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Hydration and sports

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Abstract

Proper hydration is one of the most important aspect of healthy physical activity. Sports person should balance fluid intake with fluid loss. A body water loss in excess of 2-3% of body mass can decrease performance and negatively affect health. Similarly an intake of water that is far in excess of fluid loss puts athlete at risk for potentially fatal condition. So drinking the right amount of fluids while exercising, as well as both pre- and post-workout to replace fluids loss through sweat is vital for optimum performance. The aim of this study is to educate and emphasis the importance of proper hydration to sports personalities to ensure best performance. Sufficient fluid intake will help the sportsman to achieve optimal performance.

Keywords: Sports person, hydration, exercise, optimal performance, fluids

Introduction

Water is the main component of the human body and it accounts for approximately 73% of lean body mass.^[1] The human brain is composed of 95% water, blood includes 82% water, the lungs has nearly 90% water. Sufficient hydration is vital to stay healthy and to maintain the function of every system in the body, including your heart, brain, and muscles. Insufficient Water intake affects physical and mental performance. Being a medium for cellular functions that occur in the body, water is the main component of blood and is also responsible for transporting nutrients and oxygen to tissues of the body. Water regulates body temperature and lubricates joints. Acting as a cooling agent for body, water is essential for all major bodily functions^[2].

Importance of hydration

Proper hydration is always crucial, but during exercise it is essential for maximum energy and endurance. Drinking fluid during exercise will help to reduce the risk of heat stress, to maintain normal muscle function, and to prevent fatigue due to dehydration. One of the most important functions of water is thermoregulation. During exercise, the sports man muscles generate heat leading to increased body temperature. As this occurs, the body reacts by sweating. When sweat evaporates, the body cools. If the fluids lost through sweat is not replaced, the body cannot work properly to cool itself and leads to heat-related injuries or illness.

In temperate and cold climates people can often tolerate 2% loss of body weight as water without impairment of physical performance, but in the heat this amount of fluid loss will compromise performance and may result in heat illness. Reduction in excess of 5% of body weight can decrease the capacity of performance by about 30%. Several studies have demonstrated that maintaining hydration before and during endurance exercise is useful in improving performance in a variety of conditions. The calories, potassium, and other nutrients in sports drinks provide energy and electrolytes which to help to perform for a longer period of time without fatigue. Goal of hydration during exercise is to maintain plasma volume and electrolyte balance.^[3]

Hydration and sports

Fluid requirements highly varies between athletes, perhaps between training and competition, with differing environmental conditions and degree and intensity of training and heat

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acclimatization. A proper hydration protocol considers unique features of each category of sports. If rehydration opportunities are frequent (eg, baseball, football, track and field), the sports man can consume smaller volumes at a convenient pace based on sweat rate and environmental conditions. If rehydration must occur at specific times (e.g. soccer, lacrosse, distance running), the athlete must consume fluids to maximize hydration within the sport's confines and rules. ^[4] Good hydration is taking the right amount of water before, during, and after exercise.

Pre-exercise hydration

Mandatory pre-exercise hydration is physiologically advantageous and more effective than hydration dictated by often insufficient personal preference. ^[5] To ensure proper pre-exercise hydration, the sports man should consume approximately 500 to 600ml of water or a sports drink 2 to 3 hours before exercise. It takes 60 minutes for 600ml of fluid to empty from the stomach and be absorbed by the intestine. For example if practice starts at 3pm, athlete should drink 600ml of fluid starting around 2pm so that they don't feel bloated once practice begins. ^[6]

Hydration during exercise

American college of sports medicine recommends 135-230ml every 15-20 minutes during exercise. Proper hydration during exercise enhances heat dissipation by increasing skin blood flow and sweating rate, limits plasma hyper tonicity, and helps sustain cardiac output. Research study also showed that changes in rectal temperature during exercise depended on the degree of fluid intake. When there is balance between water intake and sweat loss, rise in core temperature was slowest when compared with ad libitum water and no-water groups. This benefit of rehydration on thermoregulatory function is likely due to increased blood volume, reduced hyper osmolality, reduced cellular dehydration, and improved maintenance of extra vascular fluid volume ^[5].

Post exercise hydration

After exercise players must drink 480ml of fluids for every pound (0.45kg) of loss during exercise ^[7]. Post exercise hydration should aim to correct any fluid loss accumulated during the practice or event. It should provide water to restore hydration status, carbohydrates to replenish glycogen stores, and electrolytes to speed rehydration. When rehydration must be rapid, the sports man should compensate for obligatory urine losses incurred during the rehydration process and drink about 25% to 50% more than sweat losses to assure optimal hydration 4 to 6 hours after the event. Post-exercise restoration of fluid balance after sweat-induced dehydration avoids the detrimental effects of a body water deficit on physiological function and subsequent exercise performance ^[8]. During recovery from exercise, rehydration should include replacement of both water and salts lost in sweat. Inclusion of salt in fluid replacement beverages should be considered in conditions such as: inadequate access to meals or meals not eaten; physical activity exceeding 4 hours in duration; or during the initial days of hot weather. Under these conditions, adding modest amounts of salt (0.3 to 0.7g/L) can offset salt loss in sweat and minimize medical events associated with electrolyte imbalances (e.g., muscle cramps, hyponatremia). Adding a modest amount of salt (0.3 to 0.7g/L) to all hydration beverages would be acceptable to stimulate thirst, increase voluntary fluid intake, and decrease the risk of hyponatremia. ^[9]

Adding salt to drinks stimulates carbohydrate absorption and also enhances water uptake. Replacing the salt which is lost in sweat helps to uphold the blood volume. If excess amounts of water alone are drunk during and after endurance exercise in the heat, dilution of body fluids occur, leading to large losses of water in the urine. Water imbalance and low sodium levels can cause heat cramps and exhaustion. To prevent this, drinks should contain sodium amounts similar to those of human body fluids, or water should be drunk with food. ^[10]

Dehydration

Body loses water through breathing, sweating, and digestion. Dehydration impairs sports man performance in most events such as: endurance sports, team sports, power and sprint sports, winter sports and sports with weight classes. Dehydration also reduce endurance, decrease strength, cause cramping, and slow muscular response. Dehydration of greater than 2% loss of body weight increases the risk of nausea, vomiting, diarrhea, and other gastro-intestinal problems during exercise. Dehydration may cause a reduction in blood volume, decreased skin blood flow, decreased sweat rate, decreased heat dissipation, increased core temperature and an increased rate of glycogen use. The most prone physiological mechanism affecting a person's maximal aerobic power (VO₂max) and athletic performance is maximal cardiac output. ^[11] A review of scientific studies showed that endurance sports man like tri athletes and marathon runners had a performance drop of 7% to 60% when dehydrated. Athletes requiring muscle strength, like bodybuilders and football linemen, found their power to be reduced when their sweat loss was as low as 3% of their body weight. Losses in excess of 5% of body weight may decrease the capacity for work by about 30%. Exercise performance will be impaired when an individual is dehydrated by as little as 2% of body weight.

Hydration needs of athlete can be estimated using the following formula

Total calories/240=Number of cups of fluids needed each day. For example athlete consuming 3000 calories a day can be estimated as follows.

$$3000/240=12.5 \text{ cups per day.}$$

(It is important to remember that fluid losses during exercise must be added to the calculated estimation to cover the hydration needs of athletes.)

Guidelines to ensure proper hydration

The goal of daily fluid consumption is to ensure maintenance of optimal health.

1. Each athlete should be aware of his or her individual fluid needs and consume accordingly.
2. Optimal hydration should stimulate urination approximately every 1-2hrs
3. Urine that is pale or clear in colour typically indicates adequate hydration
4. Fluids can be obtained from water, milk, juices and sports beverage as well as water foods such as fruits, vegetables
5. Caffeine should be consumed in moderation.
6. Athletes should follow well balanced diet including moderate amount of proteins to avoid diuresis as a result of high protein diet ^[3].

Over hydration

Drinking excessive amounts of water in a short period of time can lead to hypo-Natraemia also known as water intoxication

or over hydration. When excessive amounts of water are consumed, the sodium levels in the body become diluted and the kidneys cannot excrete enough fluid. This causes the cells to become water logged and the brain to swell. Symptoms of water intoxication include headaches, disorientation, coma, and in severe cases, death. This is a potentially life-threatening situation and requires immediate medical attention.^[12]

Conclusion

For individuals participating in sports, careful monitoring of water intake to insure they are getting adequate amounts to stay hydrated is imperative. Optimal fluid balance is vital to the sports man as exercise can place severe demands on the body to maintain fluid homeostasis. Through optimal hydration athletes can avoid abnormal heart rate and core temperature that can potentially lead to health issues as well as premature fatigue that will zap performance^[3]. Proper education emphasizing the importance of hydration is important for optimal sports performance, as well as to the athlete's health.

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