

U.S. Soccer Federation 2006 Youth Soccer Heat & Hydration Guidelines



OVERVIEW

The popularity of soccer among American youth is at an all-time high. Nearly 14 million young athletes (13,832,000¹) under the age of 18 play soccer at elite and recreational levels in the United States.

The rapid growth of youth soccer participation in recent years, coupled with an increased need for qualified and certified coaches, has made insuring the safety of youth soccer players more important than ever before. Moreover, new youth soccer research from the University of Connecticut and serious cases of heat illness in the past few years across a variety of sports has prompted the U.S. Soccer Federation to issue an updated version of its "Youth Soccer Heat Stress Guidelines." The aim is to help parents, young athletes and coaches understand one of the most common and most preventable sports injuries – heat-related illnesses, including dehydration, heat cramps, heat exhaustion and heat stroke.

The following information and youth heat stress guidelines provide suggestions for preventing the potentially dangerous and sometimes deadly effects of playing in hot or humid conditions.

PHYSIOLOGICAL FACTORS THAT PUT YOUNG ATHLETES AT RISK

Heat-induced illness is one of the most preventable sports injuries. Parents, young athletes and coaches need to understand the physiological factors that put children and adolescents at risk for heat-related illness and take steps to prevent it.

Exercising children face unique stresses when they perform intense exercise in the heat. Like adults, they may have trouble adapting to the physiological demands of high environmental temperatures when participating in soccer practice and game situations. When a youth is also dehydrated this may exacerbate the response to exercise in the heat.

The physiological/psychological reasons that place children at risk are:

- 1) Children absorb more heat from a hot environment because they have a greater surface-area to body-mass ratio than adults. The smaller the child the faster the heat absorption.⁹
- 2) Children and adolescents may have a reduced ability to dissipate heat through sweating².
- 3) Children and adolescents frequently do not have the physiological drive to drink enough fluids to replenish sweat losses during prolonged exercise^{3,4}.

- 4) Youth athletes may be more easily distracted when occasions allow for them to rest and rehydrate.
- 5) Some youth athletes may be under intense pressure to make a competitive squad and may not want to report feelings of heat distress or take the appropriate amount of time to rehydrate.

FACTORS THAT PUT YOUNG SOCCER PLAYERS AT RISK

In addition to physiological considerations, several factors specific to the sport of soccer place young players at risk for heat illness. However, these risks can be reduced significantly with the close attention of medical staff (i.e. athletic trainers), parents, young athletes and their coaches. These soccer-specific factors are:

- 1) Limited stoppage time during matches, with players constantly running and moving.
- 2) Young soccer players can not take advantage of normal stoppages in play for fluid breaks because the rules do not allow, nor are they encouraged to use this time for fluid consumption.
- 3) Games are held outdoors, often in high temperatures and humidity, on large fields that offer little or no shade. Heat radiated by the sun is a major component of heat stress. This issue is complicated by limited access to shaded areas for players between halves or between games.
- 4) Young players fail to drink enough fluids at tournaments and summer camps, where numerous games and practices take place each day.
- 5) Games and practice sessions are often not modified when players are confronted with extreme heat and humidity conditions.

Additional Factors to Consider

- Communication between playing fields and medical tents at tournaments is sometimes insufficient.
- Many teams fail to recognize the need and/or importance of using light-colored, loose-fitting uniforms⁵.
- Referees could be unaware of the need and/or importance of fluid breaks.
- Mental alertness and skill performance decline with dehydration⁶ and could be a factor in injuries occurring late in matches and training sessions.

HEAT ILLNESS PREVENTION TECHNIQUES

Acclimatization to the heat is an important factor in preventing heat illness. The rate of acclimation for children is slower than that of adults⁷. A child needs as many as 8 to 10 days (45-60 minutes/day) in the new climate to acclimate sufficiently. Such exposures can be taken at a rate of one per day or one every other day. A majority of the benefits of acclimatization occur in the first 4-6 days and hence this should be an absolute minimum amount of time provided to children before intense practice and game situations are enacted. During the acclimation process, it's important to drink adequate amounts of fluid to build blood plasma volumes.

When a child becomes heat acclimated, the child's sweat rate and total sweat losses increase because they begin to sweat sooner and produce more sweat than before becoming acclimated. This allows the child to dissipate more body heat into the environment through sweat evaporation. When a child becomes acclimated and the child's sweat rate increases, it's important the child drink sufficient fluids to replace the increased sweat losses and stay hydrated. Medical staff, parents, players and coaches must understand that thirst is not a good indicator of a child's fluid needs², so children need to drink on a schedule (see FLUID GUIDELINES below).

Children must wear clothing that is light-colored and lightweight to facilitate evaporation of sweat. Parents and coaches should encourage breaks in a shaded area whenever possible, especially during tournaments, multi-game and multi-practice days. It's important to be aware of high temperatures and humidity and change practice and game times to cooler portions in the day, such as morning and dusk. Additionally, competitive rules need to be relaxed during hot weather playing conditions by allowing a 5-minute break in the middle of each half and allowing water bags to be carried by players during play. Practices must be modified based on conditions. Add rest breaks to lower core temperature and provide ample time to rehydrate.

ACTIVITY RESTRICTIONS FOR OUTDOOR PHYSICAL CONDITIONING IN HOT WEATHER

WBGT* °C (°F)	Flag Color	Guidance= for non-acclimatized personnel in boldface Guidance for fully acclimatized personnel in italics
<78.0°F	No flag	Extreme exertion may precipitate heat illness <i>Normal activity</i>
78.0°F – 82.0°F	Green	Use discretion in planning intense exercise <i>Normal activity</i> Pay special attention to at-risk individuals in both cases.
82.1°F – 86.0°F	Yellow	Limit intense exercise to 1 hour, limit total outdoor exercise to 2.5 hours <i>Use discretion in planning intense physical activity</i> Pay special attention to at-risk individuals in both cases. Be on high alert: watch for early signs and symptoms in both cases.
86.1°F – 89.9°F	Red	Stop outdoor practice sessions and outdoor physical conditioning <i>Limit intense exercise to 1 hour, limit total outdoor exercise to 4 hours (Be on high alert: watch for early signs and symptoms throughout)</i>
≥ 90°F	Black	Cancel all outdoor exercise requiring intense physical exertion <i>Cancel all outdoor exercise involving intense physical exertion</i>

*WBGT: wet bulb globe temperature

Calculation of WBGT: $0.7 T_{wb} + 0.2 T_{bg} + 0.1 T_{db}$, where T_{wb} : wet bulb temperature; T_{bg} : black globe temperature; T_{db} : dry bulb temperature

=Guidelines assume that personnel are wearing summer-weight clothing; all activities require constant supervision (i.e. via athletic trainer) to assure early detection of problems. The athletic trainer and team physician must decide if these guidelines are too general or conservative for the geographical region in which the practice or event is taking place. It is very appropriate to modify based on regional considerations and unique circumstance.

Modified from: Nunnally, SA & Reardon MJ. Prevention of heat illness. In: *Medical aspects of harsh environments: Volume I*. Pandolf, KB and Burr RE (Eds). TMM Publications, Washington, DC. 2002, pages 209-230.

FLUID GUIDELINES

The U.S. Soccer Federation provides these guidelines to help parents, players and coaches prevent dehydration and heat illness in young athletes who are active in the heat:

- 1) Weigh each child before and after activity to determine how much fluid he or she loses during activity⁹. If an athlete is lighter after activity then encourage a little more fluid consumption during the next practice/game. If the athlete is heavier after activity then encourage a little less fluid during the next practice/game.
- 2) According to the American Academy of Pediatrics¹⁰:
 - Before prolonged physical activity, the child should be well hydrated.
 - During the activity, periodic drinking should be enforced even if the child does not feel thirsty and each 20 minutes the child or adolescent should consume:
 - 5 ounces of fluid for a player weighing 90 lbs or less
 - 9 ounces of fluid for a player weighing more than 90 lbs.

Supporting research states:

- To ensure that the child is not dehydrated before the start of the practice session or game, the child should drink 12-16 ounces of fluid approximately 30 minutes before getting to the field.
- Once the activity is over, players should drink water or a sports drink every 20 minutes for an hour

* Recent research¹¹ shows that adolescent males typically lose 1-1.5 liters per hour when performing intense soccer practices/games in the heat, while younger males and females will lose from .6 to 1 liter per hour.

- 3) Teach the youth soccer player to monitor his/her own hydration status with the following tip: If their urine (as it flows, not when diluted in the bowl) is a pale yellow like lemonade then they are likely pretty well hydrated. If their urine is dark yellow like apple juice then they are likely dehydrated. This is an easy and accurate way to assess hydration status and it gets the kids involved on a personal level.

Urine Color Chart

- 4) Kids need to drink enough of the right fluids to replenish fluid losses during activity.
 - Flavored beverages that contain sodium (sports drinks) are preferable because the child may drink more of them.
 - Research shows that lightly sweetened and flavored non-carbonated beverages, like sports drinks, are preferred during exercise and are consumed in greater volumes than water⁹, diluted fruit juice¹⁰ or carbonated beverages¹².
 - Research shows that fluids containing sodium chloride (sports drinks) increase voluntary drinking by 90%, compared to drinking plain water³.

5) In addition to replacing fluid, children also need to replace the electrolytes, such as sodium, lost through sweat. Electrolyte replacement is important to stimulate an adequate thirst mechanism¹³, help the body hold on to fluid¹⁴, help prevent muscle cramps¹⁵ and to maintain sodium levels in the blood¹⁶.

6) Fluids children should avoid immediately before and during activity include fruit juices, carbonated beverages, caffeinated beverages and energy drinks.

- Fruit juices have a high sugar content, which can slow fluid absorption and cause upset stomach¹⁷ and lack sodium.
- Carbonated beverages, such as soft drinks, can reduce voluntary drinking due to stomach fullness and throat burn when gulping¹⁸ and lack sodium.
- Energy drinks should be avoided because many contain caffeine and have high carbohydrate concentrations, which slows the emptying of fluids from the stomach²⁰.

7) Be sure that each child has his/her own beverage container and that they have the opportunity to keep it cool during the practice. An individual container will allow them to monitor fluid consumption more accurately, can be filled with beverage of personal preference, will help avoid the spread of germs and viruses and the cool fluid will be replenished at a better rate than a container that sits out in the sun.

Additionally, it is important to note that dehydration also hinders exercise performance. So to maintain the same level of intensity while dehydrated the athlete will have to work even harder to keep up with everyone else.

SIGNS OF DEHYDRATION AND HEAT ILLNESS^{21,22}

If dehydration progresses unchecked, the risk of heat illness increases. Heat illness is best understood in three separate degrees of severity: heat cramps, heat exhaustion, and the most serious form, heat stroke. The symptoms outlined below are not always additive and do not necessarily occur in progression. This means a young athlete could experience heat stroke in absence of other indicators.

Dehydration

Dehydration during exercise is a common problem. Some young athletes can begin to suffer the consequences of dehydration if they become dehydrated by just 2 percent of their body weight during exercise in the heat. That's why it's important to recognize the warning signs:

- Greater fatigue for same activity
- Thirst
- Dry lips and tongue
- Irritability
- Lack of energy
- Nausea
- Headache
- Muscle cramping
- Red, flushed face
- Dark yellow urine (or no desire to urinate)
- Dizziness

Treating the symptoms of dehydration is crucial in preventing more serious conditions such as heat exhaustion.

- 1) Have the child rest in a cool place
- 2) Provide a sports drink that contains electrolytes
- 3) Prevent dehydration in the future by insuring the child consumes fluids before, during and after exercise (educate and allow ample time to rehydrate)

Muscle Cramping

Muscle cramping can be associated with exposure to excessive heat. Painful involuntary whole-body muscle cramps are often associated with loss of fluids and electrolytes. Some of the signs and symptoms of muscle cramps include:

- Muscle spasms
- “Knotting” of muscles and muscle pain
- Excessive sweat loss
- Excessive saltiness of sweat over the skin or visible dried salt on the skin
- Excessive dehydration

To treat a young athlete suffering from muscle cramps:

- Have them drink fluids with electrolytes, like a sports drink
- Gently stretch and massage cramped muscles
- Have them rest in a cool, shaded area
- Apply ice to the cramped area
- Consider additional sodium in palatable food source

Heat Exhaustion

As a child becomes dehydrated, the likelihood of heat exhaustion may increase if left untreated. Eventually, fatigue and exhaustion occur because the cardiovascular system can no longer support exercise and core body temperature control at the same time. Common symptoms of heat exhaustion are:

- Dizziness & Fatigue
- Cold, clammy skin
- Feeling chilly
- Rapid pulse

Treatment of heat exhaustion is similar to that of dehydration and should take place immediately. This treatment includes:

- Rest the child in a cool, shaded area
- Drink a sports drink that contains electrolytes
- Have the child lie down with legs elevated to promote circulation
- Athlete should begin to feel better relatively soon, if not, assume heat stroke

Heat Stroke

Heat stroke is a medical emergency, when it is not recognized promptly and treated properly it can result in death. Exertional heat stroke occurs when the thermoregulatory system is overwhelmed and/or fails to act in an appropriate manner. At this point, damage to critical organs can occur if the organs remain overheated for an extended period of time, hence the need for rapid cooling. If rapid cooling does not occur the cellular damage to the organs could be extreme and have fatal consequences. Symptoms and results of heat stroke include:

- Very high core body temperature (measured rectally - do not use oral, axillary, tympanic, temporal artery, etc, these other modes are not valid immediately following intense exercise in the heat²³.)
- Altered CNS function (i.e. confusion or unconsciousness or altered mental status, feeling out-of-sorts, extreme lethargy)
- Otherwise healthy athlete collapses during intense exercise in the heat

If an accurate temperature can not be obtained then rely on CNS function. Relying on an inaccurate temperature device could delay treatment. Remember athletes get better relatively quickly with heat exhaustion and they get worse with heat stroke. The important thing to remember is that heat stroke must be treated immediately by doing the following:

- **SEEK MEDICAL ATTENTION IMMEDIATELY** (always transport a suspected exertional heat stroke to the hospital! Cool them while waiting for transport and finish cooling on-site if adequate medical personnel is available on-site, i.e. athletic trainer or physician)
- Immediately cool the victim down by whatever means possible
 - An ice bath is preferable due to the superior cooling rates
 - Ice packs over as much as body as possible
 - A cool shower
 - Cool, wet towels
 - Water spray

Do not provide fluids since nausea and vomiting are extremely common. Remove from cooling source when temperature is lowered to 102 degrees F.

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REFERENCES

- ¹ Sporting Goods Manufacturers Association. *National Soccer Participation Survey*, 2003.
- ² Bar-Or, O. Temperature regulation during exercise in children and adolescents. In: Gisolfi C, Lamb DR, eds. *Perspectives in Exercise Science and Sports Medicine, II*. Youth, Exercise and Sport. Indianapolis, IN: Benchmark Press; 1989, 335-367.
- ³ Wilk B. and O. Bar-Or. *J Appl Physiol*, 80: 1112-1117, 1996.
- ⁴ Rivera-Brown, A. et al. *J Appl Phys* 86: 78-84, 1999.
- ⁵ Murray R. Dehydration, hyperthermia, and athletes: science and practice. *J Athl Train* 31: 248-252, 1996.
- ⁶ Gopinathem, P.M. et al. *Arch Environ Health* 43:15-17, 1998.
- ⁷ Inbar, O. *Acclimatization to Dry and Hot Environment in Young Adults and Children 8-10 Years Old*. New York, NY: Columbia University; 1978 Dissertation.
- ⁸ Yeargin S.M., Casa D.J., Decher N.R., McCaffrey M.A., Levreault M.L., Cross C.L., James C.T., O'Connor C.B., Psathas E. Youth's perception of thirst is not a valid indicator of hydration status. *Journal of Athletic Training*. 40(2S):S20, 2005.
- ⁹ American Academy of Pediatrics. *Pediatrics* 106:158-159, 2000.
- ¹⁰ Passe, D. et al. *Appetite* 35:219-225, 2000.
- ¹¹ Ganio M. S., Casa D. J., Yeargin S. W. McDermott B. P., Levreault M. L., Decher N. R., Watson G, Casa T. M., Huggins R. A. Sweat rate, fluid consumption, and hydration indices for youth soccer players: effects of educational intervention. *Medicine and Science in Sports and Exercise*. 38(5S), 2006.
- ¹² Passe, D. et al. *Int J Sports Nutr* 7:286-297, 1997.
- ¹³ Nose, H. et al. *J Appl Physiol* 65:325-332, 1988.
- ¹⁴ Maughan, R.J. and Leiper J.B. *Eur J Appl Physiol* 71:311-319, 1995.
- ¹⁵ Bergeron, M.F. *Int J Sports Nutr* 6:62-68, 1996.
- ¹⁶ Vrijens, D.M.J. and N.J. Rehrer. *J Appl Physiol* 86:1847-1851, 1999.
- ¹⁷ Davis, J.M. et al. *Eur J Appl Physiol* 57:563-569, 1988.
- ¹⁸ Ploutz-Snyder, L. et al. *Eur J Appl Physiol* 79:212-220, 1999.
- ²⁰ Murray, R. et al. *Int J Sports Nutr* 7:144-153, 1997.
- ²¹ Epstein, Y. *Am J Med Sports* 2:143-152, 2000.
- ²² Watts, S. *Am J Med Sports* 3:286-293, 2001.
- ²³ Becker S. M. Casa D. J., Brown C. M., Yeargin S. W., Ganio M. S., Roti M. W., Boots L. M., Huggins R. A., Armstrong L. E., Maresh C. M. Examining the validity of devices that assess body temperature during outdoor exercise in the heat. *Journal of Athletic Training*. 41(2S), 2006.