

U.S. Soccer Federation Youth Soccer Heat Stress Guidelines



OVERVIEW

The popularity of soccer among American youth is at an all-time high. According to the latest 2000 statistics from the Sporting Goods Manufacturers Association (SGMA), 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, a rash of well-documented cases of heat illness in the past year across a variety of sports has prompted the U.S. Soccer Federation to issue the following information and guidelines to parents, young athletes and coaches for one of the most common and most preventable sports injuries – heat-related illnesses, including dehydration, 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 do not adapt to hot weather as effectively as adults when exposed to high climatic heat stress, which makes them more susceptible to heat illness when they are active in the heat and dehydrated. The physiological reasons that place children at risk are:

- 1) Children and adolescents absorb more heat from the environment because they have a greater surface-area to body-mass ratio than adults. The smaller the child the faster the heat absorption.
- 2) Children and adolescents have a reduced ability to dissipate heat through sweating².
- 3) Children and adolescents produce more metabolic heat during physical activity².
- 4) Children and adolescents frequently do not have the physiological drive to drink enough fluids to replenish sweat losses during prolonged exercise^{3,4}.

FACTORS THAT PUT YOUNG SOCCER PLAYERS AT RISK

In addition to physiological considerations, several factors specific to the sport of soccer place children at risk for heat illness. However, these risks can be reduced significantly with the close attention of 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 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 importance of using light-colored, loose-fitting uniforms⁵.
- ✓ Referees could be unaware of the importance of fluid breaks.
- ✓ Mental alertness⁶ and skill performance decline with dehydration and could be a factor in injuries occurring late in matches and training sessions.

HEAT ILLNESS PREVENTION TECHNIQUES

Acclimation 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 exposures (30-35 minutes each) to the new climate to acclimate sufficiently. Such exposures can be taken at a rate of one per day or one every other day. During the acclimation process, it's important to drink adequate amounts of fluid to build blood plasma volumes. Kids who are not acclimated are at greater risk for heat illness than those who have become *heat acclimated*.

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. Parents, players and coaches must understand that thirst is not a good indicator of a child's fluid needs, so children need to drink on a schedule (see FLUID GUIDELINES).

Children must wear clothing that is light-colored and lightweight to facilitate body cooling. 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.

According to National Weather Service information on Heat index/Heat disorders, which relates ranges of heat index (temperature and humidity) with specific disorders, the temperature and humidity conditions outlined below place people at risk for the corresponding conditions:

| Heat Index | Possible Heat Disorders for People in High Risk Groups |
|-----------------|---|
| 130°F or higher | Heat stroke highly likely with continued exposure. |
| 105° - 130°F | Heat stroke, heat cramps or heat exhaustion likely with prolonged exposure and/or physical activity. |
| 90° - 105°F | Heat stroke, heat cramps and heat exhaustion possible with prolonged exposure and/or physical activity. |
| 80° - 90°F | Fatigue possible with prolonged exposure and/or physical activity. |

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 children before and after activity to determine how much fluid they lose during activity⁸.
- 2) The following has been adapted from the American Academy of Pediatrics policy statement⁹ on heat stress:
 - ✓ 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
 - ✓ 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, drinking every 20 minutes should be carried on for one hour.
- 3) 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 water¹⁰, diluted fruit juice¹¹ or carbonated beverages¹².
 - Research shows that fluids containing sodium chloride (sports drinks) increase voluntary drinking by 90% and prevent dehydration compared to drinking plain water³.
- 4) In addition to replacing fluid, children also need to replace the electrolytes, such as sodium, lost through sweat. Electrolyte replacement is important to stimulate a child's thirst mechanism¹³, help the body hold on to fluid¹⁴, help prevent muscle cramps¹⁵ and to maintain sodium levels in the blood¹⁶.
- 5) Fluids children should avoid immediately before, during and shortly after 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.
 - ✓ Carbonated beverages, such as soft drinks, can reduce voluntary drinking due to stomach fullness and throat burn when gulping^{12, 18}.
 - ✓ Caffeinated beverages have a mild diuretic effect and therefore could promote dehydration by increasing urine production¹⁹.
 - ✓ Energy drinks should be avoided because many contain caffeine and have high carbohydrate concentrations, which slows the emptying of fluids from the stomach²⁰.

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 suffer serious problems 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:

- Thirst
- Dry lips and tongue
- Irritability
- Lack of energy
- Dizziness
- Nausea
- Headache
- Muscle cramping
- Red, flushed face
- Dark yellow urine

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 ensuring the child consumes fluids before, during and after exercise

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

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

Heat Exhaustion

As a child becomes dehydrated, heat illness may progress to heat exhaustion 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
- ✓ Cold, clammy skin
- ✓ Feeling chilly
- ✓ Rapid pulse
- ✓ Fatigue

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

Heat Stroke

Much like a spinal injury, heat stroke is an athlete's worst nightmare because it can result in death. In contrast to heat exhaustion, which indicates a cardiovascular limitation, heat stroke represents a failure of the central nervous system. At this point, the body loses its ability to dissipate heat and cool itself, causing damage to critical organs which can lead to death. Symptoms and results of heat stroke include:

- ✓ Very high core body temperature
- ✓ Dry, hot skin and the inability to sweat. In some people, however, sweating may continue
- ✓ Confusion or unconsciousness
- ✓ Death

The important thing to remember is that heat stroke must be treated immediately by doing the following:

- ✓ **SEEK MEDICAL ATTENTION IMMEDIATELY**
- ✓ Immediately cool the victim down by whatever means possible
 - An ice bath
 - Ice packs place on the groin, neck and armpits
 - A cool shower
 - Cool, wet towels
 - Water spray
- ✓ Provide cold fluids

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REFERENCES

- ¹ Sporting Goods Manufacturers Association. National Soccer Participation Survey, 2000.
- 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 Physiol* 86: 78-84, 1999.
- ⁵ Pascoe, D. D. et al. *Sports Med* 18:94-108, 1994.
- ⁶ Gopinathem, P.M. et al. *Arch Environ Health* 43:15-17, 1988.
- 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 Gatorade Sports Science Institute, Sports Science Exchange Roundtable 39: *Maximizing Performance and Minimizing Injuries in Soccer*, Volume 11 (2000).
- ⁹ American Academy of Pediatrics. *Pediatrics* 106:158-159, 2000.
- ¹⁰ Passe, D. et al. *Appetite* 35:219-225, 2000.
- ¹¹ Passe, D. et al. *Med Sci Sports Exerc* 31:S322, 1999.
- ¹² Passe, D. et al. *Int J Sports Nutr* 7:286-297, 1997.
- ¹³ Nose, H. et al. *J Appl Physiol* 65:325-331, 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.
- ¹⁹ Gonzalez-Alonso, J. et al. *Int J Sports Med* 13:399-406, 1992.
- 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.