Hydration and Performance

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This excerpt from NSCA's Guide to Sport and Exercise Nutrition discusses the research surrounding the timing of hydration and its impact on sport performance for those participating in aerobic endurance exercise.

The following is an exclusive excerpt from the book **NSCA's Guide to Sport and Exercise Nutrition** (/store/product-detail/INV/9780736083492/9780736083492)*, published by Human Kinetics. All text and images provided by Human Kinetics.*

For endurance athletes, the competition cycle usually includes the build (precompetition) and race (competition) components. The build component is often high-intensity and high-volume work aimed at improving speed, power, and sport-specific strength. This adds stress to the body, and recovery is crucial to the athlete's ability to achieve optimal performance. During the competition cycle, the training intensity and volume are also typically quite high. Therefore, athletes should not pursue active weight loss during this cycle.

It is especially important that athletes pay close attention to fluid and electrolyte balance during aerobic endurance exercise because of the increased likelihood of becoming dehydrated, becoming overheated, or experiencing the consequences of altered electrolyte balance. While many think of running and distance cycling as the

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aerobic endurance sports, athletes who play American football, soccer, hockey, and a variety of other sports also have an increased risk for dehydration, heat illness, and low blood sodium levels. Compared to the attention given to fluid balance in aerobic endurance athletes, significantly less attention has been paid to fluid balance during strength and power exercise. A plausible explanation is that athletes are more likely to become dehydrated during long bouts of aerobic exercise; the short duration of many strength and power events, in addition to readily available fluids, makes dehydration less of a concern.

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AEROBIC ENDURANCE EXERCISE

Maintaining fluid and electrolyte balance is crucial for individuals who engage in aerobic endurance exercise. In fact, a fluid loss of a mere 2% of body weight has been shown to reduce exercise performance in both hot and temperate environments (Maughan and Shirreffs 2008). However, in one study of Ironman triathletes, a 3% reduction in body mass during competition had no adverse effects on thermoregulation or body temperature (Institute of Medicine 2005), indicating that some athletes may be better regulators of heat and require different fluid strategies.

BEFORE EXERCISE

It is important for people to begin exercise euhydrated and with normal electrolyte levels. Good hydration practices during the day, focusing on the consumption of fluids and high water content foods such as fruits and vegetables, should be the main goal. If at least 8 to 12 hours have passed since the last exercise session and fluid consumption is sufficient, the individual should be close to a euhydrated state. On the other hand, for someone who has lost a significant amount of fluid and has not replenished with fluids and electrolytes in the amounts needed to establish euhydration, an aggressive preexercise hydration protocol is in order (Sawka et al. 2007).

At least 4 hours before exercise, athletes should consume approximately 5 to 7 ml fluid per kilogram body weight. They should consume more fluid slowly, approximately 3 to 5 ml/kg body weight, 2 hours before exercise if the individual is not urinating or if the urine

is dark (Sawka et al. 2007). Consuming sodium-rich foods at this time can help stimulate thirst and retain fluids. If sodium is consumed in a beverage, the recommended amount is 20 to 50 mEq (460-1,150 mg) per liter (Swaka et al. 2007).

A common practice before an event is for athletes to attempt to hyperhydrate with water. This practice is not advised because it increases the risk of urination during the event and could dilute the sodium levels in the body, thus increasing the risk of hyponatremia (Laursen et al. 2006). For promotion of a euhydrated state before training or competition, fluid palatability is of utmost importance. Palatability or the lack of it will contribute to or detract from preexercise hydration strategies. The fluids should typically be lightly sweetened, should contain sodium, and should be cool in temperature.

DURING EXERCISE

The goal of drinking during exercise is to prevent excessive dehydration (greater than 2% of body weight from water loss) and excessive changes in electrolyte balance (Sawka et al. 2007). Although fluid replacement strategies are highly individualized, athletes should aim for 3 to 8 ounces (90 to 240 ml) of a 6% to 8% carbohydrate–electrolyte beverage every 10 to 20 minutes during exercise lasting longer than 60 to 90 minutes. This will assist in hydration and promote better performance during prolonged exercise (Sawka et al. 2007; Jeukendrup, Jentjens, and Moseley 2005).

It is well known that consuming carbohydrate during exercise maintains blood glucose levels and reduces fatigue. A sport drink typically contains the following (Institute of Medicine 2005; Jeukendrup, Jentjens, and Moseley 2005):

- 20 to 50 mEq of sodium (460-1,150 mg) per liter
- 2 to 5 mEq of potassium (78-195 mg) per liter
- About 6% to 8% carbohydrate concentration

Energy bars, gels, and other foods, depending on a person's needs and preferences, can also supply this combination (Institute of Medicine 1994). Consuming beverages with sodium (20-50 mEq/L

fluid) or snacks containing sodium will help stimulate thirst and retain water (Ray et al. 1998). In addition to sodium, a sport beverage with protein may also increase fluid retention. In a study examining fluid retention after dehydration (2.5% body weight loss), researchers gave 13 subjects beverages containing carbohydrate plus protein (6% and 1.5%, respectively), carbohydrate only (6% solution), or water at a volume equal to body weight loss over a 3-hour recovery period. Fluid retention was significantly higher for the carbohydrate–protein group than for the carbohydrate group. Both carbohydrate–protein and carbohydrate only were better than water for rehydration. The authors concluded that fluid retention after consumption of a carbohydrate–protein beverage was 15% greater than after consumption of a carbohydrate-only beverage and 40% greater than after consumption of water (Seifert, Harmon, and DeClercq 2006).

AFTER EXERCISE

After exercise, the goal is to fully replenish any fluid and electrolyte deficit from the exercise bout (Sawka et al. 2007). Athletes must consume 150% of the lost weight to achieve normal hydration within 6 hours after exercise (Maughan and Shirreffs 2008). Therefore, practically speaking, the recommendation is to ingest 20 to 24 ounces (600 to 720 ml) of fluids for every pound of body weight lost during training. Though plain water is effective for rehydration, athletes should consider a sport drink or consume their water with foods that contain electrolytes such as sodium and chloride to replace electrolyte losses (Dunford 2006).

Some research studies have shown that as a whole, alcoholic and caffeinated beverages have diuretic effects; but such effects are transient, and therefore these beverages do contribute to daily hydration recommendations. However, if rapid rehydration is the goal postexercise, it is advisable to avoid alcoholic and caffeinated beverages in the first few hours after activity (Dunford 2006). The fluid chosen in the postexercise period should promote rapid rehydration.

Depending on the amount of time before the next exercise session, consuming sodium-rich foods and beverages with water after competition or a training session should suffice. Sodium is one of the key nutrients athletes should consume in the postexercise period to return to a euhydrated state because it will help retain ingested fluids and stimulate thirst. While sweat sodium losses differ

among individuals, which can make individual sodium prescription difficult during this period, a little extra salt added to meals or snacks may be particularly useful for those with high sweat sodium losses (Swaka et al. 2007).

NSCA's Guide to Sport and Exercise Nutrition *will lead you through the key concepts of sport and exercise nutrition so that you can assess an individual's nutrition status and—if it falls within your scope of practice—develop customized nutrition plans. The book is available in bookstores everywhere, as well as online at the* ***NSCA Store*** (/store/product-detail/INV/9780736083492/9780736083492).

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