



GUIDELINES FOR PEDIATRICIANS EXERTIONAL HEAT-RELATED ILLNESS

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Exposure to excessive heat and humidity poses special problems for the athlete. Exercising muscle generates 10 to 20 times the heat generated by resting muscle; in addition, radiant heat (from direct sunlight) and reflected heat (from all surfaces, but especially sand or artificial turf) contribute to elevating the body's core temperature. To maintain heat balance, the body shunts blood away from the internal organs to the skin and then uses several mechanisms to dissipate heat. Radiation (transfer of heat to air of lower temperature), conduction (to objects of lower temperature, such as water in a swimming pool), and convection (radiation aided by moving air) are the most important heat-control mechanisms for the body at rest. During exercise at most environmental temperatures, a fourth mechanism, the evaporation of sweat, becomes the most important method for getting rid of excess body heat. In conditions of high environmental temperature, the first 3 mechanisms lose their efficiency, while evaporation of sweat becomes less useful as the environmental humidity rises. Dehydration (even as little as 1%) can interfere with thermoregulation and begin to affect performance. Children are at especially high risk for heat injury.

Heat injury can take many forms. The most common are as follows:

- **Heat Cramps** - These are painful, sustained muscle contractions, most often involving the gastrocnemius and hamstring muscle groups. It is believed they are caused by inadequate blood flow to the exercising muscle. Treatment consists of stopping exercise and beginning oral rehydration. Resting in a recumbent position and gentle massage and stretching of the involved muscles can help increase blood flow and reduce the cramp.
- **Heat Exhaustion** - This occurs in athletes who sweat profusely and experience significant volume depletion. They often have core body temperatures between 38°C (100.4°F) and 40.5°C (104.9°F). Symptoms include nausea, vomiting, dizziness or syncope, weakness, and mild mental status changes (eg, confusion, inattention). Treatment consists of vigorous rehydration with oral fluids (or intravenous fluids if mental status or gastrointestinal problems preclude oral intake). Victims also should be moved to a cooler environment, and measures to cool the body (eg, ice bags to the neck or axilla, cool towels, fanning) should be used. If symptoms do not resolve rapidly, transfer to an emergency medical facility is indicated.
- **Heat Stroke** - This is an *acute medical emergency* caused by an extreme buildup in body heat, with a failure of the body's normal thermoregulatory mechanisms. It manifests with very high core temperature (usually > 40.5°C [>104.9°F] and sometimes > 41.7°C [>107.0°F]). It is life-threatening, with a mortality rate of around 10% despite good medical management. Shock, circulatory abnormalities, disseminated intravascular coagulation, rhabdomyolysis, arrhythmias, and seizures are prominent features. Treatment involves immediate transport to an emergency medical facility. Rapid cooling, close management of circulation and hydration, and intensive multisystem monitoring and support are essential.

Heat injuries are generally preventable with careful attention to event conditions and hydration status. Preexercise hydration and frequent oral fluids during activity should be mandatory when heat and humidity are expected to be high. The normal thirst mechanism is unreliable for determining how much fluid should be consumed; about 120 to 180 mL every 15 to 20 minutes for a 40 kg child is a good starting point. Encouraging parents and coaches to weigh children before and after exercise can determine actual fluid loss and help adjust future fluid needs (2 pounds equals approximately 1 liter of fluid). If fluid replacement has been inadequate (weight loss >5% of body weight), the athlete should be held out of activity until fluid replacement has been completed. Drinks should be chilled to promote gastric emptying and stimulate thirst. Water is a good choice, although providing flavoring and additional electrolytes (ie, sports drinks) may help stimulate thirst and encourage further oral intake.

Limiting activities in times of high heat and humidity can be essential to patient safety. Having outdoor activities take place before 11 AM or after 6 PM can lower the total heat load. The American Academy of Pediatrics policy on "Climatic Heat Stress in the Exercising Child" contains guidelines to determine the relative risk of vigorous activity in different temperature and humidity settings (available at: www.aap.org/policy/098.htm). However, other factors (such as amount and type of clothing or equipment worn, direct sun exposure, and degree of acclimatization to the heat) also should be considered. Working with coaches to adjust practice or game schedules and to ensure frequent breaks for cooling down and hydration is essential for safety.

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Some sports injuries caused by contact or overuse are often accepted risks when a young person plays sports. However, “heat injury,” or illness resulting from excessive exercise in high temperature and humidity, is one type of sports injury that can almost always be prevented with proper attention to safety and common sense.

The 3 most common types of heat injury are:

- **Heat Cramps** – These are painful contractions of the muscles (most commonly leg muscles). Treatment is to stop exercise, gently massage the involved muscle, and drink lots of extra fluids.
- **Heat Exhaustion** – Symptoms include high temperature (up to 104°F), weakness, nausea, vomiting, dizziness, confusion, and fainting. Treatment is to stop exercise, either sit or lie down, and cool down (fanning, cool towels, ice bags, move to shaded or air-conditioned area). Also, giving lots of fluids is essential. If symptoms do not stop quickly, the athlete should be taken to an emergency room right away.
- **Heat Stroke** – This is a life-threatening emergency caused by extremely high temperatures (often higher than 107°F). Athletes can have seizures or go into shock or coma. They should be taken to an emergency room immediately.

Some common-sense rules to ensure safe exercise in the heat are as follows:

- **Fluids** - This is the most important way to prevent heat injury. Parents and coaches need to be sure children drink plenty of fluids before starting any exercise and that they continue to drink during exercise. A good starting point is about 4 to 6 ounces of fluid every 15 minutes for a 90-lb child. You should not depend on your child to tell you how much fluid he or she needs. Recording your child’s weight (without clothes) both before and after exercise can help you determine how much fluid your child needs and help you adjust the next day’s fluid intake. Athletes should weigh about the same before and after any activity. Cold water is fine for rehydration, but flavored sports drinks may stimulate your child to drink more. Fruit juices and soda are not good choices, as they contain too much sugar. Adding small amounts of salt to food is a good way to replace electrolytes, but avoid salt tablets, as they are irritating to the stomach and can be dangerous.
- **Environment** – It is harder for the body to control heat when temperatures are higher than 80°F, especially when the humidity is higher than 70%. Direct sunlight, as well as hot, humid winds, can also increase risk. Parents *and* coaches must be responsible for decreasing or stopping practices or competitions during periods of excessive heat and humidity. Moving practices indoors or to a shady area can help reduce the risk of heat injury to an athlete.
- **Clothing** - Heavy protective equipment or covering too much of the skin can make it more difficult for the body to get rid of excess heat. Clothing should be light-weight and should expose as much of the skin as possible for evaporation of sweat. Wearing a hat can also help.
- **Acclimatization** - This is the process by which the body gets used to exercising in the heat. The first 1 to 2 weeks of practice in hot, humid weather should start light and gradually increase in intensity.
- **Medical Conditions** - Anyone with acute illness (especially fever, vomiting, or diarrhea that can lead to dehydration) should avoid exercising in hot, humid conditions until the illness is completely gone. Children with chronic medical conditions (such as diabetes, cystic fibrosis, kidney disease) should talk to their pediatrician about how to maintain normal hydration. Certain medications (such as cold medicines) can make it harder for the body to get rid of heat and should be used as little as possible. Obesity (being overweight) can greatly increase the risk of heat injury. This is why preseason practice in late summer for larger athletes (such as football players) is especially risky. These athletes should start mild exercise early in the summer and slowly work up to full workouts. Last, anyone with a history of heat injury may be at increased risk for repeated injury and should pay extra attention to proper hydration and rest.
- **Knowledge** - Know the symptoms of heat illness and watch for them in your child. When a player feels confused, dizzy, nauseated, sleepy, or otherwise seems ill during exercise in hot, humid weather, heat illness should be considered. Have the child cool down and start drinking right away. If you do not see quick recovery, take the child to an emergency room. **It could save the child’s life.**

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