



Heat-Related Illness and Hydration

As the summer season continues on, heat and humidity remain an issue of concern. Practices in inclement weather, heat cramps, dehydration, and impaired performance are all things you may have already experienced this summer. The purpose of this month's article is to highlight some key points about managing heat-related illness, rules for proper hydration, and recognizing unsafe environmental factors.

Examples of Heat-Related Illness

1. **Heat Cramps:** spasm or cramping of muscle that often occurs in unconditioned individuals or athletes not acclimated to participating in hot, humid environments. Commonly caused by an imbalance between water and electrolytes, excessive sweating, sodium depletion, or a spinal neural mechanism.
2. **Heat Exhaustion:** characterized by sudden, extreme fatigue as the over-exerted body attempts to supply blood to the brain, exercising muscles, and skin. Common causes include: prolonged sweating, inadequate fluid and/or electrolyte replacement, diarrhea, or intestinal infection. If improperly managed, heat exhaustion can progress to heat stroke.
3. **Exertional Heat Stroke: MEDICAL EMERGENCY** that represents the failure and shutdown of the body's thermoregulatory system. After this shutdown, the core temperature continues to rise placing internal organs, most importantly, the brain at risk. If rapid cooling does not occur, all of the body's systems will begin to fail and death can occur within 20 minutes.

Management and Prevention of Heat-Related Illness

For specific treatment recommendations, please see the *Signs and Symptoms of Heat-Related Illness* chart (Figure 3) at the end of this packet.

- Wear clothing that allows heat loss and sweat evaporation
- Reschedule exercise for a cooler time of day
- Relocate exercise to a shady, breezy site or indoors with fans and/or air-conditioning
- Reduce exercise intensity and add rest breaks to maintain the same target heart rate as normally prescribed
- **STAY HYDRATED!**

Dehydration

Maintaining proper hydration plays an integral role in preventing heat illness and performing at an optimal level. Even mild dehydration impairs the body's ability to regulate core temperature and may compromise performance. This becomes even more important in hot and humid environments. Fluids should be readily accessible and athletes should be reminded to drink before, during, and after activity. Adequate hydration is the most effective way to decrease the risk of heat-related illness.

How to Stay Hydrated

Using thirst as a guideline of when to drink is not always sufficient for the athletic population. The National Athletic Trainers' Association (NATA) believes that this advice is misleading for athletes; and, can increase the risk of dehydration and heat illnesses. Research shows that relying on thirst may cause athletes to underestimate fluid needs and replace on average only about 50% of the fluid lost in sweat. Therefore, the NATA recommends athletes drink on a schedule based on their individual sweat rate, regardless of thirst, to ensure that they are replacing sweat losses.

Figure 1: General Hydration Guidelines

Pre-Exercise	Approximately 16-20 ounces, 2-3 hours before activity.
During Exercise	Approximately 28-40 ounces for every hour of exercise.
Post-Exercise	Approximately 16 ounces for every pound lost during exercise. Rapidly replace fluid loss (sweat/urine) within 2 hours of activity to enhance recovery. *

* Weighing in before and after practice can provide accurate fluid replacement needs.

Environmental Factors

Along with proper hydration, recognizing unsafe environmental factors is key in preventing heat-related illness. The Heat Stress Index highlights that despite cooler temperatures, relative humidity can place athletes at increased risk for dehydration and subsequent heat illness. Based on the combination of heat and humidity, coaches may need to alter practice time or location, increase water breaks, modify exercise intensity, and monitor all athletes for early signs of heat-related illness.

Figure 2: Heat Stress Index

		Relative Humidity (%)												With Prolonged Exposure and/or Physical Activity	
		40	45	50	55	60	65	70	75	80	85	90	95		100
Temperature (°F)	110	136	-	-	-	-	-	-	-	-	-	-	-	-	Extreme Danger: Heat Stroke or Sunstroke Likely
	108	130	137	-	-	-	-	-	-	-	-	-	-	-	
	106	124	130	137	-	-	-	-	-	-	-	-	-	-	
	104	119	124	131	137	-	-	-	-	-	-	-	-	-	Danger: Sunstroke, muscle cramps, and/or heat exhaustion likely
	102	114	119	124	130	137	-	-	-	-	-	-	-	-	
	100	109	114	118	124	129	136	-	-	-	-	-	-	-	Extreme Caution: Sunstroke, muscle cramps, and/or heat exhaustion possible
	98	105	109	113	117	123	128	134	-	-	-	-	-	-	
	96	101	104	108	112	116	121	126	132	-	-	-	-	-	
	94	97	100	102	106	110	114	119	124	129	130	-	-	-	Extreme Caution: Sunstroke, muscle cramps, and/or heat exhaustion possible
	92	94	96	99	101	105	108	112	116	121	126	131	-	-	
	90	91	93	95	97	100	103	106	109	113	117	122	127	132	Caution: Fatigue possible
	88	88	89	91	93	95	98	100	103	106	110	113	117	121	
	86	85	87	88	89	91	93	95	97	100	102	105	108	112	
	84	83	84	85	86	88	89	90	92	94	96	98	100	103	Caution: Fatigue possible
	82	81	82	83	84	84	85	86	88	89	90	91	93	95	
80	80	80	81	81	82	82	83	84	84	85	86	86	87		

Conclusion

As you can see, exercising in the summer months can have serious medical implications. However, adequate hydration, proper clothing, checking relative humidity in addition to temperature, and recognizing early signs and symptoms of heat illness are all ways to prevent dehydration and avoid serious health complications.

Signs and Symptoms of Heat-Related Illness

Figure 3: Signs and Symptoms of Heat-Related Illness

Illness	Signs and Symptoms	Treatment	Return to Play Considerations
Heat Cramps	<ul style="list-style-type: none"> • Muscle twitching • Cramps • Spasms in arms, legs, or abdomen 	<ul style="list-style-type: none"> • Restore normal hydration • Mild stretching • Ice massage of affected muscle 	<p>Assess athlete to ensure they can perform at previous activity level.</p>
Heat Exhaustion	<ul style="list-style-type: none"> • Excessive thirst • Dry tongue/mouth • Weight loss • Fatigue/weakness • Lack of coordination • Dizziness • Rapid and weak pulse • Profuse sweating • Headache, nausea, vomiting • Cool, pale skin • Core temp > 103° • Dehydration 	<ul style="list-style-type: none"> • Remove athlete from play and immediately move to shaded or air-conditioned area. • Remove excess clothing and equipment. • Cool athlete until body temperature is approximately 101°F (38.3°C) • Have athlete lie comfortably with legs propped above heart level. • If athlete is not nauseated, vomiting or experiencing any CNS dysfunction, rehydrate orally with chilled water or sports drink. • If athlete is unable to take oral fluids, implement intravenous infusion of normal saline. • Monitor heart rate, blood pressure, respiratory rate, core temperature and CNS status. • Transport to an emergency facility if rapid improvement is not noted with prescribed treatment. 	<ul style="list-style-type: none"> • Athlete should be symptom free and fully hydrated. • Recommend physician clearance • Rule out underlying condition that predisposed him/her for continue problems • Avoid intense practice in heat until at least the next day
Exertional Heat Stroke	<ul style="list-style-type: none"> • Core body temperature > 104°F • Central nervous system dysfunction (altered consciousness, seizures, confusion, emotional instability, irrational behavior/combativeness or decreased mental acuity) • Nausea, vomiting or diarrhea • Headache, dizziness or weakness • Hot/wet or red, dry skin (failure of sweat mechanism) • Increased heart rate, decreased blood pressure or fast breathing • Dilated pupils • Decerebrate posture 	<ul style="list-style-type: none"> • Rapid, whole-body cooling, immediately, is the key to optimizing treatment. Without this, physiological changes resulting in fatal consequences may occur within vital organ systems (muscle, heart, brain, etc.). • Due to superior cooling rates, immediate whole-body cooling (cold water immersion), is the best treatment and should be initiated within minutes post-incident. • However, if unavailable ice packs may be applied to armpits, groin, neck, and other areas to promote rapid cooling. • It is recommended to cool first and transport second if onsite rapid cooling and adequate medical supervision are available. • If untreated, death can occur from exertional heat stroke within 20 minutes. 	<p>The athlete's physician should devise a careful return-to-play strategy that can be implemented with the assistance of a qualified health care professional.</p>



About the Author

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