Hydration Maintenance for Unarmed Combatants

Hydration is particularly important in the realm of boxing, kickboxing, and mixed martial arts. Frequently, competitors cutting weight before weigh-ins deprive themselves of proper hydration. The implications can be severe if not corrected, particularly in Nevada's dry climate. **Dehydration (body volume depletion)** amplifies physiologic strain on core body temperature, heart rate elevation, and exertional responses. (1) The **total body water (TBW)** averages about 60% of body mass, ranging from 45-75%. The variable percentage is influenced by body composition. Trained athletes generally have higher TBW by having more muscle mass (holds higher water content) and less body fat. (1, 6) The water loss can occur from sweat, urine, respiration, and insensible skin losses. **Dehydration negatively impacts performance significantly when the body water deficit is > 2% body weight.** (2) Therefore, it is important to establish good hydration prior to competition and to maintain proper hydration during and after competition.

Exercise physiology of hydration:

Physiologic control of hydration is maintained by the kidneys. The kidney has the ability to increase the amount of water reabsorbed into the body. Decreased urine volume is one sign of dehydration. If the urine color appears darker, this also indicates a state of dehydration as the kidneys are trying to retain the majority of water volume passing. Additionally, the **response of thirst** helps inform the body when it is time to increase fluid intake. (8) As an athlete increases physical activity, control of body core temperature must be maintained. To cool the body, sweating occurs to facilitate heat loss. If the sweat is not rapidly evaporated such as in humid environments, higher sweating will occur to accomplish the cooling effects. Sweat contains a large amount of sodium and chloride (salt). If an athlete is already in a dehydrated state, the sweat concentrations of sodium and chloride are further elevated thereby increasing the body's salt loss. (1)

Impact of dehydration:

In most sports, the body starts activity with normal total body water. As activity progresses over an extended period of time, dehydration can occur. The impact of volume depletion can influence the body in multiple ways. Muscle cramps can develop. Heart (cardiovascular) function can be impaired. Heat exhaustion occurs as the body loses its ability to cool itself. Rhabdomyolysis

(breakdown of muscle) and exercise-associated hyponatremia (loss of sodium) can develop. These processes all result in decreased exercise performance.

Cramping can occur simply from muscle fatigue, but it is thought to be related to salt loss and dehydration as well. It has been observed that some athletes more prone to cramping tend to have a larger sweat volume and lose more sodium in their sweat. (1, 2) Additionally, dehydration can alter cardiovascular function by hindering autonomic cardiac control and decreasing the circulating blood volume. The result is a lack of transport of metabolic heat to the skin surface to cool the body temperature. Consequently, heat exhaustion or heat stroke can precipitate in severe competitive situations. (1, 2) Further, some research indicates that athletes can experience impaired resistance exercise performance from depleted body water. (1, 10) In cases of prolonged strenuous exercise, rhabdomyolysis (muscle breakdown) can be exacerbated by dehydration. (1) An indication of rhabdomyolysis is red colored urine. The most severe complication of dehydration or improper rehydration (water intoxication) is exercise-associated hyponatremia. This is defined by the blood's level of sodium which is normally 135-140 mEq/L. In hyponatremia, the levels fall below 135 to present with symptoms of fatigue, muscle cramps, nausea, vomiting, headache, confusion, and disorientation. (1) If not properly treated, hyponatremia can result in severe condition known as central pontine myelinolysis (brain nerve damage).

Restoring hydration pre-activity, during activity, and post-activity:

Before activity or competition is the time to confirm that the athlete is euhydrated (has normal total body water). Prehydration should begin at least 4 hours before the sporting event. Fluids should be consumed <u>slowly</u>, drinking about 5-7 mL/kg per body weight. For example, a person weighing 70 kg (about 155 lbs) would need to drink 350 mL of fluid (about the equivalent of a 12 ounce can of soda). The goal is to create sufficient urine output. In addition, eating small amounts of salted snacks and sodium-containing foods at meals can help increase thirst and retention of consumed fluids. (1) Athletes should drink fluids with 20-50 mEq/L of sodium to aid in water retention.

During exercise, the goal is to prevent excessive dehydration (>2% BW loss from water deficit). Many factors are important to consider when hydrating during competition such as the length of competition, individual sweating rates, and ability to drink during competition. It is difficult to recommend a specific amount of fluid replacement during competition since individual demands vary. The most important point is that athletes should be conscious of the amount of sweat produced during physical activity in order to gauge the amount of replacement required during and after competition. (1) It has been noted that shorter exercise

sessions do not demand beverages with high carbohydrate (sugar) content (<2.5% is sufficient). However, if exercise continues longer than 1 hour, fluid intake should be a 6-8% carbohydrate-electrolyte sports drink. (1, 7)

To restore lost fluid volume post-exercise, it is best to ingest sodium (salt) with water. (1, 2, 7) The amount of fluid that should be replaced should be equal to the number of pounds lost during the event. For every pound lost, the athlete should drink 2-3 cups of fluid. (1, 6) When the sodium is absorbed in the small intestine by a specific transporter, sodium-dependent cotransport (SLGT1), glucose and water are taken up together. This allows the blood sodium level to elevate in the rehydration phase. The consumption of salt in sports drinks not only stimulates the athlete's thirst, but also delays urine production to replenish the body's lost volume. (1, 8) This is the design concept for consuming carbohydrate-electrolyte sports drinks. Since the main electrolyte lost with intense exercise is sodium, by drinking a beverage with both sodium and simple sugars (glucose or galactose) allows for more rapid uptake and electrolyte replacement.

Some complex sugars break down into simple sugars that your body can use in exercise:

trehalose → **glucose + glucose**
maltose → **glucose + glucose**
lactose → **glucose + galactose**
sucrose → **glucose** + **fructose** (Reference: 9)

Sports drinks that contain a majority of fructose are not beneficial for electrolyte replacement because it does not work with the SLGT1 to help increase sodium absorption and restore electrolyte imbalances. Additionally, sports drinks that contain >8% carbohydrates have been associated with delayed gastric (stomach) emptying. This means it takes longer for the fluids to pass into the small intestine where the absorption will be taking place, consequently prolonging the time to restore electrolyte imbalances. (7) In cases when rapid rehydration is needed, chicken broth and chicken noodle soup containing high concentrations of sodium have been shown to rehydrate faster than plain water or carbohydrate-electrolyte drinks. (4)

Guidelines of Hydration Maintenance:

1. **Weigh yourself before and after working out or competition to determine the amount of volume loss. Drink 2-3 cups of fluid for every pound lost. (1, 6)**

2. **If dehydration is present before competition, restore lost volume by drinking fluids. Fluids should be consumed <u>slowly</u>, drinking about 5-7 mL/kg per body weight. (1)**
3. **During physical activity lasting > 1 hour, fluid intake should be a 6-8% carbohydrate containing electrolyte sports drink. (1,7)**
4. **Consume small amounts of fluids frequently, instead of large amounts at one time. (2,6)**
5. **Pay attention to the amount and color of urine after the rehydration phase. Normal urine should be pale, yellow color. Small amounts of urine or dark yellow-colored urine can indicate significant volume depletion (dehydration). (1,2,6)**

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