Heat Adaptation and Dehydration

Heat and humidity are especially dangerous to the athlete in the spring before individuals have had time for acclimatization. Here are some points to consider that will reduce the danger of dehydration and allow you to adapt fully to the heat stress to come.

1. You must evaporate 1.0-1.2 liters of sweat, per hour, to maintain thermal equilibrium. To reach the 1.0-1.2 liters an individual must lose 2.00 liters of sweat per hour, because, even on a mild, low humidity day 50%, or more of seat production is lost unevaporated. An unacclimatized individual sweats at about 700 ml per hour, which is insufficient when it comes to stabilizing core temperature. An acclimatized individual may sweat at 1.5-2.0 L per hour, while an elite athlete may double that figure (3.4-3.7 L/ h). For every 1% reduction in body weight due to fluid loss there is a 2% reduction in performance. A 3% fluid loss results in severe performance decrements.
2. A fit individual who is heat acclimatized will begin to sweat earlier during exercise at the same relative intensity and sweat more than an unacclimatized, unfit individual. Acclimatization is marked by a lower heart rate, increased sweat rate, lower skin temperature and a decreased rectal temperature, at the same level of work. Increased core temperature is associated with reduced performance in endurance events. Sweat rate is also related to body mass. A small framed, lean individual will lose less fluid during exercise than a larger, obese performer at the same, relative workload.
3. Gastric emptying decreases as running intensity increases. At the same time sweat production increases with running speed. Gastric emptying increases with the volume of fluid in the gut. You may absorb about 1 L of water per hour, which means, with a fluid loss of up to 3.4 L/hour , that the athlete will become dehydrated during intense exercise. In order to accomplish rehydration at 1L per hour, it is best to take 250 ml (about 8 oz)of water every 15 minutes, during heavy exercise. Caffeine and alcohol increase urine production and dehydration and should be avoided prior to and during competition.
4. Dehydration is marked by: a decrease in blood volume, decreased stroke volume, and a reduction in blood flow to the working muscles. In addition, blood flow to the skin decreases in order to maintain central blood volume. As a result of the reduced blood flow to the skin, cooling is impaired and core temperature rises.
5. Water is superior to sports drinks as a hydration tool in that the osmolality (concentration) of commercial products is too high which impairs absorption. During the spring and early summer, before acclimatization has taken place, it would be wise to add a little extra salt to the diet to make up for electrolyte loses. However avoid salt pills as they contain sodium in amounts greatly in excess of requirements. A small amount of sodium (100 mg Na) per 8 oz of water will aid absorption and rehydration.
6. Signs of heat exhaustion are the following: a rapid, weak pulse (however, in runners the pulse is often slow and strong, even at the onset of heat exhaustion) hypotension, faintness, profuse sweating and psychological disorientation. Core temperature rises to about 30.5 degrees C. The affected individual should be made to lie down in a cool place and take fluids. He/she should not exercise for the remainder of the day and should increase fluid intake for 24 hours, or until body weight has returned to normal. It is important to identify individuals that have experienced heat illness in the past and monitor their diet and weight for abnormal changes.
7. Heat collapse, the most common heat related illness, may occur in athletes who have failed to warm down and in spectators who have been standing for extended periods. The individual loses consciousness due to a reduced blood supply to the brain. Heat collapse can be treated by having the subject recline, elevating his/her legs and administering fluid. A physician should make certain that the collapse was not due to cumulative sodium deficiency, or heat stroke.
8. Heat stroke, which may be life threatening, is marked by: a high core temperature (>41 degrees C), hot, dry skin (in runners there may be profuse sweating ), extreme confusion, or unconsciousness. Some complications include: coma, delirium, renal dysfunction, liver damage, vomiting, diarrhea, and metabolicacidosis. Obese, unacclimatized, and older persons are at greater risk. Also, the very young and dehydrated are candidates for heat stroke.
9. The major cause of heatstroke during endurance events is dehydration caused by the ambient temperature and humidity, not the amount of water consumed during the event. If weather conditions are unfavorable, heat injuries will occur, irregardless of the amount of water consumed. In hot, humid

conditions, which limit evaporation, core temperature may rise by 1/3 degree C per minute of intense exercise. Assuming a normal core temperature of 37.8 degrees C., 15-17 minutes of exercise will result in a core temperature of between 42-44 degrees C.

10. In treating individuals with heat exhaustion, or stroke, it is important to cool the body with ice and cool water. Also, elevation of the head, or legs will aid in dispersion of fluids throughout the body. In case of heat exhaustion, raise the victim's legs above the head and for heat stroke, raise the individuals head above the legs. A good saying to remember is: "If the face is red, raise the head. If the face is pale, raise the tail."