is overwhelmed due to excessive internal heat production or inhibited heat loss in challenging environmental conditions and can progress to complete thermoregulatory system failure. This condition is life threatening.

Signs and symptoms of heat stroke include:

- Tachycardia (abnormally fast heart rate)
- Hypotension (low blood pressure)
- Sweating (although skin may be wet or dry at the time of collapse)
- Hyperventilation (rapid breathing)
- Altered mental status
- Vomiting
- Diarrhea
- Seizures
- Coma

Heat Exhaustion

Exercise (heat) exhaustion is the inability to continue exercise associated with any combination of heavy sweating, dehydration, sodium loss, and energy depletion. It occurs most frequently in hot, humid conditions.

Other signs and symptoms include:

- Unhealthy pale skin color (pallor)
- Persistent muscular cramps
- Urge to defecate
- Weakness
- Fainting
- Dizziness
- Headache
- Hyperventilation
- Nausea
- Anorexia
- Diarrhea
- Decreased urine output
- Body-core temperature that generally ranges between 97–104° F

Exertional Hyponatremia

Exertional hyponatremia is a relatively rare condition defined as a blood-sodium level less than 130 mmol/L. Low blood-sodium levels usually occur when activity exceeds four hours. The two most common reasons for hyponatremia are:

- An athlete ingests water or low-sodium beverages well beyond sweat losses
 - » Also known as water intoxication
- An athlete's sweat sodium losses are not adequately replaced

Signs and symptoms of exertional hyponatremia include a combination of:

- Disorientation
- Altered mental status
- Headache
- Vomiting
- Lethargy
- Swelling of the extremities (hands and feet)
- Pulmonary edema (swelling)
- Cerebral edema (swelling)
- Seizures

Exertional hyponatremia can result in death if not treated properly. This condition, along with other heat illnesses, can be prevented by matching fluid intake with sweat and urine losses and by rehydrating with fluids that contain sufficient sodium.

