Hot But Not Bothered

August in South Carolina is hot and humid. NATA Hall of Famer Rod Walters explains how he helps the Gamecocks beat the preseason heat.

By Dr. Rod Walters

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It is widely recognized that athletic trainers who spend any amount of time operating in hot weather should have a plan to prevent heat illness. Whether you are in Maine, California, or somewhere in between, preseason practice on a summer day can lead to heat-related problems for any team.

Here at the University of South Carolina, we have a lot of experience dealing with hot, humid weather. Over the years, we have developed a plan for working with individual athletes to identify signs of heat illness, maintaining hydration levels, and monitoring environmental stresses. This preventative maintenance helps us beat the heat without sacrificing practice time.

One Athlete at a Time

A key component to our prevention program is understanding that every student-athlete is at risk for heat illness and needs to be examined and counseled individually. This process starts with our preparticipation medical examination, where we evaluate each athlete's risk for heat illness (along with their overall health). We identify those student-athletes with signs of increased potential for heat-related problems, whether it be a less-than-optimal fitness level, history of sensitivity to heat illness, or previous illness. We then monitor these at-risk players very carefully and act on any abnormal or concerning signs.

We also look for salty sweaters—those who lose an excessive amount of sodium while working out. These athletes typically leave a white residue on their uniforms and equipment after their perspiration dries. Researchers who study water loss in athletes recommend that these athletes be prehydrated to greater levels. Therefore, we provide them with an enriched sodium drink prior to practice and engage in aggressive hydration treatments during and after participation.

Each student-athlete is also counseled individually by the athletic training staff regarding heat concerns. We ask them about any prescriptions, supplements, and energy drinks they may consume, and encourage them to avoid drinking alcohol during preseason. Athletes are also advised to refrain from excessive use of cold medications or other medications that may produce diuretic activities since this can increase the risk of heat-related problems.

Student-athletes are also encouraged to report all injuries and illnesses to the athletic training staff as they happen and are told that failure to do so can increase the chance of heat illness. We explain that in order for us to keep them safe, they need to do their part by communicating with us.

Acclimatization can also be a concern with some athletes. We generally have each of our student-athletes, including incoming freshmen, on campus for a minimum of one summer school session. Being here over the summer allows our athletes to practice in extreme heat and humidity and become acclimatized to those conditions before engaging in team preseason activities.

Water Everywhere

Of course, the number-one tool to prevent heat-related problems is hydration. We conducted a water-turnover study among our football players and observed huge losses—as much as 24 pounds of lost fluid in a day. Players were studied during two-a-day practices in August, and we found that during a 24-hour period, players were turning over about 11 liters (almost three gallons) of fluid. This occurred day-in and day-out for five days straight. The study revealed players in the 200- to 300-pound range perspire the most and really need to focus on replacing fluids and

electrolytes.

Based on those findings and my experience, I emphasize the importance of electrolyte replacement, especially sodium. Assuming that a player has a normal sweat sodium content of around 40 mEq/L and loses 11 liters of fluid in a day, that's 440 mEq of sodium lost each day. We know this equates to 10 grams of sodium, the equivalent of 25 grams of sodium chloride. Under these circumstances, an athlete will quickly run into a sodium deficit if he or she is drinking only water to hydrate. Therefore, we use sports drinks that have a higher sodium content than water. We also like sports drinks because of their nutritional value and because we see them as an attractive alternative to caffeinated beverages.

Constant fluid replacement is a major message from our athletic training staff. Sports drinks and water are placed within an arm's reach throughout our facilities. Those beverages are available at the practice fields, and in the locker rooms, athletic training room, dining halls, dormitories, and meeting rooms. Players are encouraged to drink at least 16 ounces during each meeting and before and after each practice session.

During football practice, portable water dispensers are located next to each position group, and any athlete who wants a quick drink may get one at any time he is not actively participating in a drill. In addition, fluid breaks are worked into each practice and strictly enforced. An athletic training student is assigned to each of the position groups, making copious amounts of cooled water and sports drinks available to each player.

Student-athletes also need to be educated about monitoring their pre- and post-exercise weight on a daily basis. Any weight loss greater than four percent needs to be replaced prior to leaving the locker room. Furthermore, before working out again, their weight should be within two percent of the previous day's, and we identify each athlete's target body weight on a weekly basis.

Along with hydration tips, athletes are given instruction in proper nutrition to help them prevent heat illness. During football preseason two-a-days, all players are required to eat breakfast, lunch, and dinner on campus. Additionally, in the evening, a snack is provided after the last meeting and a carbohydrate-protein supplement is provided following strength training workouts.

We also try to schedule meals in a way that encourages sufficient fluid and food replacement. Traditionally, athletes have meals shortly after practice. However, when we ask them to rehydrate immediately after practice, they often feel waterlogged and not as hungry when they sit down to eat. As a result, we try to schedule meetings or rest times immediately after practice, then meals an hour or more later. This allows athletes' hunger to peak as they sit down to eat, providing a higher-quality fueling session.

Understand the Environment

We can't turn down the sun's intensity, but we do look at the time of day we practice. For football, we try to avoid the hottest part of the day—typically between 11 a.m. until 4 p.m. The NCAA's practice guidelines for Division I football, implemented in 2003, have greatly assisted with this. If two practices are held on one day, only one practice is allowed the following day. We generally practice early in the morning and later in the evening on days we practice twice, and we only practice in full pads once a day.

Even with those types of limitations in place, it is critical that athletic trainers monitor environmental stress and communicate this information and their recommendations to coaches prior to each practice. We monitor the weather conditions using the Wet Bulb Globe Thermometer (WBGT) and apply those readings to the protocol adapted from the United States Marine Corps guidelines (see "How Bad Is It?" below). The WBGT was developed in the late 1950s for the Marine Corps Recruit Depot on Parris Island, S.C. It was later adopted universally by researchers as a heat-stress index. It is often used in occupational safety and health guidelines for working in hot environments and has been advocated for use in sports.

The first temperature (Tg), which represents the integrated effects of radiation and wind, is measured by the device's black globe thermometer. A second thermometer measures the natural wet-bulb temperature (Tnwb). This thermometer consists of a bulb covered with a wet cotton wick that is fed distilled water. Evaporation from the wet bulb cools the thermometer, which then measures the integrated effect of humidity, wind, and radiation. The final temperature element is the air temperature (Ta). It is measured by a thermometer shielded from radiation by a weather screen. It is the standard temperature that you usually see quoted in television weather reports and forecasts. The three

measurements, Tg, Tnwb, and Ta, are combined into a weighted average ((Tnwb*0.7) + (Tg*0.2) + (Ta*0.1)) to produce the WBGT.

We use this standard to adjust practice times based on environmental stressors, and we rely on it to make recommendations to our coaches regarding work-to-rest intervals during workouts. The higher the WBGT index, the greater the need for rest and recovery and the more aggressive we need to be with hydration tactics.

Although the index gives us a good idea of the dangers presented by environmental factors, we take further precautions during football sessions by increasing our index by 10 to account for the equipment the players wear. And we generally use this guide only for athletes who are in good condition, acclimatized, and exercising in situations with adequate medical supervision (which includes primary care physicians, certified athletic trainers, and athletic training students working in union to provide emergency care). If athletes have lower levels of conditioning or are not acclimatized, or if the medical staff is limited, guidelines presented in the table from the “National Athletic Trainers’ Association Position Statement: Exertional Heat Illness” are usually followed.

On The Lookout

In the event a student-athlete presents with symptoms of heat related illness, aggressive steps are taken to assess his or her medical status and provide the appropriate treatment. Any altered level of consciousness, general fatigue, or other symptoms are noted. Core body temperature assessment (rectal monitoring) is recommended, and those with temperatures above 103 degrees are submerged in a cold-water tank. The athlete is monitored while in the tank, and removed from the water when their temperature lowers to 101. This procedure allows aggressive treatment in the event the condition progresses to heat stroke.

Here are more details on how we treat heat-related illnesses:

Heat cramps: Fluids must be replaced to resolve cramps. Therefore, we start by reestablishing normal hydration status and replacing sodium losses. Next, we stretch and massage the involved muscles to help reduce the acute pain of the cramp.

Heat exhaustion: We remove athletes from activity and take them to a shaded or air-conditioned area, removing excess clothing and equipment. We then:

• Assess body temperature rectally. Those with temperatures above 103 degrees are placed in a cold-water tank.

• Keep athletes in the tank until rectal temperature is less than 101 degrees. We then lay them comfortably with legs propped above heart level.

• Rehydrate athletes orally with cool water or sports drinks, if they can tolerate fluids. If athletes can’t tolerate oral fluids, physicians may use intravenous normal saline.

• Monitor heart rate, blood pressure, respiratory rate, core temperature and central nervous system (CNS) status.

• If rapid improvement is not seen, we transport the athlete to an emergency medical facility.

Exertional heat stroke: We start by removing the athlete’s clothing and equipment and immediately immersing him in cold water (approx. 60 degrees). If cold-water immersion is not possible, we move him to a shaded area or air-conditioned facility and begin alternative cooling strategies such as spraying the body with cold water, placing ice bags on the neck and groin, or applying ice over the entire body. We then:

• Call 911
• Closely monitor ABCs, core temperature, and CNS status.
• Place an intravenous line using normal saline (if medical staff is available).
• Cease aggressive cooling when core temperature drops to 101 degrees.
• Transport to a medical facility.

Communication

The final piece of the puzzle in preventing heat illness is communication. We let athletes know the dangers of not hydrating—and how it can decrease their performance. When they see all the steps we take, they start to understand the seriousness of getting fluids into their bodies.

Of course, communication with coaches is also vital. We provide them with the actual measures of heat and propose breaks based on what is scheduled for that practice. In terms of long-range planning, we discuss ideal practice times to minimize heat exposure while maximizing exercise.

When everyone is on board with hydration and preventing heat illness, the results are less risk to athletes and better workouts. Sometimes, it takes a lot of small steps to get everyone together, but each is a giant leap in making everyone safer.

To download a PDF of the NATA's position statement on exertional heat illnesses, go to: www.nata.org/publicinformation/files/exertionalheatillness.pdf.

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Sidebar: How Bad Is It?

The Wet Bulb Globe Temperature (WBGT) index, developed by the United States Marine Corps, provides a way to account for air temperature, humidity, sunlight, and wind when determining the risk of heat illness. At the University of South Carolina, we use the following chart to determine how to limit activities based on the WBGT Index.

WBGT Index (Degrees Fahrenheit) 80-84.9
Flag Color . . . . . .Green
Heat Condition . . . . . .Heavy exercises for unacclimatized personnel will be conducted with caution and under constant supervision.

WBGT Index (Degrees Fahrenheit) 85-87.9
Flag Color . . . . . Yellow
Heat Condition . . . . . .Strenuous exercises, such as marching at standard cadence, will be suspended for unacclimatized troops in their first two or three weeks. Outdoor classes in the sun are to be avoided.

WBGT Index (Degrees Fahrenheit) 88-89.9
Flag Color . . . . . Red
Heat Condition . . . . . All physical training will be halted for those troops who have not become thoroughly

acclimatized by at least 12 weeks of living and working in the area. Those troops who are thoroughly acclimatized may carry on limited activity not to exceed six hours per day.

WBGT Index (Degrees Fahrenheit) . . . . . .90 and Above
Flag Color . . . . . Black
Heat Condition . . . . . .All strenuous non-essential outdoor physical activity will be halted for all units.