

# Fluid Replacement and Dehydration

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- Athletic performance declines with dehydration, beginning with a fluid loss equaling one to two percent of the athlete's body weight.
- It is important for all athletes to begin each exercise session well-hydrated.
- Rehydration should consist of water, carbohydrates and electrolytes, as all are lost during exercise.
- Athletes should never be punished through the restriction of fluids.

## **SIGNIFICANCE**

In order for an athlete to perform at an optimal level, close attention must be paid to the body's water and electrolyte levels. With many athletes focusing on specific aspects of their sport, along with the outcome of the event, many neglect the need for fluid replacement during activity. Many athletic events pose a challenge (e.g., very little rest) for the athlete to maintain optimal fluid levels, so it is important for athletes to have water or a sports drink close at hand in order to avoid poor performance or other detrimental physiological effects due to dehydration.

## **BACKGROUND**

Minimal fluid loss can impair performance during exercise. At moderate exercise intensity, the human body generally produces 0.5 to 1.5 liters of sweat in one hour, but this may be higher in some individuals. The sweat rate increases as the intensity of exercise increases. During intense exercise in hot conditions, some individuals can lose up to three liters of sweat in one hour. A one percent drop in body weight due to fluid loss can lead to an increased core body temperature during exercise. When an athlete loses one to two percent of body weight due to fluid loss, aerobic exercise performance can decrease. When an athlete loses three percent or more of body weight, there is an increased risk for heat illness. Prevention of dehydration occurs before exercise begins, and should include a hydration protocol agreed upon by coaches, athletic trainers and all others involved in the well-being and performance of a team or athlete.

### **Pre-exercise Hydration**

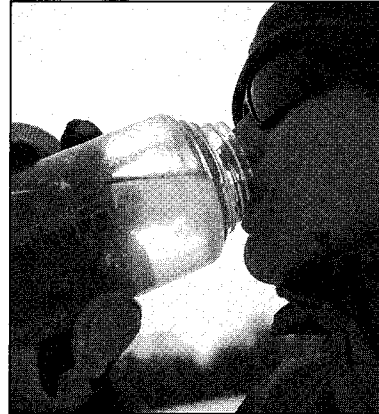
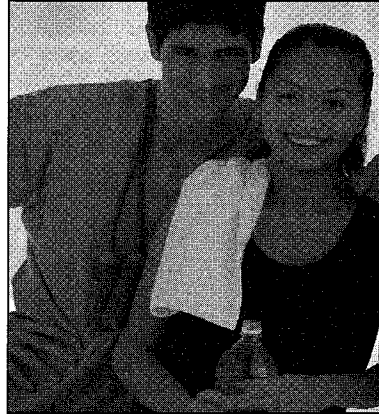
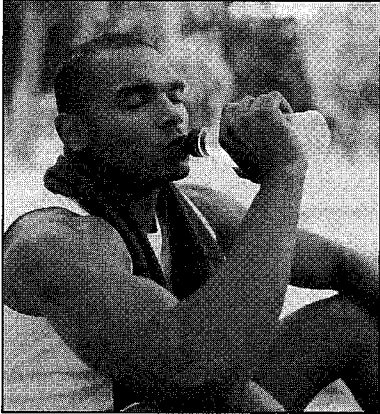
It is important for all athletes to begin each exercise session well-hydrated. Ideally, athletes should monitor their weight before and after exercise sessions in order to replace any fluids lost. It is recommended that an athlete consume 16 ounces (two cups) of water two hours before exercise begins. Another eight to 16 ounces (one to two cups) should be consumed 15 minutes prior to exercise.

### **Maintaining Hydration During Exercise**

Fluid replacement during exercise should equal fluid lost through sweat and urine, at a rate no higher than 48 ounces per hour. As previously stated, fluid loss of one to two percent of body weight can decrease aerobic performance, so the goal of the athlete should be to minimize dehydration to less than two percent loss of body weight, with less than one percent loss of body weight being optimal.

Unfortunately, relying on the body's thirst mechanism cannot prevent dehydration, so thirst should not be relied upon to determine fluid intake. By the time a person becomes thirsty, he or she is already dehydrated. An athlete should drink early and often, and be allowed unrestricted fluid replacement. Athletes should never be punished through the restriction of fluids. Unrestricted access to water or sports drinks should lead to the consumption of four to eight ounces (one-half to one cup) of fluid every 15 minutes. It is important to remember that some athletes may have a higher sweat rate than others and require more fluids to remain well hydrated. These athletes can safely tolerate up to 48 ounces per hour.

Some sports present rehydration challenges, such as soccer or certain running events. A cross country race can last up to 30 to 40 minutes for some runners and water stations should be set-up with consideration given to the course and climate. In all settings, allowing athletes to drink as much fluid as they feel necessary is important.



### Post-exercise Rehydration

Fluid replacement after exercise should aim at achieving the athlete's pre-practice or pre-event weight. Ideally, this should occur before the next practice session or competition. However, this may not be possible if there is minimal time between competition. Consumption of 16-20 ounces (2-2½ cups) of fluid for every pound lost during exercise will help achieve normal fluid state. Rehydration should consist of water, carbohydrates and electrolytes, as all are lost during exercise.

At the beginning of the fall sports season, athletes often participate in twice daily practices, and rehydration becomes even more important during this time. Athletes may be weighed prior to and after each practice session. If the athlete has not returned back to previous weight before the start of the second session, the athlete should be held out of participation in order to avoid dehydration-related illness.

### Hyponatremia

Hyponatremia is extremely rare in high school athletics, but deserves mention. This is a potentially deadly disorder that results from the over-consumption of fluids (water and sports drinks). It is most commonly seen during endurance events, such as marathons, when adult participants consume large amounts of water over several hours in the absence of significant sweating. The opposite of dehydration, hyponatremia is a condition where the sodium content of the blood is diluted to dangerous levels. Affected individuals may exhibit disorientation, altered mental status, headache, lethargy and seizures. The diagnosis can only be made by testing blood sodium levels. Suspected hyponatremia is a medical emergency and EMS (Emergency Medical Services) must be activated. It is treated by administering intravenous fluids containing sodium.

### RECOGNITION

Dehydration is common in all sports and can occur very rapidly, especially in a warm or hot environment or if the athlete starts activity less than fully hydrated. All coaches and athletes must be aware of the signs and symptoms of dehydration (Table 17). The volume and color of urine is an excellent way of determining if an athlete is well hydrated. A normal amount of nearly clear or light-colored urine indicates that an athlete is well-hydrated; small amounts of dark urine point to the need to increase fluid intake. A Urine Color Chart can be accessed at: <http://at.uwa.edu/admin/UM/urinecolorchart.doc>.

**Table 17. Signs and symptoms of dehydration.**

▪ Thirst	▪ Dizziness	▪ Heat sensations in the head or neck
▪ Irritability	▪ Muscle cramps	▪ Decreased performance
▪ Headache	▪ Chills	
▪ Weakness	▪ Nausea and vomiting	

## PREVENTION AND MANAGEMENT

Sports drinks and energy drinks are commonly seen in advertisements and differ in their ingredients. A sports drink is designed to provide re-hydration during or after an athletic activity. Most sports drinks contain six to eight percent carbohydrate solution and are a good source of electrolytes. Carbohydrate and electrolyte concentrations are formulated to allow the body's gastrointestinal tract to absorb the fluid as efficiently as possible.

Sports drinks can provide water, energy and appropriate electrolytes during competition. A carbohydrate concentration of six to eight percent can provide energy, while the higher concentration of carbohydrates found in juices and energy drinks will produce slow emptying of the stomach and may leave the athlete feeling bloated. The lower concentration of sodium found in sports drinks may also help avoid abdominal cramping. While sports drinks provide some benefits during exercise (Table 18), the main focus of an athlete's hydration protocol should be on water. With an adequate diet and water intake, athletes will be properly prepared for practice and competition.

**Table 18. Indications for the use of sports drinks.**

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**Traditional sports drinks with appropriate carbohydrates and sodium may provide additional benefit in the following general situations:**

- Prolonged continuous activity of greater than 45 minutes
  - Extremely intense activity with risk of heat illness
  - Hot and humid conditions
  - Individuals who are poorly hydrated prior to participation
  - Individuals with an increased sweat rate
  - Individuals with poor caloric intake prior to participation
  - Individuals with poor acclimatization to heat and humidity
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Energy drinks were originally marketed towards athletes as a means of rehydration and electrolyte replacement during activity. Companies that manufactured the energy drinks claimed they improved performance on the field – both in practice and games. In recent years, energy drink companies have targeted the general population and the market has been saturated with different energy drinks containing many different ingredients.

In 2006, nearly 500 new energy drink brands were introduced, often touting false claims of performance enhancement and improved recovery. Energy drinks may contain carbohydrates, caffeine, taurine and other substances that manufacturers claim enhance performance. Energy drinks **ARE NOT** recommended for pre-hydration or rehydration during or after activity. Some ingredients, such as caffeine, may act as a diuretic, and can lead to even greater fluid loss. Please see the NFHS Position Statement on The Use of Energy Drinks by Young Athletes.

## References

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McKeag DB, Moeller JL. *ACSM's Primary Care Sports Medicine*. 2nd Ed, Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins, 2007.

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