

# Climate change and health

Tips on coping with hot  
weather and heat waves



**Deutscher Wetterdienst**  
Wetter und Klima aus einer Hand



**Umwelt**   
**Bundesamt**

## Background

In August 2003, an unusually long-lasting heat wave across large parts of western Europe cost more than 40,000 people their lives. The causes of death included heart attacks, cardio-vascular disease, kidney disease, respiratory tract disorders and metabolic disorders linked to extreme heat stress.

People over the age of 70, especially women, were the most severely affected, alongside low-income groups. Those with chronic illnesses were also particularly at risk. Temperatures in cities were significantly higher than in rural areas.

## How we experience heat

The body's response to heat is a complex process. The German Meteorological Service (DWD) uses model calculations to quantify "perceived temperature", which refers to an average adult's perception of heat outdoors. On hot, sunny summer days with hardly any breeze, the "perceived temperature" is higher than the actual air temperature. In extreme cases, the perceived temperature in central Europe can be up to 15°C higher than the measured air temperature.

The DWD differentiates between two stages of thermophysiological heat stress:

## Strong heat stress

Strong heat stress occurs in weather conditions with strong sun radiation, high air temperatures (of around 29°C in the shade), elevated relative humidity and low wind speed that persist over several days. The perceived temperature is above 32°C.

## Extreme heat stress

Extreme heat stress occurs in stable weather conditions with strong sun radiation, extremely high air temperatures (around 35°C in the shade), elevated relative humidity, low wind speed and only a slight dip in temperature at night, persisting over several days. In such cases, the “perceived temperature” is above 38°C.

## Heat-related health risks

In hot weather and extreme heat, thermophysiological heat stress can be dangerous to human health. Dehydration, a deterioration in existing conditions, heat cramps, sunstroke and heatstroke are some of the potential risks. The body may exhibit warning signs which should be taken seriously, including circulatory problems, muscle cramps in the arms and legs, stomach cramps, headache, dizziness, nausea, vomiting, a fast pulse, exhaustion, agitation or disorientation, and dryness of the mouth.

## Summer smog

High air temperatures and strong sun radiation can also lead to the formation of summer smog.

Summer smog is a kind of air pollution which occurs when high levels of ground-level ozone coincide with high temperatures. It can cause mucosal irritation, impaired lung function, inflammation of the respiratory tract and reduced physical performance. Studies of the 2003 heatwave in western Europe found high concentrations of ozone and fine particulate matter during periods of extreme heat.



## Who is most at risk?

Healthy adults leading normal lives are not usually at risk, even during protracted heat waves, provided they eat and drink sufficiently.

However, the following individuals may be vulnerable:

- ▶ The elderly and others in need of nursing care, especially if they live alone;
- ▶ Infants and young children;
- ▶ Those suffering from impaired memory who rely on assistance from others;
- ▶ Those taking certain types of medication (such as sedatives, diuretics and drugs to lower blood pressure);
- ▶ Those suffering from chronic illnesses (such as neurological diseases, cardio-vascular disease, metabolic disorders, infectious diseases);
- ▶ Anyone with a fever;
- ▶ Individuals under the influence of alcohol and psychoactive drugs;
- ▶ People with known heat acclimatisation disorders;
- ▶ Those with disabilities;
- ▶ People who work or play sports outdoors.



## Older people are more at risk

In hot weather, the human body tries to eliminate surplus heat by circulating more blood through the skin and perspiring more to regulate the core temperature. As a result, the body loses more fluids and minerals (electrolytes) than usual. We are alerted to the loss of fluid by feeling thirsty. At the same time, our bodies try to acclimatise to the higher air temperatures. In older people and those with impaired acclimatisation, this function may be impaired or slower. They do not drink enough fluids because they do not feel thirsty, putting them at risk of becoming (severely) dehydrated. Their ability to perspire is impaired, which in turn limits the amount of heat their bodies are able to dissipate. Older people are particularly at risk during the first onset of hot weather in early summer and during lengthy hot spells, because their bodies do not have time to acclimatise to the high temperatures, putting them under extreme stress.



# Heat stress-related conditions

## Heatstroke:

### *Cause and symptoms:*

In heatstroke, the body absorbs more heat than it is able to emit to the environment due to the high air temperatures. As a result, the core temperature can quickly spiral out of control, climbing to as much as 41°C within just 10–15 minutes. The symptoms of heatstroke include unusual anxiety, an extremely high temperature (over 39°C when measured orally), hot, red skin, headache, dizziness, sleepiness, extreme thirst, disorientation, cramps and unresponsiveness through to unconsciousness. Heatstroke can develop very rapidly (within one to six hours) and the sufferer may die in less than 24 hours if left untreated.

### *What to do:*

Heatstroke is life-threatening! Seek medical assistance immediately. Take the affected individual to a cool place until help arrives. If they are still fully conscious, give them something to drink. Loosen any tight clothing, apply a cool damp compress, and gently fan them.



## Heat collapse:

### *Cause and symptoms:*

In relentless hot weather, the body's attempts to dissipate heat by increasing blood flow through the skin can cause blood pressure to drop dangerously low. This reduces the amount of blood circulating through the brain, leading to short-term unconsciousness and collapse.

### *What to do:*

Move the affected individual to a cool, shady place and remove any surplus clothing. If possible, get them to sip a electrolyte drink. Seek urgent medical assistance.





## Heat exhaustion:

### *Cause and symptoms:*

Heat exhaustion is a milder form of heat stress. It can occur after several days of hot weather due to an imbalance or deficit of fluids. Heat exhaustion is the body's response to the fluids and electrolytes lost in sweat. If these losses are not replaced with a sufficient intake of water and electrolytes, the sufferer will gradually become weaker and their skin will turn ashen and clammy; they may also suffer from muscle cramps, nausea, vomiting, dizziness, confusion, fever, fainting or unconsciousness. Older people are particularly prone to heat exhaustion.

### *What to do:*

If the symptoms worsen or persist for more than an hour, seek medical assistance. Otherwise, help the affected individual to cool down.

The following may help:

- ▶ Plenty of cool (non-alcoholic) drinks containing electrolytes;
- ▶ Rest;
- ▶ A cool shower or bath, or sponging them down with cool water
- ▶ An air-conditioned environment;
- ▶ Lightweight, comfortable clothing.







## Heat cramps:

### *Cause and symptoms:*

People who suffer from heat cramps tend to be those who perspire a lot during physical exertion, causing the body to lose salts and fluids. The low concentration of minerals in the muscles leads to painful cramps. Heat cramps may also be a sign of heat exhaustion. Symptoms may include muscle pain or cramps normally occurring in the stomach, arms or legs, often linked to strenuous physical activity. People with heart conditions and those on a low-sodium diet should seek medical assistance if they experience heat cramps.

### *What to do:*

- ▶ Cease all physical activity and sit quietly in a cool place;
- ▶ Drink juice or a sports drink containing electrolytes;
- ▶ Once the cramps have subsided, do not resume strenuous activity for several hours, because further over-exertion may lead to heat exhaustion or heatstroke;
- ▶ If muscle cramps persist for more than an hour, seek medical assistance.



## Heat exanthema:

### *Cause and symptoms:*

Heat exanthema (heat rash) is a skin irritation caused by excessive perspiration. Heat rash can occur at any age but is particularly common in young children. The symptoms are a skin rash with red spots or tiny blisters, often concentrated in the throat and upper chest area, around the groin, under the breasts and in the elbow creases.

### *What to do:*

Try to spend as much time as possible in a cool, dry place. The affected areas of the body should be kept dry. Talcum powder can help ease the symptoms. Do not apply ointments or creams because these keep the skin warm and moist and could make the symptoms worse.



## Sunburn:

### *Cause and symptoms:*

Sunburn is a form of skin damage. Although the symptoms are usually mild and often heal within a week, severe sunburn may require medical assistance. The symptoms of sunburn are red, hot, painful skin.

### *What to do:*

Infants and small children should never be exposed to full sun. If an infant under the age of one suffers sunburn or exhibits any of the following symptoms, get medical help immediately:

- ▶ Fever;
- ▶ Blistering;
- ▶ Severe pain at the site of the sunburn.

Sunburn should be treated as follows:

- ▶ Avoid all further sun exposure;
- ▶ Apply cold compresses or immerse the sunburnt area in cool water;
- ▶ Apply a hydrating, cooling lotion to the affected areas. Avoid ointments and butter;
- ▶ Never pop the blisters.





## Sunstroke:

### *Cause and symptoms:*

Exposing your head to strong sun radiation can cause inflammation of the membrane covering the brain (aseptic meningitis) and life-threatening brain swelling (cerebral oedema). The symptoms include severe headache, a stiff neck, sensitivity to light, nausea, vomiting and disorientation.

### *What to do:*

Move the person to a cool, shady place. Cover them with cold, damp sheets. If the symptoms are severe, call an ambulance.

### *General recommendations:*

If you see any of the following symptoms, take the sufferer to hospital or call an ambulance:

- ▶ Severe headache;
- ▶ Persistent vomiting;
- ▶ A very high temperature (above 39°C);
- ▶ Sudden confusion;
- ▶ Cramps;
- ▶ Disorientation;
- ▶ Shock;
- ▶ Loss of consciousness.



# How to stay healthy in hot weather



## Protect yourself from the heat:

- ▶ Modify your daily schedule; avoid going outside in the midday heat if possible, and limit outdoor activities to the early morning and evening;
- ▶ Avoid strenuous activity, including sports. If physical exertion is unavoidable, drink two to four glasses of non-alcoholic beverages every hour;
- ▶ Stay in the shade whenever possible;
- ▶ Wear a wide-brimmed sun hat and sunglasses;
- ▶ Whenever you are exposed to the sun, use sunscreen with at least protection factor 20 (for young children, at least factor 30) labelled “UVA/UVB protection” or “broad-spectrum”;
- ▶ Never leave children or anyone with a health condition in a parked vehicle, even for the shortest time.



## Make sure you are eating and drinking enough:

- ▶ Your body needs adequate fluids to be able to replace lost electrolytes. Suitable options include sodium-rich mineral water, juices, soups, broths, together with watery fruits such as melons, cucumbers, tomatoes, strawberries and peaches. In addition, drink at least one-and-a-half to two litres of fluid per day. If your body temperature rises by one degree, for example because of a fever (body temperature increase from 37 to 38°C), you should drink at least an additional 0.5 litres of fluid per day;
- ▶ Avoid drinks containing alcohol, caffeine or high levels of sugar, as these may dehydrate you;
- ▶ Avoid very cold drinks, as these can stress the stomach. Eat several small, light meals spread over the day.



## Cool down:

- ▶ Stay indoors in a cool room;
- ▶ Ventilate rooms at night and early in the morning. During the daytime, keep rooms shaded;
- ▶ Cool down with a cool shower or bath;
- ▶ Hold your wrists under running cool water;
- ▶ Put a cool, damp compress on your forehead or the nape of your neck, or a cooled gel mask on your eyes; alternatively, use a water spray onto your face, arms and décolletage;
- ▶ Rub chilled foot cream into your feet. Dab cold water or ice cubes onto your temples and throat and behind your ears;
- ▶ Wear lightweight, loose, pale-coloured clothing (cotton).



## For infants and small children:

- ▶ The younger the child, the more sensitively he or she will react to heat. For this reason, infants (under the age of one) should never be exposed to direct sun radiation.
- ▶ Wherever possible, keep children indoors between 11.00 am and 3.00 pm, or at least in the shade, because this is when the sun is strongest;
- ▶ Ideally, children should be dressed in loose, light-coloured cotton clothes with a wide-brimmed hat or cap with neck protection;
- ▶ At least 20 minutes before going outside, cover children in waterproof sunscreen with a high protection factor (at least factor 30).

# Looking after elderly people at home



## Room and environment:

- ▶ Check the temperature of the room in the morning between 8.00 am and 10.00 am, at lunchtime at around 1.00 pm, and in the evening after 10.00 pm. The room temperature should not exceed 26°C;
- ▶ Ventilate rooms at night and early in the morning. Keep room shaded during the daytime;
- ▶ Minimise the use of artificial light and electrical appliances, as these are sources of heat;
- ▶ Do not allow heat to become trapped in clothing and bedclothes. Use lightweight bed linen, as few pillows as possible, and cover the elderly person with just a sheet.



## Eating and drinking:

- ▶ Provide a plentiful supply of cool (not ice-cold) drinks, such as herbal or fruit tea, fruit juice mixed with mineral water, mineral or tap water. Avoid coffee, black tea and green tea because of the dehydrating effects of caffeine;
- ▶ Ideally, offer them one or two beverages every hour, to achieve a daily fluid intake of at least one-and-a-half to two litres;
- ▶ Important: Some illnesses (such as dementia) will require careful monitoring of fluid intake. Get the patient's doctor to prepare a daily drinking plan.
- ▶ For individuals who tend to perspire heavily, be sure to compensate for lost salt. Offer them sodium-enriched mineral water (>20 mg/l);
- ▶ As a general rule of thumb, only serve low-sodium drinks such as fruit juice, tea and coffee if you are certain the person is getting enough salt from their food;
- ▶ Prepare light meals: plenty of vegetables, salads and water-rich fruit;
- ▶ Avoid foods that are hard to digest, such as processed cold meats;



- ▶ Keep food refrigerated or consume soon after purchase. Open tubs of yoghurt, liquid food etc. and open bottles of fruit juice can spoil quickly in hot weather, because the sugar in them promotes the growth of bacteria at higher temperatures, potentially causing diarrhoea.

## + Further measures:

- ▶ Use a cooling body lotion or a water spray;
- ▶ Offer to prepare a cold foot bath;
- ▶ Check the elderly person's body temperature daily, or in very hot weather, several times a day. It should not exceed 36.9°C;
- ▶ Look out for possible signs of overheating, such as anxiety, disorientation or vomiting. If the person has cool, dry skin but a high core temperature, this could be a potential sign of heatstroke. In such cases, call a medical doctor;
- ▶ Change sweat-soaked bedding more often than usual;
- ▶ If possible, use mesh underwear with an incontinence pad rather than disposable, plastic-coated adult nappies.



# Forecasting systems and measures

## The DWD's heat health warning system

From May to September, the German Meteorological Service (DWD) checks the heat stress situation in Germany daily. Heat alerts are issued at 10.00 am each morning as early warning weather forecasts.

The following DWD website contains information on weather patterns, including any heat alerts currently in place:

[www.dwd.de/warnungen](http://www.dwd.de/warnungen)

Further details of heat alerts can be found at

[https://www.dwd.de/DE/wetter/warnungen\\_aktuell/kriterien/uv\\_hitze\\_warnungen.html?nn=508722](https://www.dwd.de/DE/wetter/warnungen_aktuell/kriterien/uv_hitze_warnungen.html?nn=508722)

You can also subscribe to a newsletter to stay informed about the latest heat alerts.

[https://www.dwd.de/DE/service/newsletter/newsletter\\_hitzewarnungen\\_node.html](https://www.dwd.de/DE/service/newsletter/newsletter_hitzewarnungen_node.html)







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