

Heat-Related Illness

Traveler Summary

Key Points

- High temperature and humidity can affect the body's ability to regulate its temperature through perspiration.
- Some people may be more susceptible due to age, illness, poor physical conditioning, or medication.
- Heat-related illnesses include:
 - Heat rash: appears as red raised spots or patches in areas of the body with lack of air exposure (usually in underarms, groin, and under breasts).
 - Heat edema: swelling of the ankles and/or hands
 - Heat cramps: painful involuntary contractions of large muscles associated with exertion
 - Heat syncope: dizziness or fainting due to overheating
 - Heat exhaustion: mild to moderate illness with weakness, dizziness, headache, nausea, thirst, rapid pulse, and elevated body temperature (38.5–40°C; 101.3–104°F); mental function is normal. Often occurs during or after exertion in hot humid areas.
 - Heat stroke: serious disorder with headache, confusion, irrational behavior, drowsiness, shortness of breath, convulsions, elevated body temperature (> 40°C; 104°F), and unconsciousness. May or may not be related to activities.
- Heat exhaustion should be treated with ingestion of cold liquids and a cold shower. Heat stroke can be rapidly fatal and urgent medical care should be sought.
- Prevention includes:
 - Wearing light-colored, lightweight, loose fitting, water-vapor permeable clothing
 - Wearing a wide-brimmed hat and applying sunscreen.
 - Scheduling strenuous activity in the early morning or late afternoon and building in rest time.
 - Maintaining hydration as dictated by thirst. A normal diet usually contains adequate salt; salt supplementation or the use of sports drinks is unnecessary.

Introduction

Heat illness is common worldwide, not just in hot countries. Death from heat stroke ranges from 10% to 33% of cases; heat stroke due to exertion is the likeliest risk to the traveler. Thermoregulation and acclimatization determine human tolerance and vulnerability to high environmental and body temperatures. Humans gain heat more easily than they lose heat. Travelers visiting a country where temperatures or humidity exceed those at home or who plan to exercise more vigorously than normal should take precautions against heat-related illnesses.

Thermoregulation

Thermoregulatory mechanisms enable humans to maintain a resting core body temperature of 36.8°C +/- 0.5°C (98.4°F +/- 0.9°F) and to survive in environmental temperatures ranging from polar to equatorial. The body gains heat from radiation in a hot environment and generates additional heat through metabolism (physical activity, shivering, and digestion); the body temperature may rise without harm to 40°C (104°F) or higher in exercising athletes. Heat is lost through exposure to a cool environment (air, air conditioning, or cold water), by evaporation of sweat or water from the skin, and by ingestion of cold fluids. Evaporation may be assisted by a breeze or a fan. Appropriate clothing can help prevent the absorption of radiant heat and permit the evaporation of sweat. When heat gain outpaces heat loss/dissipation, commonly from exercise in a hot climate, body core and skin temperatures rise and heat illness may develop. Heat stroke develops when body core temperature rises above a critical level.

Acclimatization

Thermoregulation maintains body temperature in a given climate. Acclimatization (the process of the body adjusting to changes in the environment) in a hot environment increases the cooling responses of the body and protects against dehydration and salt deficiency. This process takes a minimum of 7 to 10 days, after which the risk of heat-related illness diminishes. Two hours or less is the advised maximum amount of time for exercise heat-stress during the acclimatization period. Acclimatization to wet-

heat conditions takes longer than acclimatization to dry-heat conditions and may not even be attainable. Sportsmen, hikers, and outdoor workers (including military personnel or aid workers) may need specially designed acclimatization schedules. Behavioral adaptation to a hot climate may also be necessary; for example, proper pace when exercising or wearing suitable clothing is important so that heat gain does not outpace heat loss.

Heat-Related Illness

Heat rash ("prickly heat") appears as red raised spots or patches in areas of body that are sweaty and lack air exposure, such as underarms, groin, and under breasts. Sweat gland ducts are blocked and become itchy.

Treatment: Travelers should use cool baths or compresses to help soothe irritated skin, apply 1% hydrocortisone cream to the affected areas to decrease itching, and keep the skin as cool and dry as possible.

Heat edema is swelling of the ankles and/or hands due to dilation of blood vessels and leakage of fluid into the tissues.

Treatment: Travelers should elevate their legs, wear compressions stockings, and acclimatize.

Heat cramps are painful involuntary contractions of large muscles associated with exertion in hot environments.

Treatment: Rehydration with oral salt or electrolyte replacement solutions.

Heat syncope is dizziness or fainting due to overheating. It occurs when the body, in an effort to cool itself, causes the blood vessels to dilate to such an extent that blood pools, resulting in a fall in blood pressure and reduced blood flow to the brain. Advanced age, prolonged standing, and heart problems may predispose to this condition.

Treatment: Travelers should lie or sit down, drink cool nonalcoholic liquids, loosen or remove tight clothing, cool off with a fan or cold shower, and acclimatize. To prevent further episodes, move about and exercise leg muscles.

Heat exhaustion is mild to moderate heat illness due to exposure to high environmental heat or strenuous physical exercise when evaporation of sweat is impaired and fluid intake has not kept pace with fluid loss. Symptoms include exhaustion, weakness, dizziness, headache, nausea, thirst, rapid pulse, and low blood pressure. Body temperature is usually raised to 38.5–40°C (101.3–104°F). Mental function is normal.

Treatment: Travelers should treat symptoms immediately: find a cool shady spot to rest, take a cold bath or shower or mist the skin with cold water and fan (to assist with evaporation), and drink cool nonalcoholic liquids. Muscle cramps indicate salt depletion; if they occur, travelers should drink liquids with added salt: use 1 to 2 level teaspoons of salt for each liter (about 4 cups) of fluid. If untreated, heat exhaustion can lead to heat stroke. Travelers should not take fever-reducing medications.

Heat stroke is the most serious heat-related disorder. It may follow heat exhaustion or arise spontaneously in a very hot environment (classical heat stroke) or following strenuous exercise (exertional heat stroke), even before the development of water and salt depletion symptoms. Body temperature is usually above 40°C (104°F). Mental function is abnormal.

Heat stroke occurs when the body is unable to control its temperature. The core body temperature rises rapidly, the sweating mechanism fails, and the body cannot cool down. Symptoms include headache, confusion, irrational behavior, drowsiness, shortness of breath, convulsions, and unconsciousness. Victims often complain of feeling cold and may shiver. The skin may be hot and dry or profusely sweaty. Heat stroke can be rapidly fatal. If the body temperature continues to rise, multiple organs can fail.

Exertional heat stroke occurs predominantly in healthy people who are exercising or working in a hot and humid climate, but it can also affect those who are unfit or not acclimatized to the weather.

Classic heat stroke most commonly affects children, the elderly, or chronically ill persons with underlying risk factors.

Treatment: Victims should be cooled down as quickly as possible: remove clothing, immerse trunk and limbs in a cold bath (preferably iced) or a natural body of cold water, or (second best) mist the skin with cold water and fan. Medical help should be sought immediately. Rehydration with oral or intravenous fluids is required. Do not give fever-reducing medication.

Risk Factors

The risk factors for heat-related illness include:

- Exposure to environmental temperatures above 35°C (95°F)
- Physical activity (e.g., swimming) in water temperatures above 33°C (91°F)
- Physical activity in the heat, especially for children
- Physical activity while wearing excessive, insulating, or impermeable clothing

- Advanced age, due to the decreased ability to sweat and dissipate heat even while at rest
- Obesity, poor physical conditioning, lack of acclimatization, alcohol abuse, and dehydration
- Cardiovascular, respiratory, kidney, or neurological diseases; mental illness; underlying illness with fever; and skin conditions that affect sweating (e.g., extensive scarring or recent severe sunburn)
- Use of medications that may interfere with heat regulation, notably sedatives; tranquilizers; certain drugs for mood disorders (depression and psychosis), movement disorders, blood pressure, attention deficit disorder, or colds; diuretics; laxatives; amphetamines; and cocaine
- Pilgrimages to destinations with high temperatures, such as Saudi Arabia for Hajj and Umra (see *Hajj and Umra Travelers*) and India
- Lack of air conditioning during heat waves in cities with normally moderate climates

Need for Medical Assistance

Treatment for heat related illness is mostly carried out on the spot. Heat edema, heat syncope, and heat exhaustion usually respond quickly. Heat stroke is a medical emergency and cooling should begin immediately when the diagnosis is suspected. Ideally, victims should be transferred to a medical facility capable of critical care management.

Prevention

Before travel, check the climate at the destination and take into consideration planned activities, body mass index, physical fitness level, and the existing medical conditions and medications listed under Risk Factors. If indicated, seek advice and get into good physical shape. Allow time for acclimatization at the destination.

When outdoors at the destination, wear light-colored, lightweight, loose fitting, water-vapor permeable clothing that covers as much skin as practicable to prevent absorption of radiant heat. Fabrics such as cotton and linen are good choices. Avoid synthetic materials. Clothes should fit loosely for maximum cooling effect. On bright days or in the sun, wear a comfortable, ventilated, light-colored hat with a wide brim and use sunscreen to prevent sunburn (see *Sun Protection*).

In the heat of the day, seek shade and a breeze; rest indoors in the afternoon. Schedule sightseeing and other physical activities in the early morning or evening. Maintain hydration by regularly drinking enough water to keep the urine a pale-yellow color, and drink whenever thirsty. As the day and the body heat up, sweating may become the only means of losing heat. If exercising during the heat of the day, take regular breaks for hydration, cooling, and rest.

Sweat rates during exercise in the heat average 1 to 1.5 liters/hour (4-6 cups/hour). Salt supplementation or the use of sports drinks is unnecessary for cumulative losses of less than 8 liters. A normal diet usually contains adequate salt; increasing dietary salt at meals should generally be sufficient for longer expeditions or periods of exercise.

Deliberate strategies for prevention should be included when planning activities with an identifiable risk of heat-related illness. A particularly crucial strategy is to avoid high-exertion activities in exposed or hot areas.