

## How Do Our Bodies Adjust to Heat across the Ages?

"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."<sup>1</sup>



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.<sup>2</sup>

**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.<sup>3,4</sup>

**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.<sup>5</sup> Age-related changes may include changes to the skin, such as poor blood circulation and inefficient sweat glands.<sup>5</sup> 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.<sup>6</sup> 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.<sup>6</sup>

**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 the skin, leaving less for the muscles, which increases the heart rate and may increase problems with these chronic conditions. These illnesses may also make those with chronic illnesses feel weak or cause fever. High blood pressure and other conditions may require changes in diet, such as restricting salt. If you have a chronic illness, 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.<sup>2, 5, 6, 7, 8, 9</sup>

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