

Heat Stress and Athletic Participation

Early fall football, cross country, soccer, and field hockey practices are conducted in very hot and humid weather in many parts of the United States. Due to the equipment and uniform needed in football, most of the heat problems have been associated with football. From 1995 through the 2000 football season there have been 17 heat stroke deaths in football. This is not acceptable. There are no excuses for heatstroke deaths if the proper precautions are taken. During hot weather conditions the athlete is subject to the following:

HEAT CRAMPS – Painful cramps involving abdominal muscles and extremities caused by intense, prolonged exercise in the heat and depletion of salt and water due to profuse sweating.

HEAT SYNCOPE – Weakness, fatigue, and fainting due to loss of salt and water in sweat and exercise in the heat. Predisposes to heat stroke.

HEAT EXHAUSTION (Water Depletion) - Excessive weight loss, reduced sweating, elevated skin and core body temperature, excessive thirst, weakness, headache, and sometimes unconsciousness.

HEAT EXHAUSTION (Salt Depletion) - Exhaustion, nausea, vomiting, muscle cramps, and dizziness due to profuse sweating and inadequate replacement of body salts.

HEAT STROKE – An acute medical emergency related to thermoregulatory failure. Associated with nausea, seizures, disorientation, and possible unconsciousness or coma. It may occur suddenly without being preceded by any other clinical signs. The individual is usually unconscious with a high body temperature and a hot dry skin (heat stroke victims, contrary to popular belief, may sweat profusely).

It is believed that the above mentioned heat stress problems can be controlled provided certain precautions are taken. According to the American Academy of Pediatrics Committee on Sports Medicine, heat related illnesses are all preventable. (Sports Medicine: Health Care for Young Athletes, American Academy of Pediatrics, July 2000). The following practices and precautions are recommended:

1. Each athlete should have a physical examination with a medical history when first entering a program and an annual health history update. History of previous heat illness and type of training activities before organized practice begins should be included. State high school association's recommendations should be followed.
2. It is clear that top physical performance can only be achieved by an athlete who is in top physical condition. Lack of physical fitness impairs the performance of an athlete who participates in high temperatures. Coaches should know the **PHYSICAL CONDITION** of their athletes and set practice schedules accordingly.
3. Along with physical conditioning, the factor of acclimatization to heat is important. Acclimatization is the process of becoming adjusted to heat and it is essential to provide for **GRADUAL ACCLIMATIZATION TO HOT WEATHER**. It is necessary for an athlete to exercise in the heat if he/she is to become acclimatized to it. It is suggested that a graduated physical conditioning program be used and that 80% acclimatization can be expected to occur after the first 7-10 days. Final stages of acclimatization to heat are marked by increased sweating and reduced salt concentration in the sweat.
4. The old idea that water should be withheld from athletes during workouts has **NO SCIENTIFIC FOUNDATION**. The most important safeguard to the health of the athlete is the replacement of water. Water must be on the field and readily available to the athletes at all times. It is recommended that a minimum of 10 minute water break be scheduled for every half hour of heavy exercise in the heat. Athletes should rest in a shaded area during the break. **WATER SHOULD BE AVAILABLE IN UNLIMITED QUANTITIES**.
5. Check and be sure athletes are drinking the water. Replacement by thirst alone is inadequate. Test the air prior to practice or games using a wet bulb, globe, temperature index (WBGT Index) which is based on the combined effects of air temperature, relative humidity, radiant heat, and air movement. The following precautions are recommended when using the WBGT Index: (ACSM's Guidelines for the Team Physician, 1991)

Below 64.....Unlimited activity
65-72.....Moderate risk

74-82.....High risk
 82 plus..... Very high risk

6. There is also a weather guide for activities that last 30 minutes or more (Fox and Mathews, 1981) which involves knowing the relative humidity and air temperature:

<u>AIR TEMP</u>	<u>DANGER ZONE</u>	<u>CRITICAL ZONE</u>
70 F	80% RH	100% RH
75 F	70% RH	100% RH
80 F	50% RH	80% RH
85 F	40% RH	68% RH
90 F	30% RH	55% RH
95 F	20% RH	40% RH
100 F	10% RH	30% RH

RH = RELATIVE HUMIDITY

One other method of measuring the relative humidity is the use of a sling psychrometer, which measures wet bulb temperature. The wet bulb temperature should be measured prior to practice and the intensity and duration of practice adjusted accordingly. Recommendations are as follows:

Under 60 F.....Safe, but always observe athletes.
 61-65 F.....Observe players carefully.
 66-70 F.....Caution.
 71-75 F.....Shorter practice sessions and more frequent water and rest breaks.
 75+ F.....Danger level and extreme caution.

7. Cooling by evaporation is proportional to the area of the skin exposed. In extremely hot and humid weather reduce the amount of clothing covering the body as much as possible. **NEVER USE RUBBERIZED CLOTHING.**
8. Athletes should weigh each day before and after practice and **WEIGHT CHARTS CHECKED.** Generally a 3% weight loss through sweating is safe and over a 3% weight loss is in the danger zone. Over a 3% weight loss, the athlete should not be allowed to practice in hot and humid conditions. Observe the athletes closely under all conditions. Do not allow athletes to practice until they have adequately replaced their weight.
9. Observe athletes carefully for signs of trouble, particularly athletes who lose much weight, and the eager athlete who constantly competes at his/her capacity. Some trouble signs are nausea, incoherence, fatigue, weakness, vomiting, cramps, weak rapid pulse, visual disturbance and unsteadiness.
10. Teams that encounter hot weather during the season, through travel or following an unseasonably cool period, should be physically fit, but will not be environmentally fit. Coaches in this situation should follow the above recommendations and substitute more frequently during games.
11. Know what to do in case of an emergency and have your emergency plans written with copies to all your staff. Be familiar with immediate first-aid practice and prearranged procedures for obtaining medical care, including ambulance service.

HEAT STROKE – THIS IS A MEDICAL EMERGENCY – DELAY COULD BE FATAL. Immediately cool body while waiting for transfer to a hospital. Remove clothing and place ice bags on the neck, in the axilla (armpit), and on the groin areas. Fan athlete and spray with cold water to enhance evaporation.

HEAT EXHAUSTION – OBTAIN MEDICAL CARE AT ONCE. Cool body as you would for heat stroke while waiting for transfer to hospital. Give fluids if athlete is able to swallow and is conscious.

SUMMARY: The main problem associated with exercising in the hot weather is water loss through sweating. Water loss is best replaced by allowing the athlete unrestricted access to water. Water breaks two or three times per hour are better than one break an hour. Probably the best method is to have water available at all times and to allow the athlete to drink water whenever he/she needs it. Never restrict the amount of water an athlete drinks, and be sure the athletes are drinking the water. The small amount of salt lost in sweat is adequately replaced by salting food at meals. Talk to your medical personnel concerning emergency treatment plans.

Know the Heat Index Before You Start Practice

Courtesy of the Wisconsin High School Football Coaches Association

The Heat Index is the opposite of "wind chill." It combines the effects of heat and relative humidity. Fortunately many radio stations provide the heat index during hot weather. If not, use the accompanying chart to determine the daily heat index. Keep these guidelines in mind and adjust your practice to the weather.

Heat Index

Practice Adjustment

Under 80 — Green Flag

Normal practice, no restrictions, full go!

80 – 90 — Yellow Flag

Exercise caution. Take extra water breaks and keep an eye on the bigger players.

90 – 100 — Red Flag

Stop! Sunstroke, heat cramps and heat exhaustion are possible with prolonged exposure and practice. Consider practicing without pads or shorten practice and remove pads for parts of practice. Provide extra water and monitor bigger players.

Over 110 — Black Flag

Danger zone, practice not recommended. There is an extreme danger of sunstroke, heat exhaustion and heatstroke. Use common sense and make new plans.

What to do When Heat Waves Strike

- Increase intake of non-carbonated, caffeine free beverages such as water and juice.
- Encourage players to drink more water than they are thirsty for.
- Wear uniforms that are light in color and loose fitting. Mesh jerseys are ideal.
- Strip off pads for conditioning parts of practice.
- Give special attention to the bigger players and light-skinned players who haven't been out in the sun.
- Use the heat index to make the proper adjustments to practice.

*Aspecial thank you to WFRV-TV Channel 5 meteorologist Tom Mahoney and the U.S. Naval Academy for their assistance in preparing this information.

HEAT SAFETY TIPS

The American Red Cross offers these tips to help prevent illness due to heat:

- Slow down and avoid strenuous outdoor activity.
- Stay indoors as much as possible.
- Wear lightweight, light-colored clothing.
- Drink plenty of water regularly and often.
- Eat small meals and eat more often. Avoid foods high in protein, which increase metabolic heat.
- Avoid using salt tablets unless directed by a physician.

Heat-related illness in early stages can usually be reversed. Follow these procedures for care:

- Get the victim out of the heat.
- Loosen any tight clothing.
- Remove perspiration-soaked clothing.
- Apply cool, wet cloths, such as towels or sheets to the skin.
- Fan the victim.
- If victim is conscious, give cool water to drink.
- Ice packs or cold packs can be applied to the victim's wrists, ankles, groin, armpits and neck to cool the large blood vessels.
- Let the victim rest in a comfortable position, and watch for changes in condition.
- Call for an ambulance if victim refuses water, vomits or starts to lose consciousness.

Prevention of these heat-caused conditions is much easier than the treatment. The Red Cross advises that people be careful so that enjoyable summertime activities do not become dangerous and life-threatening.

HEAT INDEX CHART

High heat index values are a combination of temperature and humidity. For example, if the temperature is 95° and the relative humidity is 55%, the heat index temperature is 110°. Studies have shown that possible heat disorders which could affect people from these conditions include sunstroke, heat cramps and heat exhaustion. Heatstroke is possible with prolonged exposure and/or physical activity. People are urged to use common sense when pursuing outdoor activities.

To use this chart, simply read across from temperature scale on the left hand side to the intersecting relative humidity that is read across the top.

		Relative Humidity (%)																					
		0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
Air Temperature	120	107	111	116	123	130	139	148															
	115	103	107	111	115	120	127	135	143	151													
	110	99	102	105	108	112	117	123	130	137	143	150											
	105	95	97	100	102	105	109	113	118	123	129	135	142	149									
	100	91	93	95	97	99	101	104	107	110	115	120	126	132	138	144							
	95	87	88	90	91	93	94	96	98	101	104	107	110	114	119	124	130	136					
	90	87	88	90	91	93	94	96	98	101	104	107	110	114	119	124	130	136					
	85	76	79	80	81	82	83	84	85	86	87	88	89	90	91	93	95	97	99	102	102	102	108
	80	73	74	75	76	77	77	78	79	79	80	81	81	82	83	85	86	86	87	88	89	91	91
	75	69	69	70	71	72	72	73	73	74	74	75	75	76	76	77	77	78	78	79	79	80	80
	70	64	64	65	65	66	66	67	67	68	68	68	69	69	70	70	70	71	71	71	71	71	72



RECOMMENDATIONS FOR HYDRATION TO PREVENT HEAT ILLNESS



TYPES OF SPORTS DRINKS

◆ **Fluid Replacers**

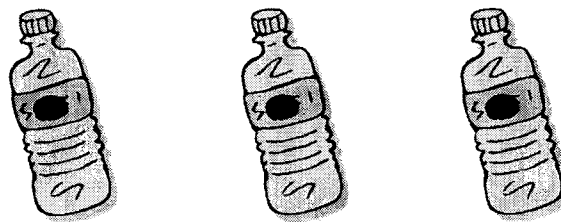
- Examples: Water, Gatorade, 10K, Quikkick, Max
- These drinks are absorbed as quickly as water and typically are used for activities lasting less than 2 hours.

◆ **Carbohydrate loaders**

- Examples: Gatorlode, Exceed High, Carboplex
- These drinks replace more muscle glycogen to enhance greater endurance.
- They should be used after ultra-endurance events to increase muscle glycogen resynthesis after exercise.

◆ **Nutrition Supplements**

- Examples: Gatorpro, Exceed Sports, Ultra Energy
- These supplements are fortified with vitamins and minerals and they help athletes maintain a balanced diet.
- They can be used as a meal replacement supplement for athletes who wish to skip a high fat meal, or as extra calories for athletes who wish to gain weight.

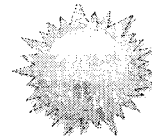
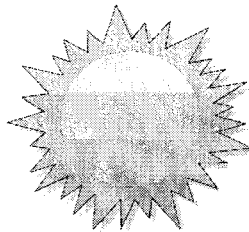
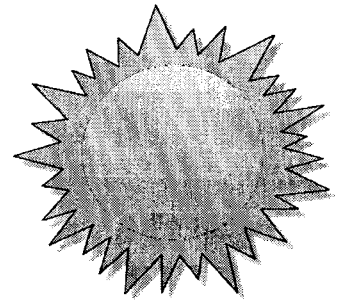


WHAT NOT TO DRINK

- ◆ Drinks with Carbohydrate (CHO) concentrations of greater than eight percent should be avoided.
- ◆ Fruit juices, CHO gels, sodas, and sports drinks that have a CHO greater than six to eight percent are not recommended during exercise as sole beverages.
- ◆ Beverages containing caffeine, alcohol, and carbonation are not to be used because of the high risk of dehydration associated with excess urine production, or decreased voluntary fluid intake.

HYDRATION TIPS AND FLUID GUIDELINES

- ◆ Drink according to a schedule based on individual fluid needs.
- ◆ Drink before, during and after practices and games.
- ◆ Drink 17-20 ounces of water or sports drinks with six to eight percent CHO, two to three hours before exercise.
- ◆ Drink another 7-10 ounces of water or sport drink 10 to 20 minutes before exercise.
- ◆ Drink early — By the time you're thirsty, you're already dehydrated.
- ◆ In general, every 10-20 minutes drink at least 7-10 ounces of water or sports drink to maintain hydration, and remember to drink beyond your thirst.
- ◆ Drink fluids based on the amount of sweat and urine loss.
- ◆ Within two hours, drink enough to replace any weight loss from exercise.
- ◆ Drink approximately 20-24 ounces of sports drink per pound of weight loss.
- ◆ Dehydration usually occurs with a weight loss of two percent of body weight or more.



WHAT TO DRINK DURING EXERCISE

- ◆ If exercise lasts more than 45-50 minutes or is intense, a sports drink should be provided during the session.
- ◆ The carbohydrate concentration in the ideal fluid replacement solution should be in the range of six to eight percent CHO.
- ◆ During events when a high rate of fluid intake is necessary to sustain hydration, sports drinks with less than seven percent CHO should be used to optimize fluid delivery. These sports drinks have a faster gastric emptying rate and thus aid in hydration.
- ◆ Sports drinks with a CHO content of 10 percent have a slow gastric emptying rate and contribute to dehydration and should be avoided during exercise.
- ◆ Fluids with salt (sodium chloride) are beneficial to increasing thirst and voluntary fluid intake as well as offsetting the amount of fluid lost with sweat.
- ◆ Salt should never be added to drinks, and salt tablets should be avoided.
- ◆ Cool beverages at temperatures between 50 to 59 degrees Fahrenheit are recommended for best results with fluid replacement.

PREVENT HEAT INJURIES AND INCREASE PERFORMANCE

*By Tim McGuine Athletic Trainer
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During hot, humid weather, parents can help their kids prevent heat injuries and increase their performance at the same time. First, they need to encourage their kids to eat a well balanced diet. An athlete who eats a balanced diet will insure that they effectively replace minerals such as sodium and potassium which can be lost through excessive sweating. Sodium supplementation in the form of special pills and drinks is often unnecessary. Chances are, your athlete is already consuming too much sodium through their regular diet. Potassium is found in many foods such as bananas, tomatoes, grapes and oranges as well as many fruit juices. Football players who eat or drink these foods should not need to supplement their diets with commercial sport drinks.

Parents need to be aware that what they feed their son in the two to three days prior to a game can have a dramatic effect on his performance. To perform well, athletes need to make sure that they get 55% to 65% of their calories from carbohydrates. Some football players mistakenly believe they need high amounts of protein in their diets and even try protein supplementation with special powders and drinks. A diet that is high in protein can lead to dehydration since the body uses water to rid itself of extra protein.

Having each meal, especially the pre-game meal, contain plenty of fluids is also very important. An athlete can be slightly dehydrated and still not feel thirsty enough to drink a glass of water. Therefore, parents should make sure that they have plenty of cold water and fruit juices at home and encourage their kids to drink as much as they can before they head to practice. As a final reminder, drinks such as soda, that contain caffeine can increase the risk of dehydration and should be eliminated or dramatically reduced in the athletes' diet.

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HELPFUL HINTS FOR FOOTBALL PARENTS

Each football player should:

- * Drink 3-4 cups of water two hours before each practice / game.
- * Drink one cup of water every 20 minutes of practice.
- * Drink as much water and fruit juice as possible immediately following a practice / game.
- * Snack on high carbohydrate foods such as fresh fruit and juices throughout the day.
- * Eat a well balanced diet throughout the season.
- * Eliminate caffeinated or carbonated drinks from their diet.