

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. During the 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 sweating.
- **Heat Syncope**- Weakness, fatigue and fainting due to loss of salt and water in sweat and exercise in the heat. Predisposes to heatstroke.
- **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.
- **Heatstroke**- 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 (heatstroke 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, 1991). The following practices and precautions are recommended:

1. Each athlete must have a physical exam with a medical history prior to trying out for 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 percent acclimatization can be expected to occur after the first seven to ten 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 ten minutes be scheduled for a water break every half hour of heavy exercise in the heat. **Water should be available in unlimited quantities**. Check and be sure athletes are drinking the water. Cold water is preferable. Drinking ample water before practice or games has also been found to aid performance in the heat.

5. Salt should be replaced daily. Modest salting of foods after practice or games will accomplish this purpose. Salt tablets are not recommended. **Attention must be directed to replacing water - fluid replacement is essential.**
6. Know both the **temperature and humidity**. The greater the humidity, the more difficult it is for the body to cool itself. Test the air prior to practice or game 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 |

7. 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:

| Air Temp | Danger Zone | Critical Zone |
|----------|---------------|----------------|
| 70 F | 80 percent RH | 100 percent RH |
| 75 F | 70 percent RH | 100 percent RH |
| 80 F | 50 percent RH | 80 percent RH |
| 85 F | 40 percent RH | 68 percent RH |
| 90 F | 30 percent RH | 55 percent RH |
| 95 F | 20 percent RH | 40 percent RH |
| 100 F | 10 percent RH | 30 percent RH |

8. RH = Relative Humidity
9. 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 plus | Danger level and extreme caution |

10. Cooling by evaporation is proportional to the area of skin exposed. In extremely hot and humid weather reduce the amount of clothing covering the body as much as possible. **Never use rubberized clothing.**
11. Athletes should **weigh** each day before and after practice and **weight charts checked**. Generally, a three percent weight loss through sweating is considered safe and over a three percent weight loss is in the danger zone. Over a three percent 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.
12. Observe athletes carefully for signs of trouble, particularly athletes who lose significant 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.

13. Teams that encounter hot weather during the season through travel or following an unseasonable 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.

14. Know what to do in case of emergency and have your emergency plans written with copies to all your staff. Be familiar with immediate first aid practices and prearranged procedures for obtaining medical care, including ambulance service

1. **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 area. An increasing number of medical personnel are now using a treatment for heat illness that involves applying either alcohol or cool water to the victim's skin and vigorously fanning the body. The fanning causes evaporation and cooling. (Source--The First Aider--September 1987)

2. **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.

15. **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 per 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.

| RH % | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---|-----|-----|-----|-----|
| 90 | 119 | 123 | 128 | 132 | 137 | 141 | 146 | 152 | 157 | 163 | 168 | 174 | 180 | 186 | 193 | 199 | ALL OUTDOOR PRACTICE SUSPENDED DUE TO DRY BULB EXTREME HEAT | | | | |
| 85 | 115 | 119 | 123 | 127 | 132 | 136 | 141 | 145 | 150 | 155 | 161 | 166 | 172 | 178 | 184 | 190 | | | | | |
| 80 | 112 | 115 | 119 | 123 | 127 | 131 | 135 | 140 | 144 | 149 | 154 | 159 | 164 | 169 | 175 | 180 | | | | | |
| 75 | 109 | 112 | 115 | 119 | 122 | 126 | 130 | 134 | 138 | 143 | 147 | 152 | 156 | 161 | 166 | 171 | | | | | |
| 70 | 106 | 109 | 112 | 115 | 118 | 122 | 125 | 129 | 133 | 137 | 141 | 145 | 149 | 154 | 158 | 163 | | | | | |
| 65 | 103 | 106 | 108 | 111 | 114 | 117 | 121 | 124 | 127 | 131 | 135 | 139 | 143 | 147 | 151 | 155 | | | | | |
| 60 | 100 | 103 | 105 | 108 | 111 | 114 | 116 | 120 | 123 | 126 | 129 | 133 | 136 | 140 | 144 | 148 | | | | | |
| 55 | 98 | 100 | 103 | 105 | 107 | 110 | 113 | 115 | 118 | 121 | 124 | 127 | 131 | 134 | 137 | 141 | | | | | |
| 50 | 96 | 98 | 100 | 102 | 104 | 107 | 109 | 112 | 114 | 117 | 119 | 122 | 125 | 128 | 131 | 135 | | | | | |
| 45 | 94 | 96 | 98 | 100 | 102 | 104 | 106 | 108 | 110 | 113 | 115 | 118 | 120 | 123 | 126 | 129 | | | | | |
| 40 | 92 | 94 | 96 | 97 | 99 | 101 | 103 | 105 | 107 | 109 | 111 | 113 | 116 | 118 | 121 | 123 | | | | | |
| 35 | 91 | 92 | 94 | 95 | 97 | 98 | 100 | 102 | 104 | 106 | 107 | 109 | 112 | 114 | 116 | 118 | | | | | |
| 30 | 89 | 91 | 92 | 93 | 95 | 96 | 98 | 99 | 101 | 102 | 104 | 106 | 108 | 110 | 112 | 114 | | | | | |
| 25 | 87 | 88 | 90 | 91 | 92 | 93 | 94 | 96 | 97 | 99 | 100 | 101 | 103 | 104 | 106 | 108 | | | | | |

Green- Normal practice unlimited access to water

Tan- Normal activity with unlimited access to water and more frequent water breaks limit exposure to direct sunlight

Gold- 30 minutes out/ 30 minutes indoors total outdoor practice time cannot exceed one hour. Total practice time cannot exceed 2 hours

Red- All outdoor practices are canceled.