

Body Temperature and How to Measure It

What is body temperature?

Body temperature is a measure of the body's ability to generate and get rid of heat. The body is very good at keeping its temperature within a narrow, safe range in spite of large variations in temperatures outside the body.

When you are too hot, the blood vessels in your skin expand (dilate) to carry the excess heat to your skin's surface. You may begin to sweat, and as the sweat evaporates, it helps cool your body. When you are too cold, your blood vessels narrow (contract) so that blood flow to your skin is reduced to conserve body heat. You may start shivering, which is an involuntary, rapid contraction of the muscles. This extra muscle activity helps generate more heat. Under normal conditions, this keeps your body temperature within a narrow, safe range.

Where is body temperature measured?

Your body temperature can be measured in many locations on your body. The mouth, ear, armpit, or rectum are the most commonly used places. Temperature can also be measured on your forehead. The forehead is the ideal part of the body from which to take a temperature because it is supplied by the temporal artery, which receives blood through the aorta and the carotid artery, guaranteeing a considerable flow of blood. Moreover the forehead is the only part of the body close to the brain which is not covered in hair.

What is normal body temperature?

Most people think of a "normal" body temperature as an oral temperature of 98.6 °F. This is an average of normal body temperatures. Your temperature may actually be 1°F or more above or below 98.6 °F. Also, your normal body temperature changes by as much as 1°F throughout the day, depending on how active you are and the time of day. Temperature readings, even in the same individual, may be different in different regions of the body, and may be influenced by the ambient temperature and other external factors. Body temperature is very sensitive to hormone levels and may be higher or lower when a woman is ovulating or having her menstrual period.

Normal Temperature Ranges

<i>Measurement method</i>	<i>Normal temperature range</i>
Rectal	97.9° F to 100.4° F
Ear	96.4°F to 100.4°F
Oral	95.9°F to 99.5°F
Axillary (Armpit)	94.5°F to 99.1°F
Temporal artery (forehead)	95.0°F to 100.4°F

Because of the heat loss from parts of the body uncovered by clothing, the normal temperature measured on a person's forehead is usually lower than that of covered parts of the body. Thermofocus' internal software automatically adjusts the temperature to provide a reading which correlates approximately to the oral temperature. It also automatically adjusts to the ambient room temperature.

It is important to know the normal temperature of each member of the family when they are in good health and at various times of the day, in order to be able to detect a potential fever. If you decide to consult a doctor, inform him or her of the type of measurement you have taken and your normal temperature under healthy conditions.

What is a fever?

In most adults, an oral temperature above 100 °F (37.8 °C) or a rectal or ear temperature above 101 °F (38.3 °C) is considered a fever. A child has a fever when his or her rectal temperature is 100.4 °F (38 °C) or higher.

What can cause a fever?

A fever may occur as a reaction to:

- Infection. This is the most common cause of a fever. Infections may affect the whole body or a specific body part (localized infection).
- Medications, such as antibiotics, narcotics, barbiturates, antihistamines, and many others. These are called drug fevers. Some medications, such as antibiotics, raise the body temperature directly; others interfere with the body's ability to readjust its temperature when other factors cause the temperature to rise.
- Severe trauma or injury, such as a heart attack, stroke, heat exhaustion or heatstroke, or burns.
- Other medical conditions, such as arthritis, hyperthyroidism and even some cancers, such as leukemia, Hodgkin's lymphoma, and liver and lung cancer.

Can a low body temperature be dangerous?

An abnormally low body temperature (hypothermia) can be serious, even life-threatening. Low body temperature may occur from cold exposure, shock, alcohol or drug use, or certain metabolic disorders, such as diabetes or hypothyroidism. A low body temperature may also be present with an infection, particularly in newborns, older adults, or people who are frail. An overwhelming infection may also cause an abnormally low body temperature.

Can a high body temperature be dangerous?

The brain is the most important and delicate organ in the body, and the one most liable to damage from excessive temperature. Furthermore, the head is the first part of the body to modify its temperature in the case of a fever, whether rising or falling.

Heatstroke occurs when the body fails to regulate its own temperature, and body temperature continues to rise. Symptoms of heatstroke include mental changes (such as confusion, delirium, or unconsciousness) and skin that is red, hot, and dry, even under the armpits.

Classic heatstroke can develop without exertion when a person is exposed to a hot environment and the body is unable to cool itself effectively. In this type of heatstroke, the body's ability to sweat and transfer the heat to the environment is reduced. A person with heatstroke may stop sweating. Classic heatstroke may develop over several days. Babies, older adults, and people with chronic health problems have the greatest risk of this type of heatstroke.

Exertion heatstroke may develop when a person is working or exercising in a hot environment. A person with heatstroke from exertion may sweat profusely, but the body still produces more heat than it can lose. This causes the body's temperature to rise to high levels.

Both types of heatstroke cause severe dehydration and can cause body organs to stop functioning. **Heatstroke is a life-threatening medical emergency**, requiring emergency medical treatment.

Why It Is Done

Body temperature is checked to:

- Detect fever.
- Detect abnormally low body temperature (hypothermia) in people who have been exposed to cold.
- Detect abnormally high body temperature (hyperthermia) in people who have been exposed to heat.
- Help monitor the effectiveness of a fever-reducing medication.
- Help plan for pregnancy by determining if a woman is ovulating.

Temporal Artery Thermometry

According to the Community Paediatrics Committee of the Canadian Paediatric Society, *“Infrared arterial temperature can be measured with a device that is passed over the front of the forehead in the temporal area. This relatively new method of body temperature measurement has been shown to be more accurate than tympanic thermometry and better tolerated than rectal thermometry.”*

Oral thermometry

Oral is the most common method of taking a temperature. However, oral temperature is easily influenced by the recent ingestion of food or drink and mouth breathing. This method of temperature measurement cannot be used in young children, or unconscious or uncooperative patients. To get an accurate temperature, the person must be able to breathe through the nose. Generally, it is suggested that the accuracy of oral thermometry lies somewhere between that of axillary (armpit) and rectal thermometry. This accuracy may increase with age and the ability to use the proper temperature taking technique on the patient.

Rectal thermometry

Rectal thermometry has traditionally been considered the gold standard to temperature measurement, but recent studies have revealed some possible limitations as readings are slow to change in relation to changing core temperature (they may stay elevated long after a patient's core temperature has begun to fall, and vice versa). Readings from rectal thermometry can also be affected by the depth of the measurement, conditions affecting local blood flow, and the presence of stool. Proper sterilization is also essential to prevent contamination, and there is also a potential risk of rectal perforation. Most importantly, many parents are not comfortable with this method, and most children resent it.

Axillary (armpit) thermometry

While it is generally easier to take the axillary temperature (compared to oral or rectal), this method has been found to be the worst estimate of core temperature in children. However, because of the risk of rectal perforation, it is often recommended by pediatricians as a screening test for fever in neonates, despite the low sensitivity and accuracy.

How to take an ear temperature

Ear thermometers may need to be cleaned and prepared for use. These steps can be followed when using an ear thermometer; however, follow the instructions for your specific model.

1. Check that the probe is clean and free of debris. If dirty, wipe it gently with a clean cloth. Do not immerse the thermometer in water.
2. To keep the probe clean, a disposable probe cover should be used. Use a new probe cover each time you take an ear temperature. Attach the disposable cover to the probe.
3. Turn the thermometer on.
4. For babies younger than 12 months, pull the earlobe down and back. This will help place the probe in the ear canal. Center the probe tip in the ear and push gently inward toward the eardrum.
5. For children older than 12 months and for adults, pull the earlobe up and back. Center the probe tip in the ear and push gently inward toward the eardrum.
6. Press the "on" button to display the temperature reading.
7. Remove the thermometer and throw away the used probe cover.

Using forehead strips or pacifiers

The forehead plastic temperature strips (forehead thermometer or fever strip) and the pacifier thermometers are not as reliable as the other methods. If your baby is younger than 3 months or your child's fever rises higher than 102°F (38.9°C), recheck the temperature using another method.

How It Feels

Taking your temperature by mouth is only mildly uncomfortable, since you must keep your mouth closed and breathe through your nose while the thermometer is in place.

Taking a rectal temperature can be slightly uncomfortable but should not be painful.

Taking your temperature with an ear thermometer causes little or no discomfort. It is not inserted very far into the ear, and it provides a reading in only a few seconds. For this reason, the ear thermometer is widely used in health professional's offices and hospitals. However, it may be less accurate than digital thermometers.

Taking your temperature with a plastic strip thermometer feels like having an adhesive bandage on your forehead. Although it causes very little discomfort, it is not as reliable as other methods, so another kind of thermometer should be used if the plastic strip shows an abnormal temperature.

Risks

There is very little risk of complications from taking a temperature.

When taking a rectal temperature, do not insert the thermometer into the rectum more than 0.5 in. (1.3 cm) to 1 in. (2.5 cm). Further insertion can be painful and may damage rectal tissues.

Results

Body temperature is a measure of the body's ability to generate and get rid of heat.

Rectal and ear (tympanic membrane) temperatures are normally as much as 1°F (0.6°C) higher than oral temperatures; armpit temperatures, however, may be as much as 1°F (0.6°C) lower than oral temperatures. If your oral temperature is 99 °F(37.2 °C), your rectal or ear temperature may be about 100 °F(37.8 °C) and your armpit temperature about 98 °F(36.7 °C). When you tell your health professional about your temperature measurement, be sure to mention whether it was taken in the mouth, rectum, armpit, or ear.

Body temperature

Normal:	The average normal temperature is 98.6 °F (37 °C). However, "normal" varies from person to person. Your temperature will also vary throughout the day, usually being lowest in the early morning and rising as much as 1°F (0.6°C) in the early evening. Your temperature may also rise by 1°F (0.6°C) or more if you exercise on a hot day. A woman's body temperature typically varies by 1°F (0.6°C) or more through her menstrual cycle, peaking around the time of ovulation.
Abnormal:	An oral temperature of 100 °F (37.8 °C) or a rectal or ear temperature of 101 °F (38.3 °C) indicates a slight fever.
	A rectal temperature of 100.4 °F (38 °C) or higher in a child indicates a fever.
	A rectal or ear temperature of less than 97 °F (36.1 °C) indicates a low body temperature (hypothermia).

What Affects the Test

Inaccurate temperature readings can be caused by:

- Not keeping your mouth closed around the thermometer when taking an oral temperature.
- Not leaving a thermometer in place long enough before reading it.
- Not putting the proper thermometer in the right place.
- Not following the instructions for proper use that come with the thermometer.
- Taking an oral temperature within 20 minutes after smoking or drinking a hot or cold liquid.
- Taking a temperature by any method within an hour of exercising vigorously or taking a hot bath.

What To Think About

- Body temperature is only one way of monitoring your health. Besides temperature, other basic measurements to monitor your health include your pulse, breathing rate (respiration), and blood pressure. These basic measurements are called your vital signs.
- A fever can make you feel uncomfortable. To treat the discomfort of a fever, wear light clothing and use light blankets or other bedding. Drink cool liquids. A bath or shower

with lukewarm (not cool) water can lower body temperature. Cool or cold water can cause shivering and can cause the blood vessels near the skin to contract, which will raise the body temperature further.

- Fever-reducing medications can lower body temperature. Unless a fever is high enough to call a health professional, fever-reducing medication is not necessary but may help you feel more comfortable. When a fever causes discomfort, use acetaminophen (such as Tylenol) or ibuprofen (such as Advil or Motrin). Aspirin also reduces fever but should not be given to anyone younger than age 20 because of the risk of Reye's syndrome.
- When reading medical information that mentions body temperatures, note whether the temperature is listed as an oral or rectal temperature. Many books and other information about children's health list all body temperatures as rectal temperatures, because this method is preferred for measuring body temperature in a young child. If a body temperature is listed but neither oral nor rectal is specified, you may assume it is an oral temperature.
- Glass thermometers containing mercury are no longer recommended. If you have a glass thermometer, contact your local health department for instructions on how to dispose of it safely. If you break a glass thermometer, call your local poison control center immediately.