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| Deutsche Sauna-Akademie® | **Deutsche Sauna-Akademie** |
| **Titel** | What Happens to the Body in a Sauna? |
| **Subtitel** | From hot skin and sweating to cardiovascular regulation, fluid shifts and recovery |
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**Short answer:** A sauna produces a controlled heat load. Within minutes, skin temperature rises, skin blood vessels dilate and a large share of cardiac output is redirected toward the body surface. Heart rate increases and sweating begins so that heat can be transported from the body core to the skin and released by evaporation. Because heat gain still exceeds heat loss, core temperature gradually rises and water and electrolytes are lost in sweat. The nervous, hormonal and cardiovascular systems coordinate these responses to defend homeostasis. After leaving the heat, cooling reverses much of the skin circulation response, and recovery allows temperature, circulation and fluid balance to move back toward baseline. The physiological effect of sauna is therefore not one isolated reaction but a coordinated whole-body response to heat.

The first thing a sauna heats is not the body core but the body surface. Hot air and thermal radiation from the stove, walls and ceiling rapidly warm the skin. From that moment, the organism begins an active defence of its internal temperature. The skin circulation changes, the heart works differently, sweat glands are activated, body water is redistributed and the brain continuously integrates thermal signals.

This is why sauna cannot be understood simply as 'sitting in a hot room'. It is a short period of passive heat stress that requires coordinated thermoregulatory, cardiovascular, autonomic, endocrine and fluid-regulatory responses. [1–5]

## 1. The skin heats first

Mean skin temperature rises rapidly in a Finnish sauna and can approach approximately 40–41 °C under substantial exposure. The temperature increase is much faster at the skin than in the body core because the skin is directly exposed to hot air and radiant heat. Classic thermophysiological work describes a sauna heat load in the order of several hundred watts per square metre of skin surface under typical hot Finnish-sauna conditions. [1]

Temperature-sensitive nerve endings in the skin immediately signal the thermal environment to the central nervous system. At the same time, direct local heating promotes vasodilation. The skin changes from a relatively small circulatory compartment into one of the body's major destinations for blood flow.

## 2. Skin blood vessels open

The purpose of cutaneous vasodilation is heat transport. Warm blood from the body core is moved toward the skin, where heat can be transferred to the environment or removed through sweat evaporation. During substantial passive heat stress, skin blood flow can rise by several litres per minute above resting levels. [5]

This redistribution explains the characteristic reddening of the skin. It is not evidence that 'toxins are leaving the body'; it is primarily a thermoregulatory vascular response.

The same response also changes cardiovascular conditions elsewhere. As peripheral vascular beds dilate, systemic vascular resistance can fall. The circulation must maintain arterial pressure while simultaneously supplying the greatly enlarged skin circulation.

## 3. The heart rate rises

The heart compensates mainly by beating faster and increasing cardiac output. Heart rate can rise substantially during sauna exposure, but the magnitude varies with temperature, humidity, duration, body position, hydration, acclimation and individual physiology. [2–5]

A recent controlled study of 50 healthy adults completing 10-minute Finnish-sauna exposures found an average heart-rate increase of about 42 beats per minute and an average core-temperature rise of about 0.4 °C; both air temperature and relative humidity independently contributed to the response. [6]

The increase in heart rate does not mean that sauna is physiologically identical to exercise. In exercise, working skeletal muscles generate large amounts of metabolic heat and require increased oxygen delivery. In sauna, much of the cardiovascular work serves thermoregulation: moving blood toward the skin and maintaining circulation during passive heat exposure.

## 4. Sweating begins – the body's most important cooling mechanism in the sauna

As thermal input continues, the hypothalamus and autonomic nervous system activate eccrine sweat glands. Sweat is secreted onto the skin surface. The liquid itself does not cool the body simply by being present; cooling occurs when water evaporates.

Evaporation requires a large amount of energy. That energy is taken from the skin, creating an outward heat flow. In the dry-hot Finnish sauna, evaporation is therefore the body's principal effective route for dissipating heat. [1,5]

Classic measurements report sweat rates around 0.6–1.0 kg per hour under substantial sauna heat stress, although actual rates vary widely. Short sauna sessions obviously produce only a fraction of an hour's loss, and sweating differs markedly among individuals.

## 5. Why the body still gets hotter despite sweating

Sweating does not mean that heat balance has been achieved. The sauna environment can transfer more heat to the body than evaporation can remove. When net heat storage remains positive, body-core temperature begins to rise.

In conventional sauna studies, increases in core temperature of several tenths of a degree Celsius are common during short exposures; longer or more intense exposures can produce increases approaching or exceeding 1 °C. The exact change is not a fixed property of 'sauna' but the result of the thermal dose. [1–4,6]

This distinction is important: a rise in core temperature is a consequence of net heat storage, not the primary event. The skin and circulation react first; core temperature follows as the heat balance remains positive.

## 6. Humidity changes the effectiveness of sweating

Sauna temperature is only one part of the thermal load. Water-vapour pressure determines how readily sweat can evaporate. When humidity rises during löyly or Aufguss, the vapour-pressure gradient between wet skin and room air becomes smaller. Evaporative cooling is reduced even though sweat production may continue.

This helps explain why an Aufguss can suddenly feel much hotter without a corresponding rise in air temperature. Recent experimental data confirm that both sauna air temperature and relative humidity independently influence heart-rate and core-temperature responses. [6]

At sufficiently high local vapour pressure, water vapour can also condense on cooler skin and release latent heat. Visible moisture on the body is therefore not necessarily all sweat.

## 7. Body water shifts and plasma volume can fall

Sweat is drawn ultimately from body water. As fluid is lost, plasma volume can decrease and blood constituents can become temporarily more concentrated. The body responds by conserving water and sodium and by stimulating thirst.

With modest short exposures, healthy adults generally compensate well. But repeated sauna cycles without adequate fluid replacement can progressively reduce circulatory reserve. As dehydration advances, heart rate may rise further, skin blood flow and sweating capacity can become harder to maintain, and core temperature can increase more rapidly at the same external heat load.

This is one reason why 'more sweating' should not be confused with 'more benefit'. Sweat is primarily a cooling response and a source of fluid and electrolyte loss—not a detoxification system.

## 8. The kidneys and hormones help defend fluid balance

Heat and sweating activate fluid-regulatory mechanisms. Changes in blood volume and osmolality stimulate thirst and hormonal systems involved in retaining water and sodium. Urine production can fall as the kidneys conserve fluid.

The endocrine response to sauna is complex and depends strongly on exposure intensity, duration and acclimation. Changes have been reported in catecholamines, cortisol, growth hormone, renin-angiotensin-aldosterone activity and other mediators, but these responses are variable and should not be turned into simplistic claims that a particular hormone is 'boosted' in a therapeutically meaningful way. [2,3]

The physiologically important point is broader: multiple hormonal systems participate in maintaining blood pressure, fluid balance and homeostasis during heat stress.

## 9. Breathing changes less dramatically than circulation

Ventilation may increase during substantial heat stress, but the respiratory system is not the principal route of heat loss in a sauna. Most thermoregulatory work occurs through the skin circulation and sweating.

Very hot or humid air can nevertheless alter respiratory sensation, and rapid increases in humidity during Aufguss may be perceived strongly in the upper airways. For this reason, respiratory sensation is not a reliable measure of whole-body heat storage: a very intense sensation can occur before core temperature has changed greatly.

## 10. The autonomic nervous system coordinates the response

Thermoregulation is largely automatic. Thermal information from skin and core is integrated centrally, particularly in hypothalamic networks. Autonomic pathways then regulate skin vessels, sweat glands, cardiovascular responses and endocrine systems.

The sauna response is therefore not simply 'relaxation' or simply 'stress'. During the heat phase, the organism is actively regulating a significant thermal challenge. Subjective relaxation can coexist with substantial cardiovascular and thermoregulatory activity.

## 11. Heat also activates cellular stress responses

Heat exposure can activate cellular protective systems, including heat-shock proteins. These proteins participate in protein folding, repair and cellular stress tolerance. They are one mechanistic reason repeated, recoverable heat exposure is scientifically interesting. [4]

But the concept is often overstated. Heat-shock proteins do not mean that more heat is always better. Biological stress responses generally show dose dependence: too little stimulus may produce little response, an appropriate stimulus can activate adaptation, and excessive stress can become harmful.

This is consistent with the principle of health-oriented sauna bathing: moderate, repeatable exposure is physiologically more plausible as a training stimulus than occasional extreme heat.

## 12. What happens to blood pressure?

There is no single blood-pressure response that applies to every minute of every sauna session. Cutaneous vasodilation tends to reduce peripheral vascular resistance, while heart rate and cardiac output increase to support circulation. Individual systolic and diastolic responses vary during exposure.

After sauna, several studies and pooled analyses report reductions in blood pressure in many participants, but this should not be interpreted as an immediate therapeutic guarantee for every individual. Hydration, posture, medication, cardiovascular status and the cooling procedure all influence the response. [3,7]

Standing up after heat exposure can be particularly relevant because dilated skin vessels and reduced plasma volume may transiently reduce venous return. Dizziness is therefore a signal to sit or lie down and end further thermal loading.

## 13. What happens when the bather leaves the sauna?

Leaving the hot room stops the major environmental heat input, but the body does not instantly return to baseline. Skin and core temperatures remain elevated, sweating may continue and skin vessels remain dilated for a time.

Cooling reverses the direction of the thermal process. Fresh air increases convective and evaporative heat loss. Water removes heat much more efficiently. Cold-water application causes rapid cutaneous vasoconstriction, increasing peripheral vascular resistance and changing central blood distribution. [8]

This is why cooling is physiologically part of the sauna bath rather than an optional afterthought. The warm phase creates the thermal disturbance; cooling begins the controlled return toward thermal balance.

## 14. Recovery completes the cycle

After cooling, temperature distribution, heart rate, vascular tone and fluid balance still require time to stabilise. A recovery period allows the organism to process the preceding heat–cold sequence before another sauna cycle begins.

A health-oriented sauna therefore consists of more than heat. It is a sequence of WARM → COLD → RECOVERY. Repeated exposure becomes a plausible adaptive stimulus only when each cycle is sufficiently reversible and recovery is adequate.

## What changes first – and what changes later?

The physiological sequence can be simplified as follows:

- Seconds to first minutes: skin temperature rises; thermal receptors signal heat; skin vasodilation begins.
- First minutes: skin blood flow and heart rate increase; sweating is activated.
- With continued exposure: sweat evaporation removes heat, but net heat storage remains positive; core temperature rises.
- As sweating continues: water and electrolytes are lost; plasma volume may begin to fall and fluid-conserving mechanisms become more important.
- During Aufguss/löyly: higher humidity reduces evaporative cooling and can abruptly increase perceived and physiological heat load.
- After leaving: environmental heat input falls; air and water cooling remove stored heat; skin vessels constrict with cold exposure.
- During recovery: heart rate, vascular tone, thermal distribution and fluid balance move progressively toward baseline.

## What sauna does not do

Several visible sauna responses are easy to misinterpret. Red skin does not mean toxins are being flushed out; it reflects increased cutaneous blood flow. Sweating does not primarily detoxify the body; its main function is evaporative cooling. A temporary reduction in body mass is predominantly water loss, not fat loss.

Likewise, a high heart rate does not make sauna equivalent to exercise, and extreme heat is not automatically more beneficial than moderate heat. The value of sauna lies in the coordinated physiological response to a controlled and recoverable thermal stimulus.

## Conclusion

A sauna produces a remarkable whole-body response from a relatively simple environmental stimulus. The skin heats first. Blood vessels dilate. Blood is redistributed toward the body surface. Heart rate and cardiac output rise. Sweat glands release water, and evaporation attempts to remove heat. When heat gain remains greater than heat loss, core temperature rises. At the same time, fluid-regulatory, autonomic and cellular systems work to maintain homeostasis.

The body is therefore not passively 'being heated'. It is actively regulating the heat load every second of the exposure.

And this explains the central principle of health-oriented sauna bathing: the goal is not to overwhelm these regulatory systems, but to activate them with a controlled stimulus, cool the body appropriately, allow recovery—and repeat the process over time.

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Editorial note: The numerical examples in this article describe typical responses reported in controlled studies and are not individual target values. Actual responses depend on sauna temperature and humidity, duration, body position, hydration, acclimation, age, health status and cooling method. This article provides scientific and educational information and does not replace individual medical assessment.