



ACSM Sports Medicine Basics

YOUTH SPORTS – MAKING IT SAFE IN THE HEAT



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Playing sports effectively and safely in the heat can be particularly challenging at any age. There has been a long-standing belief that children are less effective than adults in regulating body temperature during exercise in the heat and, consequently, are less capable of performing well in a hot environment. Accordingly, a common concern has been that youth are at greater risk for incurring exertional heat illness compared to adults. More current research, however, does not support this viewpoint, indicating that children (9 to 12 years old) do not have insufficient cardiovascular capacity, less effective thermoregulation or lower exercise-heat tolerance when hydration is sufficiently maintained. Guidelines for youth athletes training and competing in the heat should thus focus on readily modifiable risk factors such as intensity and duration of activity, hydration management and scheduling of play. With the right precautions and adjustments to activity implemented, youth athletes can be safe during practice, training and competition in the heat, have fun and enjoy the health-enhancing benefits of sports.

Hydration

As environmental heat stress (air temperature, humidity and solar radiation), intensity and duration of practice, training or play increase, sweat loss proportionately increases. For young athletes, sweating rates ranging from near 0.5 to 1.0 liter per hour are very common during vigorous activity in the heat. In older

adolescents, the rate of sweat loss can reach or exceed 2.5 liters per hour, especially if it is humid.

Accordingly, youth athletes in many sports can readily incur a significant total body water deficit during practice, training and competition, especially when participating in multiple sessions on the same day over several days in a row. Ready access to water or other drinks and unrestricted voluntarily drinking does not always prevent a significant post-exercise body water deficit, following a long practice, training session or contest. The potential negative effects on cardiovascular and thermal strain and exercise-heat tolerance, performance and safety can be considerable. These consequences underscore how important it is to encourage sufficient fluid intake and optimize hydration status, as this can play an important role in maintaining performance and reducing exertional heat illness risk. Consuming 100 to 250 mL (approximately 3-8 oz.) every 20 minutes for 9- to 12-year-olds and up to 1.0 to 1.5 L (about 34-50 oz.) per hour for adolescent boys and girls during vigorous physical activity in the heat is generally enough to sufficiently minimize body water deficits, so long as pre-activity hydration status is good.

Optimal rehydration, during and after extensive physical activity, often involves more than simply ample water intake. With growth and maturation, a young athlete's

sweat rate increases through the adolescent years. Concurrently, sweat electrolyte losses (particularly sodium and chloride) during sports practice, training and play generally increase as well, due to a larger volume of sweat and a greater sweat sodium concentration. Acclimatization (getting used to) to the heat typically lowers one's sweat sodium concentration; however, sweat sodium losses can still be substantial, even for a young athlete who is well-acclimatized to the heat. With pre- or early pubescent athletes, it is unlikely that a sweat-induced sodium deficit incurred during a single practice, training session or competition bout will be enough to have a significant physiological or performance impact. Thus, a normal diet will typically be sufficient to maintain daily electrolyte balance, even if only water is consumed during these activities. This often is not the case with older adolescents who generally sweat considerably more and can lose via sweating 2000 to nearly 5000 mg of sodium per hour. In these instances, a more deliberate effort to match sodium intake during and between each session or event with individual sweat sodium losses just incurred is imperative. This will help to better retain and distribute the ingested water to all body fluid compartments (i.e., prompt more complete rehydration) and reduce the risk for incurring exertional heat cramps.

Thermal Strain

Even with adequate hydration, a young athlete's metabolic heat production, heat storage and body core temperature will progressively increase during long-term and rapidly rise during vigorous physical activity in the heat. Fortunately, to date, there have been very few reported exertional heat stroke deaths in most youth sports held outdoors, with the stark exception of American football during preseason football practice sessions when there has been an apparent failure to provide an appropriate acclimatization period to the heat, uniform/protective gear and activity—that is, going too hard, too long, with too much uniform! However, extensive thermal strain is routinely observed in young athletes in a variety of other sports as well during hot-weather training and competition.

Repeated-bout Effects and Scheduling Challenges

One of the biggest challenges for a youth athlete to maintain hydration (sufficient water and electrolyte balance), minimize thermal strain and perform optimally is during hot weather two-a-day practices or tournament play, when multiple sessions, matches or games occur on the same day with inappropriately short rest and recovery periods between bouts of strenuous exercise. Not only are there physiological “carry-over” effects from previous same-day strenuous physical activity, following a very long, intense practice or contest, a heavily sweating older adolescent will likely be facing a substantial body water and sodium deficit. But, even with ample hydration and body core temperature returning to baseline before starting the second bout of exercise, these milestones alone are not sufficient to avert greater perception of effort and, for some young athletes, greater cardiovascular and thermal strain during the second and subsequent sessions.

Medical Conditions

There are several notable chronic clinical conditions (e.g., diabetes insipidus, type 2 diabetes mellitus, obesity) and medications (e.g., a dopamine reuptake inhibitor to treat attention-deficit/hyperactivity disorder) that can decrease exercise-heat tolerance and increase exertional heat illness risk. More commonly, many youth athletes practice or compete in the heat with a current or following a recent illness. This can readily increase the risk of participating in vigorous physical activity in the heat because of the potential negative residual effects on hydration status and regulation of body temperature. The risk is especially significant for illnesses involving gastrointestinal distress (e.g., vomiting, diarrhea) and/or fever.

Table 1. Fundamental Factors Contributing to Exertional Heat Illness Risk During Youth Athletic Activities in the Heat.

• A hot and/or humid climate
• Not sufficiently acclimatized to exercising in the heat/humidity
• Not sufficiently acclimatized to the intensity or duration of activity or the uniform/protective equipment
• Excessive physical exertion – intensity, duration or both
• Inappropriate clothing or uniform/protective equipment configuration that promotes excessive heat retention
• Poor hydration status
• Insufficient cardio-respiratory fitness
• Inadequate sleep or rest
• Insufficient rest/recovery time between same-day practice/training sessions or contests
• Overweight/Obesity
• Current or recent illness and other clinical conditions (or medications) that affect hydration status and thermoregulation

Making it Safe

With sufficient preparation and appropriate modification of known readily modifiable contributing risk factors, exertional heat illness during practice and play is usually preventable. Allowing youth athletes to progressively get used to the environment, as well as the intensity and duration of practice/conditioning and uniform/protective equipment configurations is fundamental to health and safety. Sensible modifications of activity, uniform/protective equipment configurations and scheduling of practice/training and play also play a big role in effectively keeping kids safe. Lastly, and very importantly, close monitoring of youth athletes and appropriate prompt response to signs of evolving exertional heat illness are critical priorities for all who oversee and assist with youth participating in sports in the heat.

Key Points

- Education and training on exertional heat illness risks and effective prevention and risk-reduction strategies should be regularly provided and emphasized to youth athletes, coaches, staff and parents
- Youth athletes should be well-prepared prior to participating in any outdoor athletic activity in the heat; this includes being well-hydrated, well-nourished and sufficiently fit and rested
- Progressive acclimatization to the heat—that is, graduated appropriate exposure to a hot and/or humid environment the uniform and protective equipment, and the intensity and duration of practice/training and competition—is essential

- Water and other appropriate fluids should be readily accessible and youth athletes should be given regular opportunities to consume these fluids freely throughout athletic activities
- Outdoor athletic activities in the heat should be appropriately modified for safety in relation to the environmental conditions; this can include lowering intensity and/or duration of activities, increasing frequency and duration of breaks to rehydrate and cool down, minimizing uniform and protective gear, or canceling an activity altogether or rescheduling it to a cooler time of day
- Coaches and tournament/event administrators should provide sufficient rest and recovery time between multiple same-day training sessions and contests
- A written emergency action plan with effective (and practiced in advance!) protocols and on-site readily available trained personnel and facilities for managing all forms of exertional heat illness and other medical emergencies should be in place
- Close monitoring is vital – any significant deterioration in performance or early signs of struggling and developing exertional heat illness should be sufficient reason to immediately stop participation and promptly seek appropriate medical attention for those affected
- Youth athletes also have the responsibility to promptly report to an adult any symptoms or signs of developing exertional heat illness for themselves or their teammates
- Any young athlete experiencing exertional heat illness should not return to practice or competition for the remainder of the current practice/training session, game or match
- While adequate hydration is integral to safety of youth athletes during practice and competition in the heat, many other contributing factors can put children and adolescents at great clinical risk during athletic activities, even if they are well-hydrated (Table 1)

By following these guidelines and putting the emphasis on the kids, most healthy children and adolescents can safely participate in outdoor sports—even when it is hot!

About the Author

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