HEALTHHINTS

Texas Cooperative Extension The Texas A&M University System

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Heat

Keeping your cool in the hot Texas sun

The warm Texas sun...it's what calls people home to Texas; it's what brings vacationers from afar; it's why some people relocate to the state; and it's why others wish they never had relocated here. For those who call Texas home, hot temperatures are a way of life, but for those who are unfamiliar, it can be a rude awakening and a difficult adjustment.

As we enter the Fall months and look forward to cooler air, it is not uncommon to realize that our summer might not end until October. Instead of donning their jeans and windbreakers, the kids are heading off to school in shorts and flip-flops. Still, we follow the schedule of schools across the nation with football practice, cross-country track, and the tennis team in full swing.

INSIDE HEALTHHINTS...

Unfortunately, along with these activities come concerns, particularly, heat concerns.

This issue of *HealthHints* will address how to stay healthy in the heat and how to help if someone falls ill from heat exposure. Not only will we focus on children, but we'll also focus on others at risk, such as the elderly, individuals with illness, overweight individuals, unfit individuals, people who are not acclimatized, and athletes of all ages.

So, turn on the air conditioner, and let's take a look at how we can keep our cool in the hot Texas sun.

Living in or Traveling to Another State?

According to the Centers for Disease Control's *Morbidity and Mortality Weekly*, Arizona, Nevada, and Missouri had the highest heat-related death rates from 1999-2003.[1] If you live in another state or will be spending time somewhere else, it is important to become acclimated to the temperature, especially the heat. Regardless of your home state, it is important to consider the dangers of hot environments when it comes to your well-being.

Too Hot To Handle

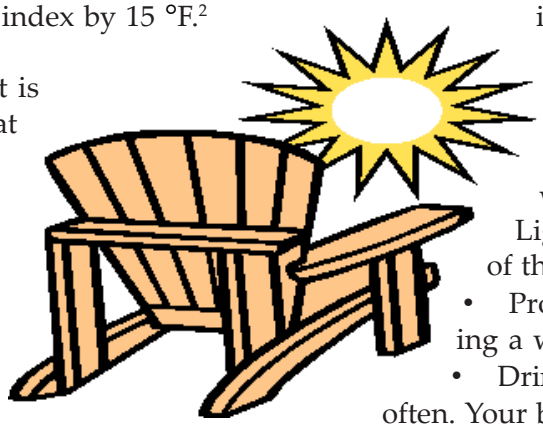
When to be on high alert

If the weather report says we're experiencing a heat wave and the heat index is 101 degrees Fahrenheit (°F), what does that mean to us, and how do our bodies adjust?

Heat wave: A heat wave is defined as a prolonged period of excessive heat and humidity. The National Weather Service steps up its procedures to alert the public during these periods of excessive heat and humidity.[2]

Heat index: The heat index is a number in degrees Fahrenheit that tells how hot it really feels when relative humidity is added to the actual air temperature. Exposure to full sunshine can increase the heat index by 15 °F.[2]

Extreme heat: Extreme heat is defined as temperatures that hover 10 °F or more above the average high temperature for the region and last for several weeks.[3]



For information on heat and weather concerns in your area, consult the National Oceanic & Atmospheric Administration (NOAA) website at *http://www.noaawatch.gov/*.

The Federal Emergency Management Agency (FEMA) and the American Red Cross give the following tips if you are expecting or experiencing extreme heat conditions:

In preparation...

- Install window air conditioners snugly; insulate if necessary.
- Check air-conditioning ducts for proper insulation.
- Install temporary window reflectors (for use between windows and drapes), such as aluminum foil-covered cardboard, to reflect heat back outside.
- Weather-strip doors and sills to keep cool air in.
- Keep storm windows up all year.
- Cover windows that receive morning or afternoon sun with drapes, shades, awnings, or louvers. Outdoor awnings or louvers can reduce the heat that enters a home by up to 80 percent.

In the heat...

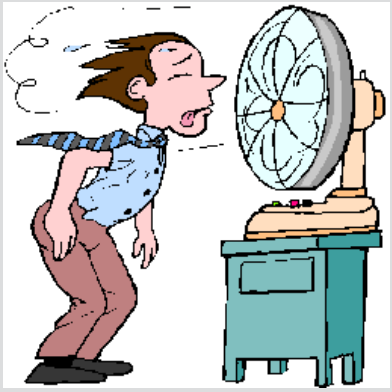
- Slow down. Avoid strenuous activity/work during the warmest part of the day. If you must do strenuous activity, do it during the coolest part of the day, which is usually in the morning between 4:00 a.m. and 7:00 a.m. Use a buddy system when working in extreme heat, and take frequent breaks.
- Stay indoors as much as possible, and limit exposure to the sun.
- If air conditioning is not available, stay on the lowest floor, out of the sunshine.
- Consider spending the warmest part of the day in public buildings such as libraries, schools, movie theaters, shopping malls, and other community facilities.
- Wear loose-fitting, lightweight, light-colored clothing. Light colors will reflect away some of the sun's energy.
- Protect the face and head by wearing a wide-brimmed hat.
- Drink plenty of water regularly and often. Your body needs water to keep cool. **Note: People who have epilepsy or heart, kidney, or liver disease; or are on fluid-restricted diets; or have a problem with fluid retention should consult a doctor before increasing liquid intake.**
- Drink plenty of fluids even if you do not feel thirsty.
- Water is the safest liquid to drink during heat emergencies. Avoid drinks with alcohol or caffeine in them. They can make you feel good briefly, but they make the heat's effects worse on your body. This is especially true about beer, which dehydrates the body.
- Eat well-balanced, light, and regular meals. Eat small meals, and eat more often. Avoid foods that are high in protein, which increase metabolic heat.
- Avoid using salt tablets unless directed to do so by a physician.

- Check on family, friends, and neighbors who do not have air conditioning and who spend much of their time alone.
- Never leave children or pets alone in closed vehicles. Even when you crack or roll down windows, temperatures inside a vehicle climb much higher than the outdoor temperature.[2, 4]

Electric Fans?

Many people who do not have air conditioning use electric fans to try to keep cool. Electric fans do not cool the air, but they can help sweat to evaporate, which cools the body.[2] Though electric fans may provide comfort, when the temperature is in the high 90s, fans will not prevent heat illness.[5] The fan can cause sweat to evaporate too quickly from the skin and accelerate dehydration.[6] Additionally, older people don't usually sweat as much as younger people. For this reason, older individuals should not use fans as their sole means for staying cool because fans work only when we sweat.[7] In fact, a person who sits inside a closed room with no air conditioning and a fan blowing on them can have increased dehydration, and when the room is hot, actually increase thermal stress.[6]

If you need a fan to stay cool in hot weather, don't sit directly in front of the fan, and always open a window for ventilation when running a fan.[6] A better way to stay cool is to take a cool shower or bath, spray the body with water to get cooling from evaporation,[7] or get to a place that has air conditioning during the hottest part of the day.[5] If you need help finding a place to stay cool or getting transportation, call a friend, family member, or your local health department.



Coping Mechanisms

How the body keeps cool in the heat

"Your body is always working to keep balance between how much heat it makes and how much it loses. Your brain is the thermostat. It sends and receives signals to and from parts of your body that affect temperature, such as the spinal cord, muscles, blood vessels, skin, and glands that make substances known as hormones. Too much heat causes sweating. When sweat dries from your skin, the surface of your body cools and your temperature goes down."[8]

" A pea-sized bead of sweat can cool nearly 1 liter (about 1 quart) of blood by 1 degree Fahrenheit."[9]

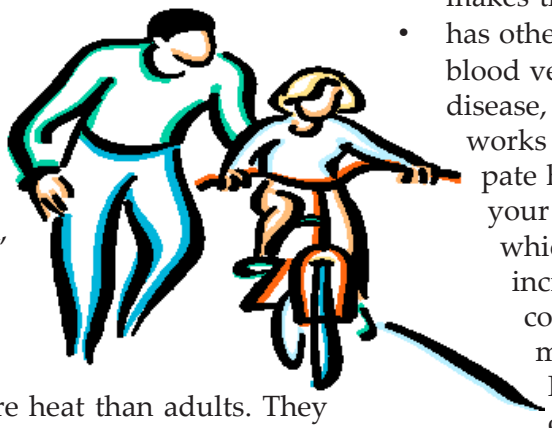
To understand how this works in the body, consider that "the human body, being warm blooded, maintains a fairly constant internal temperature, even though it is being exposed to varying environmental temperatures. To keep internal body temperatures within safe limits, the body must get rid of its excess heat, primarily through varying the rate and amount of blood circulation through the skin and the release of fluid onto the skin by the sweat glands. These automatic responses usually occur when the temperature of the blood exceeds 98.6 °F and are kept in balance and controlled by the brain. In this process of lowering the internal body temperature, the heart begins to pump more blood; blood vessels expand to accommodate the increased flow, and the microscopic blood vessels (capillaries) that thread through the upper layers of the skin begin to fill with blood. The blood circulates closer to the surface of the skin, and the excess heat is lost to the cooler environment.

If heat loss from increased blood circulation through the skin is not adequate, the brain continues to sense overheating and signals the sweat glands in the skin to shed large quantities of sweat onto the skin surface. Evaporation of sweat cools the skin, eliminating large quantities of heat from the body.

As environmental temperatures approach normal skin temperature, cooling of the body becomes more difficult. If the air temperature is as warm as or warmer than the skin, blood brought to the body surface cannot lose its heat. Under these conditions, the heart continues to pump blood to the body surface; the sweat glands pour liquids containing electrolytes onto the surface of the skin, and evaporation of the sweat becomes the principal effective means of maintaining a constant body temperature. Sweating does not cool the body unless the moisture is removed from the skin by evaporation. Under conditions of high humidity, the evaporation of sweat from the skin is decreased, and the body's efforts to maintain an acceptable body temperature may be significantly impaired.

These conditions adversely affect an individual's ability to work in the hot environment. With so much blood going to the external surface of the body, relatively less goes to the active muscles, the brain, and other internal organs; strength declines; and fatigue occurs sooner than it would otherwise. Alertness and mental capacity also may be affected. Workers who must perform delicate or detailed work may find their accuracy suffering, and others may find their comprehension and retention of information lowered."[10]

Additionally, at different ages, our bodies vary and change in the way they handle heat. Older adults, as well as young children, are at high risk for adverse effects from excessive heat.[11]



Children produce more heat than adults. They also sweat less. This makes it hard for children to cool off. Children also may not remember to drink enough fluids and rely on adults to monitor their fluid intake. Parents, coaches, and other care providers must make sure that children stay adequately hydrated and take it slow to gradually acclimate to the heat. A child may be at higher risk for heat illness if he/she:

- has a low fitness level (rarely exercises),
- is overweight,
- has recently been ill with vomiting or diarrhea (fluid loss),
- drinks caffeinated beverages or takes medications that cause dehydration (e.g., antihistamines or diuretics), or
- has previously had a heat-related illness.[12, 13]

Older people are at high risk for developing heat-related illness, as well, because the ability to respond to heat can become less efficient with advancing years.[14] Age-related changes may include changes to the skin, such as poor blood circulation and inefficient sweat glands.[14] The body's ability to conserve water is reduced; the sense of thirst becomes less acute, and the body is less able to respond to changes in temperature.[15] Because of these changes, older adults may not sense the change in temperature and respond appropriately. Chronic illness, hormonal changes associated with menopause, use of certain medications, disability, and outright neglect are also issues that affect many older adults and can be contributors to heat illness.[15]

A person of any age is at higher risk if he/she:

- has undiagnosed or uncontrolled diabetes. Diabetes affects the way the body uses blood sugar and causes increased thirst and more frequent urination.
- has a condition known as diabetes insipidus, which is caused by a hormonal disorder that makes the kidneys unable to conserve water.
- has other chronic illnesses, such as heart or blood vessel problems, lung disease, kidney disease, or high blood pressure. The body works in such a way that in order to dissipate heat, more blood circulates through your skin, leaving less for your muscles, which increases your heart rate and may increase problems with these chronic conditions. These illnesses may also make you feel weak or cause fever. High blood pressure and other conditions may require changes in your diet, such as restricting salt. Talk with your doctor about your diet and how to avoid too much salt loss during a heat wave or exertion in the heat.
- has any illness that causes general weakness or fever.
- has an illness that causes diarrhea or vomiting.
- takes medications that make it harder for the body to cool itself. This may occur because of a resulting inability to perspire, or increased urination and/or perspiration with these

medications. These medications may include diuretics, sedatives, tranquilizers, antihistamines, some psychiatric drugs, and some heart and blood pressure medications.
- is overweight. People who are overweight may be prone to heat illness because they tend to retain more body heat.
- is underweight. Sometimes people who are very underweight have a difficult time regulating their body temperature.
- has any form of mental impairment. Mental impairment can create increased risks for heat illness, such as not knowing to drink enough fluids, inability to find a way to a cooler setting, etc.
- drinks alcoholic beverages. Alcoholic beverages can cause loss of fluid due to frequent urination. It can also interfere with normal blood sugar control. Alcohol use may also cause mental impairment, which may result in a person's inability to know when to get cool or drink appropriate fluids to stay hydrated.[8, 11, 14, 15, 16, 17]

Lifestyle Factors

In addition to physical factors, lifestyle factors and attitudes also can increase the risk for heat illness, including:

- extremely hot living quarters
- lack of transportation
- overdressing
- visiting overcrowded places
- not understanding weather conditions[14]
- living alone (particularly among elderly)
- low socio-economic status
- living in a "run-down neighborhhood" or place that feels unsafe[18]
- feeling heat warnings "weren't meant for them"
- feelings that one is "in good shape"
- feeling that it is a matter of pride to survive the heat.[6]

Elderly persons - particularly those living alone - are at increased risk. Older people, particularly those at special risk, should stay indoors on especially hot and humid days, particularly when there is an air pollution alert in effect. People without fans or air conditioners should go to an air conditioned building, such as shopping malls, movie houses, and libraries. Friends or relatives might be asked to supply transportation on particularly hot days. Many communities, area agencies, religious groups, and senior citizen centers also provide such services as cooling centers.[14]

Still, living alone and being elderly are not the only risk factors of concern. Low socio-economic status correlates highly with risk factors such as poor health, obesity, diabetes, and cardiovascular disease.[6] In fact, "**the risk factors for death from heat strongly correlate with the conditions you find in poverty....People who have access to three hours of air conditioning a day are less likely to die**."[6]

Of major concern are significant links between run-down neighborhoods and heat-related deaths. Even people who have close relational ties in such areas were not able to stave off the deadly effects of a heat wave.[18] "Those [neighborhoods] that had concentrations of liquor stores, bars, and youth-oriented businesses, and buildings in poor condition, had higher heat mortality."[18] People in such neighborhoods may feel especially isolated, "unable to find much in the way of relief from heat and unwilling to go outside in the first place because they fear for their safety."[18]

Adverse Effects of Heat

Defining heat illnesses

Old or young or somewhere in between, everyone is susceptible to heat illness if precautions are not taken. Excessive exposure to a hot environment, especially while active or working, can bring about a variety of heat-induced disorders.[10] "Being hot for too long can cause many heat illnesses, all grouped under the name hyperthermia (hy-per-ther-mee-uh)."[8]

Let's take a look at some of these conditions so we can learn how to avoid them and how to treat them when necessary.

Heat cramps are painful, involuntary muscle spasms, usually in the abdomen, arms, or legs, typically occurring during heavy/strenuous exercise or activity in hot environments.[2, 19] Heavy sweating is usually involved in heat cramping. The sweating depletes the body of moisture and salt. Low levels of salt in the muscles may be the cause of heat cramps.[3]

Treatment: Apply firm pressure or gentle massage to the cramping muscle to relieve the spasm. Have the person stop all activity and sit quietly in a cool place. Give clear juice or electrolyte-containing sports drinks to replenish salt and fluids. If vomiting occurs, discontinue fluid intake. Practice gentle stretching of the area, and apply ice if necessary. If cramps don't go away within 1 hour, call the victim's doctor.[2, 3, 19, 20]

Heat edema is a swelling of the ankles and feet when you get hot.[8]

Treatment: Putting your legs up (elevating them) should help. If that doesn't work fairly quickly, check with your doctor.[8]

Heat exhaustion is the most common heat illness and often comes on suddenly. It is caused by decreased blood volume due to dehydration. Symptoms may include dizziness/feeling faint, headache, nausea, profuse sweating, clammy/cool skin, rapid/weak pulse, body temperature at or slightly below normal, low grade fever, low blood pressure, and ashen/pale appearance.[2, 20, 21]

Treatment: Get the victim out of the sun immediately. Lay the person down, elevating the legs and feet slightly. Loosen or remove the person's clothing. Cool the person by applying cool, wet cloths (changing them often) or spraying or sponging him/her with cool water. Move the victim to an air conditioned environment, or fan him/her if air conditioning is not available. Give sips of cool (not iced) water or a sports drink containing electrolytes. If nausea occurs, discontinue the drink. If vomiting continues, seek immediate medical attention. Monitor the person carefully. Heat exhaustion can quickly become heat stroke (see page 7) if left untreated. Call 9-1-1 if fever is greater than 102 °F, fainting, confusion, or seizure occur.[2, 20, 21]

Heat rash is a skin irritation caused by excessive sweating during hot, humid weather. It can occur at any age but is most common in young children. Heat rash looks like a red cluster of pimples or small blisters. It is more likely to occur on the neck and upper chest, in the groin, under the breasts, and in elbow creases.[3]

Treatment: The best treatment for heat rash is to provide a cooler, less humid environment. Keep the affected area dry. Dusting powder may be used to increase comfort. Treating heat rash is simple and usually does not require medical assistance. Other heat-related problems can be much more severe.[3]

Heat stroke is a **life-threatening, medical emergency**. Heat stroke can result in permanent disability or death if emergency treatment is not provided. Heat stroke occurs when the body is unable to regulate its temperature[3] (the body's cooling system shuts off or blood volume is so low that the person stops sweating and goes into shock[20]). The body's temperature rises rapidly; the sweating mechanism fails, and the body is unable to cool down. Body temperature may rise to 106 °F or higher within 10 to 15 minutes.[3] Warning signs vary, but may include:

- An extremely high body temperature (above 103 °F, orally)
- Red, hot, and dry skin
- No sweating
- Rapid, strong pulse or heartbeat
- Rapid, shallow breathing
- Elevated or lowered breathing
- Throbbing headache
- Dizziness
- Nausea
- Confusion
- Irritability
- Unconsciousness.[3]

Treatment: Have someone call 9-1-1 while you begin cooling the victim in whatever way you can. Here are some steps to take (time is crucial, so use/do what is at hand):

- Get the victim to a shady area.
- Cool the victim rapidly using whatever methods you can. For example, immerse the victim in a tub of cool water; place the person in a cool shower; spray the victim with cool water from a garden hose; sponge the person with cool water; or if the humidity is low, wrap the victim in a cool, wet sheet and fan him or her vigorously.
- Monitor body temperature, and continue cooling efforts until the body temperature drops to 101-102 °F.
- If emergency medical personnel are delayed, call the hospital emergency room for further instructions.
- Do not give the victim fluids to drink.
- Get medical assistance as soon as possible.[3, 22]

Heat syncope is a sudden dizziness that may come on when you are active in the heat. If you are not used to hot weather or take a form of heart medication known as a beta blocker, you are more likely to feel faint when in the heat.[8]

Treatment: Putting your legs up and resting in a cool place should make the dizzy feeling go away.[8]

Dehydration

Our bodies' need for fluid

One of the major contributors to heat-related illness is dehydration. Dehydration is a condition that occurs when you don't have enough water in your body to carry out normal functions.[23]

"Water is your body's principal chemical component, comprising, on average, 60 percent of your weight. Every system in your body depends on water. For example, water flushes toxins out of vital organs, carries nutrients to your cells, and provides a moist environment for ear, nose, and throat tissues."[23]

If we don't keep water in balance, however, it can lead to dehydration. Every day we lose water through our breath, sweat, urine, and bowel movements. For our bodies' to function properly, we must replenish its water supply by consuming beverages and foods that contain water.

But how much water should we drink each day? How much should we take in through food? Do we need 8 glasses a day?

Some approximations of water needs for the average healthy adult living in a temperate climate have been attempted as follows:

Replacement approach - "The average urine output for adults is 1.5 liters a day. You lose close to an additional liter of water a day through breathing, sweating, and bowel movements. Food usually accounts for 20 percent of your total fluid intake, so if you consume 2 liters of water or other beverages a day (a little more than 8 cups) along with your normal diet, you will typically replace the lost fluids."[23]

Dietary recommendations - "The Institute of Medicine advises that men consume roughly 3.0 liters (about 13 cups) of total beverages a day and women consume 2.2 liters (about 9 cups) of total beverages a day."[23]

These guidelines are rough estimates and don't take into account special circumstances. Actually, water needs depend on many factors, including your health status, your size, how active you are, and where you live.[23] Here are some hydration guidelines from the Mayo Clinic that are based on our circumstances:

Exercise - "The more you exercise, the more fluid you'll need to keep your body hydrated. An extra 1 or 2 cups of water should suffice for short bouts of exercise, but intense exercise lasting more than an hour (for example, running a marathon) requires additional fluid. How much additional fluid is needed depends on how much you sweat during the exercise, but 13 to 26 ounces (or about 2 to 3 cups) an hour will generally be adequate, unless the weather is exceptionally warm."[23]

"In general, it's best to start hydrating the day before strenuous exercise. Producing lots of clear, dilute urine is a good indication that you're well hydrated. Two hours before an endurance event such as a marathon or half-marathon, drink 2 cups of water. During the activity, replenish fluids at regular intervals, and continue drinking water or other fluids after you're finished."[15] "Drinking 16 ounces of fluid per pound of body weight lost during exercise is recommended."[23]

"Keep in mind that drinking too much cannot only cause bloating and discomfort, it may lead to a potentially fatal condition in which your blood sodium becomes too low (hyponatremia). This occurs when you drink more fluids than you lose through sweating."[15] "During long bouts of intense exercise, it's best to use a sports drink that contains sodium, as this will help replace sodium lost in sweat and reduce the chances of developing hyponatremia...."[23]

Environment - Hot or humid weather can make you sweat and requires additional intake of fluid to help lower your body temperature and replace what you lose through sweating. Heated indoor air also can cause your skin to lose mois-

ture during wintertime, increasing your daily fluid needs. You may also need more water in wintertime if you sweat when wearing insulated clothing. Further, altitudes greater than 2,500 meters (8,200 feet) may trigger increased urination and more rapid breathing, which use up more of your fluid reserves.[15, 23]

Illnesses or health conditions - "Signs of illnesses, such as fever, vomiting and diarrhea, cause your body to lose additional fluids. In these cases, you should drink more water and may even need oral rehydration solutions, such as Gatorade, Powerade or Ceralyte."[23] "Start giving extra water or an oral rehydration solution at the first signs of illness — don't wait until dehydration occurs. And although they might sound appealing, traditional "clear fluids" such as ginger ale or other sodas contain too much sugar and too little sodium to replenish lost electrolytes."[15]

"Certain conditions, including bladder infections or urinary tract stones, also require increased water intake. On the other hand, certain conditions such as heart failure and some types of kidney, liver, and adrenal diseases may impair excretion of water and even require that you limit your fluid intake."[23]

Pregnancy or breast-feeding - "Women who are expecting or breast-feeding need additional fluids to stay hydrated. Large amounts of fluid are lost especially when nursing. The Institute of Medicine recommends that pregnant women drink 2.4 liters (about 10 cups) of fluids daily and women who breast-feed consume 3.0 liters (about 12.5 cups) of fluids a day."[23]

To make sure you are getting enough water, you can monitor your body in the following ways:

Check your urine - If your urine is dark yellow or amber in color[15] or small in quantity, it is likely concentrated with metabolic wastes, and you need to drink more fluids. Your urine should be a pale yellow color and normal quantity when you are getting enough fluids. If you are not going to the bathroom every 2 to 4 hours, you are not drinking enough.

Weigh yourself - By weighing yourself before and after work or exercise, you can monitor the pounds lost during your activity. For every pound lost, you should drink at least 2 cups of fluid. In hot weather, those who work outside or exercise may find that they've sweat off as much as 5 to 8 pounds. This is water loss, not fat loss.

Monitor your feelings - If you feel chronically fatigued, lethargic, or have a constant headache, you may be dehydrated. Monitor yourself and others for impaired performance, heat cramps, chills, clammy skin, rapid pulse, gastrointestinal problems, dizziness, dry mouth, hallucinations, no sweat or urine, swollen tongue, unsteady walk, high body temperature, refusal of water, vomiting, and changes in levels of consciousness. These may all be signs and symptoms of severe heat problems.[16, 24]

Note: You should always replenish your fluids at regular intervals before you become thirsty. Thirst is **NOT** an indicator of when fluids are needed. Some individuals may even refuse water when under heat stress.

The Right Fluids & Foods

Choosing hydration

In addition to getting enough fluid, getting the right type of fluid is important. A rule of thumb is to try to drink 4 to 8 ounces (i.e., 1/2 to 1 cup) of cool water every 15 minutes during work or exercise in a hot environment to prevent dehydration. Cold fluids seem to be absorbed more rapidly from the stomach than those that are warm or room temperature.[25, 26]

Commercial sports drinks can help to replace fluids as well, but they should not contain more than 6 to 8 percent glucose or be high in fructose. Glucose concentrations higher than 8 percent will slow down water absorption when working or exercising in the heat.[25] You can also make homemade sports drinks. Here's a recipe for a homemade sports drink that will work as effectively as store-bought drinks, but it costs a lot less:

In the bottom of a pitcher, dissolve 4 tablespoons of sugar and 1/4 teaspoon of salt in 1/4 cup of boiling water. Add either 1/4 cup of orange juice or 2 tablespoons of lemon juice and 3-3/4 cups of cold water; chill. Makes 1 quart.

Each 8-ounce glass of this sports drink contains 12 grams of carbohydrate (5 percent glucose), provides 55 calories, and costs about 7 cents to make. A typical store brand may cost about 28 cents per 8-ounce glass.[16]

Soft drinks and energy drinks (like Red Bull and Atomic Energy) contain glucose levels that are too high for proper rehydration during work or exercise in the heat. For example, the average soft drink contains between 10 to 12 percent glucose.

Caffeinated beverages are not advised due to the potentially diuretic effect of caffeine.

Alcoholic beverages should be avoided as a means for replacing fluids. Alcoholic beverages can impede performance, and are high in calories and low in carbohydrates. It is a myth that beer is a good sports drink, filled with carbohydrates, potassium, and B vitamins. In fact, beer is a poor source of carbohydrates (only 50 of the 150 calories in a beer are carbohydrates), and you would have to drink 11 cans of beer to get the recommended intakes of some B vitamins. Beer also has a dehydrating effect because it causes frequent urination and loss of fluid (diuretic effect). Pre-exercise alcohol can interfere with normal blood sugar control.[16]

Salt or salt solution consumption is not necessary. The concentration of sodium in your blood actually increases during exercise because you lose proportionately more water than sodium. Your first need is to replace fluids. You will get adequate sodium in the foods you eat. In one study, even athletes who lost 6 percent of their body weight only lost 1 to 2 teaspoons of salt. Additionally, the less salt you eat, the less you lose because kidneys and sweat glands tend to conserve sodium when it is in short supply.[16]

Although it is important to take in fluids through the right beverages, about 20 percent of total water intake is through foods.[23] Many fruits and vegetables, such as watermelon and cucumbers, are nearly 100 percent water by weight.[23] So when you are considering healthy nutrition, fruits and vegetables are always a good choice, including a good choice for hydration.

Acclimating to the Heat

A gradual introduction - emphasis on athletes

Whether you're a parent or coach with an athlete, or someone traveling into a warmer region for a time, it is important to make sure you and your loved ones take time to acclimate to the heat before going "full throttle" in it. A large concern of parents and coaches alike is the safety of children as they go back into school sports and athletics. Most heat-related problems occur within the first few days of activity for athletes going into a practice schedule.[12] Athletes and coaches should be encouraged to slowly get used to working in the heat.[26]

Here are some guidelines for activity in a hot environment that can help acclimate your athlete to the heat and keep heat illness at bay:

- Get used to the daytime heat by working out in it for 20 minutes a day. Work up to 30-60 minutes 5 to 10 days ahead of the sport start date.[26] Note that young athletes may need up to 14 days to safely acclimate to heat;[12] therefore, acclimation of young athletes to the heat should take place over a two-week period.[27]

- Stretch before and after exercise.[26]

- Take in fluids before, during, and after practice or competitions.
  Before: Drink 1-1/2 to 2-1/2 cups of cold water 10 to 20 minutes before exercising in the heat (1 cup = 8 ounces).
  During: Try to match fluid loss with fluid intake. A rule of thumb would be about 1 cup of water every 10 to 15 minutes.
  After: Continue drinking water after the activity, even if you don't feel thirsty. It can take up to 12 hours to achieve fluid replacement after strenuous activity.[26] Athletes should try to replace fluid deficit within 1 to 2 hours after exercise is complete.[28]

  Note: While water is fine for activity up to 30 minutes in duration, for activity 30-60 minutes in duration, encourage sports drinks. A flavored sports drink may promote an increase in the quantity of fluids consumed.[27] Avoid carbonated or caffeinated beverages. They are absorbed at a slower rate and can cause greater dehydration due to diuretic effect (frequent urination).[26]

- Have convenient access to hydration for scheduled breaks as well as outside of scheduled breaks.[27] Overdrinking should also be avoided since it can compromise physical performance and health due to low sodium levels in the blood - this condition is rare, but can occur among endurance athletes.[23, 29]

- Have athletes weigh themselves before and after practice. Their goal should be to regain weight lost during practice (within 1 to 2 pounds) between practice bouts.[26] Note that this weight loss is water loss, not fat loss.

- Encourage athletes to check the color of their urine during training/competitions in the heat. Urine should be clear and normal quantity, indicating good hydration. Dark yellow and/or reduced quantity indicates dehydration.[26]

- After an exercise period, don't just stop cold and rest.[30] Make sure athletes cool-down immediately following strenuous exercise.[26] Athletes should move about at low intensity for 10 to 20 minutes after exercise to remove lactic acid that has accumulated. During exercise, lactic acid builds up in the muscle and can cause soreness, fatigue, and possibly cramping.[30] This is very important for recovery between multiple bouts of exercise, such as "2-a-days."[26] Cooling down can help athletes feel better as well as reduce muscle soreness.[30]

- Encourage exercise before 10 am or after 6 pm, when it is likely to be cooler outdoors. If possible, exercise/practice in shaded areas.[17]

- Wear light-weight (like cotton), loose fitting, light-colored clothing as much as possible. Minimize the amount of equipment and clothing worn by athletes/players in hot and humid conditions, particularly during the acclimation period.[27]

- Take steps to avoid sunburn. Sunburn decreases the body's ability to cool itself.[17] Encourage athletes to use a sunscreen with SPF 15 or higher and to reapply it as needed. Wear a hat to cover the face and neck.

- Provide proper rest periods during and in between practice sessions.[27]

- Encourage athletes to get plenty of sleep. Most young athletes need a minimum of 7-8 hours of sleep to recover from strenuous activity. Encourage rest or naps during leisure time if an athlete needs to catch up on sleep.[26]

- Those supervising athletes should be able to recognize the basic signs and symptoms of dehydration and heat illness.[29] Remember, children produce more heat, sweat less, and may be less likely to drink enough fluids during exercise.[12] So, it is the responsibility of the adults in charge to be sure that children remain safe in the heat by taking appropriate precautions.

Parents, athletic staff, athletes, and kids of all ages should be educated about the negative effects of heat and how to minimize them. Modifications should be made when it is hot, especially when working with prepubescent and adolescent athletes, but also for anyone who is not yet acclimated. Taking steps to get acclimated, stay hydrated, and simply stay out of the hottest parts of the day can go a long way to prevent heat illness.

A Measure of Heat: Wet Bulb Globe Temperature (WBTG)

"Sometimes, it's just too hot and muggy to go full throttle on the field. To determine when heat and humidity make strenuous exercise inadvisable for youngsters, coaches should use a device called a psychrometer to measure wet bulb globe temperature (WBGT)."[12]

The WBGT is the standard index of temperature and humidity combined. The American Academy of Pediatrics (AAP) has issued these guidelines for safe outdoor activity based on WBGT:

- WBGT below 75 °F. All activities are allowed, but coaches should be alert for heat-related symptoms.

- WBGT between 75 °F and 78.6 °F. Children should take rest periods in the shade for long enough to cool off. They should also drink fluids every 15 minutes.

- WBGT between 79 °F and 84 °F. Children who haven't yet acclimated to the heat or who are at higher risk of dehydration and heat-related illnesses should stop playing and get out of the heat.

- WBGT 85 °F and above. Cancel or postpone all outdoor games or activities. Practice may be held in an air-conditioned space.[12, 13]

If your coach doesn't have access to such measurement, he/she can follow guidelines represented by measures of temperature and relative humidity (heat index or apparent temperature). For more information see the *Parents' and Coaches' Guide to Dehydration and Other Heat Illnesses in Children* at the following website: *http://www.nata.org/publicinformation/files/parentandcoachesguide.pdf.*

Fact Sheets to Support this Topic

The following fact sheets are provided for use in your programming:

Avoiding Dehydration during Sports
http://texashelp.tamu.edu/004-natural/pdfs/avoiding-dehydration.pdf

Hyperthermia: Too Hot for Your Health
http://www.niapublications.org/agepages/PDFs/Hyperthermia-Too_Hot_For_Your_Health.pdf

Working Outdoors in the Heat
http://fcs.tamu.edu/health/Health_Education_Rural_Outreach/Health_Hints/2006/september06/heat-handout.pdf

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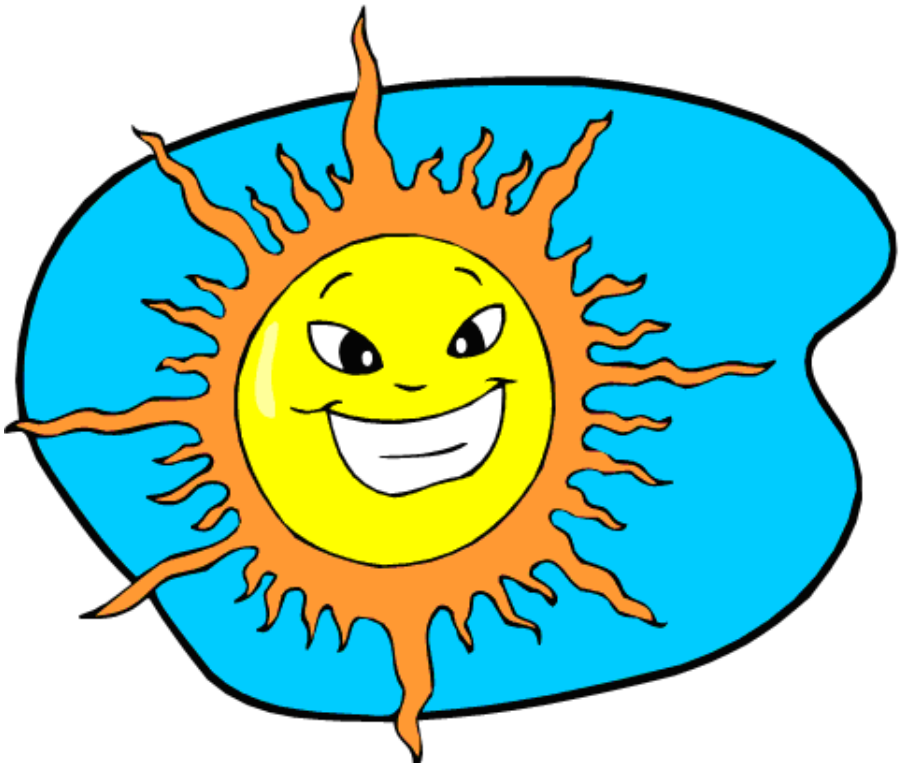

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Working Outdoors in the Heat

Whether you work outdoors in agriculture, construction, coaching, or some other capacity, caution should be taken when temperatures rise. Asphalt and concrete store heat longer and gradually release heat at night, making road work extremely hot. Strenuous activity in the heat causes the body to sweat in an effort to cool itself. When sweat evaporates, the body begins to cool. A pea-sized bead of sweat can cool nearly 1 liter (about 1 quart) of blood by 1 °F. In hot, humid conditions, however, evaporation of sweat becomes more difficult, and keeping the body's temperature regulated can become a problem if precautions are not taken.

If you or your employees work in the outdoor heat, take these safety precautions:

Get acclimated to the heat. If you have just begun summer work, returned from a vacation, or had an extended illness, it is important to begin work gradually. It will take an adult about 5-7 days to acclimate to the heat.

Implement work-rest cycles. Distribute the workload evenly over the day and amongst able workers with adequate rest periods. Do **not** increase the duration of rest periods in hopes of increasing the duration of work periods - this can result in heat illness. Short, but frequent, work-rest cycles are the greatest benefit to the worker.

Provide cool rest areas. Shaded or air conditioned areas with a a temperature of 76 °F are preferable. The rest area should be as close to the work area as possible.

Drink 1/2 cup to 1 cup of cool water every 15 to 20 minutes. For work longer than 1 hour in duration, an electrolyte-containing sports drink may be preferred to replace lost nutrients. To prevent dehydration, it is crucial that the water intake during the workday be about equal to sweat loss. Do not rely on thirst as a measure of the need for fluid. A worker may produce 2 to 3 gallons of sweat over the course of a day.

Wear appropriate clothing. Clothing helps to prevent the transfer of heat from the air to the body. This advantage may be nullified, however, if the clothes interfere with the evaporation of sweat, such as in humid environments. In most cases, the best choice is to wear light-weight (like cotton), loose-fitting, light-colored clothing and a hat with a wide brim to protect the face and neck.

Work in pairs. Each person should have a partner whose job is to check on the other to watch for signs of heat illness.

Postpone nonessential tasks. When feasible, the most stressful tasks should be performed during the cooler parts of the day (early morning or at night). Double shifts and overtime should be avoided whenever possible during high temperature conditions.

Educate employers and workers. Both employers and workers should know the hazards of working in the heat, the benefit of implementing the above guidelines, as well as the signs and symptoms of heat illness.

For more information on heat and heat illness, see the *HealthHints* newsletter on this topic at *http://fcs.tamu.edu/health/Health_Education_Rural_Outreach/index.php*.

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Signs of Heat Illness

Excessive exposure to a hot environment, epecially while active or working, can bring about a variety of heat-induced disorders, which can be very serious - potentially causing permanent disability or death.

Heat exhaustion is the most common heat illness and often comes on suddenly. It is caused by decreased blood volume due to dehydration. Symptoms may include:

- Dizziness/feeling faint
- Headache
- Nausea
- Profuse sweating
- Clammy/cool skin
- Rapid/weak pulse
- Body temperature at or below normal
- Low grade fever
- Low blood pressure
- Ashen/pale appearance.

If left unattended, heat exhaustion can result in the more disabling and deadly heat stroke. **Heat stroke** occurs when the body is unable to regulate its temperature and cool down. Body temperature may rise to 106 °F or higher within 10 to 15 minutes. Warning signs vary, but may include:

- An extremely high body temperature (above 103 °F, orally)
- Red, hot, and dry skin
- No sweating
- Rapid, strong pulse or heartbeat
- Rapid, shallow breathing
- Elevated or lowered breathing
- Throbbing headache
- Dizziness
- Nausea
- Confusion
- Irritability
- Unconsciousness.