Strategies for Training and Competing in the Heat and Humidity

Training and competing are usually plenty tough. But add sweltering heat or the drenching humidity to the equation, and the degree of difficulty rises to a whole new level. Heat and humidity are probably the most common performance-impairing environmental challenges you'll encounter as an athlete. So it definitely pays to know how to safely and effectively train — and compete — in the heat.

**Working Your Muscles Makes You Faster, Stronger — and Hotter**

You'd like to think that all the energy your muscles are churning out during exercise is going towards making you faster or stronger. In truth, about 75% of that muscle energy is turned into heat. If that heat were to remain in your body, your core temperature would quickly rise and your performance would rapidly plummet. You'd also be at risk for heat-related illnesses, such as heat stroke, caused by hyperthermia. Fortunately, your body has powerful physiological mechanisms for eliminating muscle-generated heat. In addition, there are important strategies you can employ to maximize your athletic performance and reduce the dangers of exercising in the heat and humidity.

**Temperature Regulation in Action**

The physiology term for managing your core body temperature is thermoregulation, and there are two important mechanisms for keeping your cool: As your muscles crank out the heat, blood flowing through muscle tissue absorbs the heat and carries it away and toward the skin. Triggered by an uptick in core body temperature, your brain sends a signal to the blood vessels in your skin to dilate or expand. This allows the skin to hold a larger volume of warmed blood. If the ambient air is cooler than the temperature of your skin, a heat exchange occurs, and heat from the blood circulating in the skin is released to the cooler surroundings. You cool off in the process. Heat loss is further accelerated by sweating. As you exercise, your core temperature rises and your sweat glands receive a signal from the brain to begin secreting sweat onto your skin. If the ambient air is sufficiently dry, sweat evaporates from your skin and a cooling effect takes place.

**Double Whammy: Heat and Humidity**

When the air temperature exceeds 96.8°F (36°C), instead of heat flowing from your skin to the outside environment, heat exchange is reversed, and your body begins to absorb heat from the environment. So when it's scorching outside, one of your two key thermoregulatory mechanisms has essentially been knocked out of commission. When this occurs, sweating becomes the primary means for eliminating the heat generated by muscle contraction. When you're training or competing hard outdoors in the heat, a sweat rate of 34-85 fl oz per hour (1.0-2.5 liters per hour) is typical. In sweltering conditions, sweat rates of greater than 85 fl oz per hour (2.5 liters per hour) can occur. What does running a distance event in Hawaii have in common with a summertime football training camp in New England? A potent combination of heat and humidity. This formidable duo poses a serious challenge to thermoregulation during exercise because when you add humidity to the mix, the air is heavy with moisture. If the air were
Dry, sweat would evaporate readily from the skin and a cooling effect would result. But when the surrounding air is saturated with moisture, sweat doesn’t effectively evaporate from your skin during exercise. Instead, it builds up and then drips off your body. As a result, you lose the cooling effect of sweat evaporation. Thus, the combination of high heat and humidity puts a serious damper on your ability to thermoregulate. In these extreme conditions, you risk having the heat load build up to a critical level at which your body can’t function optimally. At that point, you experience very strong signals from your body, prompting you to stop exercising in order to lower your core temperature. However, some athletes have been known to labor on and fight through these strong biological cues, only to end up suffering serious heat illnesses from the very high core body temperatures that result.

**Dehydration: Another Insult**

Dehydration is another critical factor that influences your ability to cool yourself during exercise. When it’s hot out, sweating is the primary means for eliminating heat generated by contracting muscles, and sweat rates of 34–85 fl oz per hour (1.0–2.5 liters per hour) or more are common. However, for this cooling mechanism to function optimally, the fluids you’re losing as sweat need to be replaced. The problem is that during exercise, you typically don’t feel a sensation of thirst until after you’ve lost 1–2% of your body weight as fluid. That equates to 1.5–3.0 lbs. of fluid for a 150-pound athlete (0.68–1.36 kg for a 68-kg athlete). With that amount of fluid loss, you’re already in the throes of dehydration; your body’s ability to cool itself is undermined because dehydration results in decreased blood flow to the skin and a lower sweat rate. Thus, both mechanisms for thermoregulation are compromised when you’re running low on fluids.

**Navigate Heat and Humidity: Acclimate First**

Fortunately, there are strategies you can employ to help you stay cool when training or competing in hot, humid weather. Acclimating to the heat is an important one. You can acclimate to the heat by regular exposure to hot environments. A key adaptation that occurs with heat acclimation is an increase in the volume of fluid that circulates in your body. With more fluid available, the heart pumps more fluid with each beat, and this leads to a lower heart rate during exercise. In addition, less sodium is excreted in sweat and urine. The extra sodium retained in your body is useful in maintaining an appropriate sodium concentration in the blood when the fluid volume expands. Interestingly, a low-sodium diet seems to impair the body’s ability to expand fluid volume. So if you’re trying to acclimate to the heat, make sure you’re consuming adequate sodium. Two other critical adaptations include the onset of sweating at a lower core temperature and a higher sweat rate. The increase in fluid volume and lower heart rate occur within about 3–6 days of daily heat exposure. The decrease in sweat and urine sodium takes about 5–10 days, and the increase in sweat rate and the lower temperature threshold for the onset of sweating and dilation of blood vessels in the skin occur in 1–2 weeks. Training sessions of about 100 minutes in hot conditions are most effective for inducing heat acclimatization, and there is no advantage to spending additional time in the heat. Also, exercising in the heat every third day for 30 days is the acclimatization equivalent of exercising every day for 10 days. Keep in mind that heat acclimatization is not permanent. Effects gradually disappear if they are not maintained by repeated exposure to heat. Adaptations start to disappear in about a week and are mostly gone within 30 days. Also, adaptations to dry heat seem to endure longer than adaptations to the combination of heat and humidity. Finally, the better trained you are endurance-wise, the faster acclimatization occurs and the longer the effects are sustained. So if you have a big competition coming up in extreme weather conditions, plan your training accordingly.

**Other Important Heat/Humidity Strategies**

**Timing of Competitions**

If there is an option for a lower-temperature or lower-humidity time of day to compete in, take advantage of it. If a competition is scheduled for smack-dab in the heat of the day, talk to event organizers and see if the time can be changed to early morning or evening when conditions are more bearable. Encourage your fellow athletes to support you. Clothing Clothing worn while exercising becomes a layer of insulation that interferes with heat transfer from your skin to the environment. It can also hinder the evaporation of sweat, which is the most important route for eliminating heat when it’s really hot outside. So as a practical matter, minimize the amount of clothing you wear in hot weather conditions, and make sure it poses the least amount of interference to evaporation. Fluids You might guess that adapting to the heat would decrease your need for fluids, but in reality, the opposite is true. Because you sweat...
sooner and at a faster rate when you’re acclimated to the heat, your fluid needs are higher. Researchers have found that after dehydration takes hold, core body temperatures are the same, whether or not you’ve acclimated to the heat beforehand. So, all those hard-earned advantages of heat acclimation are wiped out if you become dehydrated. To stay hydrated during exercise, it is the recommendation of authorities such as the American College of Sports Medicine that athletes consume fluids at a rate that closely matches sweat rate. This suggests fluid intake along the lines of 13-26 fl oz (400–800 mL) for every hour of exercise, preferably taken frequently in smaller amounts, such as 3-7 fl oz (100–200 mL) of fluid every 15 minutes. However, fluid needs can vary considerably. Determining your sweat rate is the best approach. It’s really quite simple, and it’s important to calculate your sweat rate for the various environmental conditions you will encounter, including hot and humid conditions. Opt for a Sports Drink. Water is fine for exercise of an hour or less in cooler weather. However, for endurance exercise, and especially in the heat and humidity, a sports drink that provides carbohydrates, fluids, and sodium is a much better option than plain water. The advantages are many. First, a sports drink provides carbohydrates to fuel your muscles. Second, athletes freely consume more fluids when their hydration beverage is flavored, as is the case with a sports drink. Third, sodium and carbohydrates in a sports drink cause the fluid in the beverage to be absorbed more quickly. The sodium also helps maintain your drive to continue drinking fluids during exercise, which is crucial to meeting your fluid needs. Finally, the sodium also helps you retain the fluid that you’ve consumed. Conversely, drinking plain water doesn’t refuel muscle, it tends to satisfy your thirst before your fluid needs have even been met, and it can lead to the elimination of fluids, via urination, even though you’re still not fully rehydrated.

**Beating the Heat**

In summary, if heat and humidity are in your summer training or competition plans, plan to acclimatize to the conditions. Do that by training in a hot environment for about 100 minutes daily for 10 days. Full adaptation usually takes place within about a week or two. Wear minimal clothing in the heat and make sure the clothes you do wear don’t interfere with the evaporation of sweat. Avoid dehydration by consuming fluids at a rate that closely matches your sweat rate. And finally, stay hydrated with a well-designed, good-tasting sport drink that features sodium and carbohydrates. Following these strategies gives you the best shot at beating the heat.

References: