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Titel	Why Does an Aufguss Feel So Much Hotter?
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Short answer: An Aufguss can feel dramatically hotter even when the sauna air temperature changes only modestly because it changes the pathways by which heat is exchanged at the skin. Water evaporated on the hot stones raises the water-vapour pressure of the cabin air. This reduces the vapour-pressure gradient that normally allows sweat to evaporate from wet skin, so the body's most important cooling mechanism in the hot sauna becomes less effective. If the local dew point rises to or above skin temperature, water vapour can also condense on the cooler skin and release latent heat. Fanning intensifies the effect by replacing the relatively protective boundary layer at the skin with fresh hot, humid air. The characteristic heat pulse of Aufguss is therefore not simply 'hot steam'. It is the combined result of reduced evaporative cooling, altered convection, possible condensation and the rapid redistribution of humid air.

Few sauna phenomena are as immediate as an Aufguss. The cabin may have been comfortably hot for several minutes. Water is poured onto the stones, the familiar hiss is heard, the sauna master moves the air—and within seconds the same room can feel dramatically hotter.

The intuitive explanation is often that 'steam is hotter than air'. That is incomplete. The temperature of the cabin air may rise only slightly and can even fall locally when water is applied to the heater. What changes abruptly is the amount and distribution of water vapour and, with it, the heat and mass transfer at the surface of the body.

Understanding Aufguss therefore requires four connected pieces of physics: water-vapour pressure, evaporation of sweat, condensation of water vapour and air movement. The physiology follows directly from those processes.

1. A dry-hot sauna is possible because sweat can evaporate

Classic Finnish sauna combines high air temperature with comparatively low humidity. The body receives heat by convection and thermal radiation, while sweating provides the main active mechanism for dissipating heat in such a hot environment.

Sweat production itself is not cooling. Cooling occurs mainly when liquid water actually evaporates from the skin. The phase change requires a large amount of energy—the latent heat of vaporisation—which is drawn from the skin and ultimately from body heat.

At skin temperature, the latent heat is roughly 2.4 kJ per gram of water. Thus, 100 g of sweat that truly evaporates can remove on the order of 240 kJ of heat. Sweat that drips from the body without evaporating uses only a small fraction of that potential cooling effect.

2. The key variable is water-vapour pressure

Relative humidity is familiar, but it can be misleading in a sauna because the amount of water vapour that air can contain rises steeply with temperature. Five per cent relative humidity at 90 °C is not comparable with five per cent at 20 °C.

For the skin, the more direct physical variable is water-vapour partial pressure: the pressure contributed by water vapour in the air.

A wet skin surface at approximately 37 °C is associated with a saturation vapour pressure of about 6.3 kPa. If the surrounding sauna air has a lower water-vapour pressure, there is a vapour-pressure gradient from the wet skin toward the air. This gradient helps drive evaporation.

For example, if the sauna air is at about 3.5 kPa while wet skin is at about 6.3 kPa, the gradient is approximately 2.8 kPa outward. That does not by itself determine the exact evaporation rate, but it illustrates why dry sauna air can accept water from the skin.

3. What happens when water hits the stones?

The stones contain substantial thermal energy. When liquid water reaches sufficiently hot stone surfaces, energy is transferred into the water. The water is heated and a large fraction is converted into water vapour.

The energy required for this phase change is initially supplied by the heater and stones. The resulting water vapour enters the convective air flow above the heater and is transported through the sauna.

The added vapour increases the absolute water content and, crucially, the water-vapour partial pressure of the air. The effect is transient because vapour is continuously redistributed, ventilated out of the room and condensed on cooler surfaces.

4. Why the air temperature does not explain the heat pulse

If temperature alone determined thermal sensation, an Aufguss would be difficult to explain. The characteristic heat pulse can occur too rapidly and too strongly to be accounted for by a major increase in mean cabin air temperature.

The reason is that the heat balance at the skin changes even without a large rise in air temperature. The same hot air now contains more water vapour, so the body loses less heat by evaporation and may, under suitable local conditions, gain additional heat through condensation.

The bather therefore experiences a change in net heat flow rather than merely a change in thermometer reading.

5. First mechanism: sweat evaporation becomes less effective

Evaporative heat loss depends strongly on the vapour-pressure difference between the wet skin and the surrounding air. Modern thermophysiology describes this gradient, together with air velocity and skin wettedness, as a central determinant of evaporative heat loss.

During Aufguss, ambient water-vapour pressure rises. The difference between wet skin and air becomes smaller. As a result, each square centimetre of wet skin has less capacity to evaporate sweat.

The paradox is important:

The bather may sweat more while being cooled less effectively.

A wet body is therefore not evidence of efficient cooling. It only shows that liquid water is present on the skin.

6. The evaporation limit

If ambient water-vapour pressure approaches the saturation vapour pressure at the wet skin surface, the driving force for evaporation approaches zero. If the ambient vapour pressure exceeds the local saturation pressure at the skin, net evaporation can cease and the direction of water transfer can reverse locally.

This is why vapour pressure is more informative than the statement that a sauna has 'high humidity'. It tells us whether the environment still provides an evaporative sink for sweat.

In the Academy's teaching model, wet skin at about 37 °C corresponds to approximately 6.3 kPa. Sauna air before Aufguss may lie well below this value; during a strong humidity pulse, local vapour pressure can approach or temporarily exceed it. The actual value varies with height, location, ventilation and the dynamics of the löyly cloud.

7. Second mechanism: condensation can reverse the latent-heat flow

Evaporation and condensation are opposite phase changes.

When sweat evaporates, latent heat is absorbed at the skin: this cools the body. When water vapour condenses into liquid water on the skin, latent heat is released: this heats the skin.

At sauna-relevant temperatures, the latent heat associated with one gram of water is roughly 2.3–2.4 kJ. The physical symmetry is striking: evaporation of one gram can remove roughly this amount of heat; condensation of one gram can release roughly the same order of energy.

This does not mean that grams of vapour necessarily condense uniformly over every bather during every Aufguss. Condensation is local and transient. It depends on vapour pressure, skin temperature, dew point, air movement and the temperature of the boundary layer.

8. Dew point: the bridge between humidity and condensation

The dew point is the temperature at which air with a given water-vapour content becomes saturated. If a surface is colder than the local dew point, water vapour can condense on that surface.

In a sauna, the skin is much cooler than the hottest cabin air. After an Aufguss, the dew point of the humid air can rise rapidly. Where the local dew point exceeds the skin-surface temperature, condensation becomes physically possible.

The 2026 Finnish sauna study explicitly examined the difference between dew point and skin temperature as an index of condensation potential. The association with heart-rate response was weak and there was no significant relationship with core-temperature change under those study conditions. Humidity itself showed the clearer physiological association. This is an important caution: condensation is a valid physical mechanism, but its quantitative contribution should not be exaggerated for every real-world Aufguss.

9. What recent human data tell us

Laatikainen-Raussi and colleagues studied 50 healthy recreationally active adults during four 10-minute Finnish sauna sessions separated by 30-minute recovery periods. Participants were allowed to throw water onto the stones. Mean core temperature increased by about 0.4 °C and heart rate by about 42 beats per minute.

Both air temperature and relative humidity were independently associated with increases in heart rate and core temperature. Temperature was the dominant determinant of thermal perception, while humidity made a smaller but measurable contribution.

The study therefore supports the central physiological claim: humidity is not merely an atmospheric sensation. It contributes independently to thermoregulatory and cardiovascular strain.

10. The classic physics of löyly

Finnish sauna physics has recognised the importance of phase transitions for decades. Vesala's analysis of phase transitions in sauna described both sensible and latent heat flux during löyly and emphasised that the balance between evaporation and condensation depends on the water-vapour pressure of the air relative to conditions at the skin.

Helamaa and Aikäs likewise described good löyly as a product not simply of temperature but of air purity, temperature, moisture content and thermal radiation.

The modern picture therefore does not replace traditional sauna knowledge. It explains it more precisely.

11. Is the water on the skin really sweat?

Not necessarily.

During a humid Aufguss, the liquid film on the body can contain sweat and externally derived condensate. This is more than a theoretical possibility. A stable-isotope tracer experiment was specifically designed to distinguish sweat water from condensed sauna water and demonstrated that condensation can contribute to the water collected from the skin during sauna exposure.

The practical implication is simple: visible wetness is not a reliable measure of sweat production.

A guest can look dramatically wetter after Aufguss partly because the environment has placed water on the skin, while at the same time the evaporation of the guest's own sweat has become less effective.

12. Third mechanism: fanning changes the boundary layer

A thin layer of air lies immediately next to the skin. This boundary layer differs from the freely moving cabin air in temperature and humidity and acts as resistance to both heat and mass transfer.

Air movement disturbs and renews that layer.

In a cooler or dry environment, increasing air velocity can enhance evaporation and therefore cooling. In a very hot, humid sauna, however, the incoming air may itself be hotter than the skin and already rich in water vapour. Removing the boundary layer then increases contact with precisely the environment from which the body is trying to protect itself.

The result can be a rapid increase in convective heat transfer while the potential for evaporative cooling remains limited.

13. Why a towel stroke can feel like a wave of heat

A towel does not create heat. It moves air.

During Aufguss, humid air is not perfectly homogeneous. A rising plume develops above the heater and is transported by the room's convective circulation. Measurements and recent pilot observations show that löyly can move rapidly and unevenly through the cabin.

Fanning redistributes this air and directs it toward bathers. The sensation of a 'heat wave' therefore corresponds to a rapid local change in air velocity, temperature and vapour pressure at the skin.

This also explains why two guests in the same cabin can experience the same Aufguss very differently depending on bench height, distance, direction of the air pulse and local airflow.

14. Fanning can either support evaporation or increase heat load

The effect of air movement cannot be described simply as 'more wind equals more cooling'.

If surrounding air is cooler than the skin and sufficiently dry, increased air velocity can enhance both convective and evaporative heat loss. If surrounding air is much hotter than the skin, convection can reverse direction and add heat to the body.

If that hot air is also humid, the increased air velocity can simultaneously deliver more sensible heat while offering little evaporative relief.

This is why vigorous fanning after an Aufguss can be much more intense than the same towel movement in a cooler, drier environment.

15. Four processes occur at the skin at the same time

The characteristic Aufguss sensation can be understood as the sum of four simultaneous processes:

- Radiation: hot stove and cabin surfaces continue to transfer thermal radiation to the body.
- Convection: hot air transfers sensible heat to the cooler skin; fanning can increase this exchange.
- Evaporation: sweat attempts to evaporate and remove latent heat, but rising ambient vapour pressure reduces this capacity.
- Condensation: where local vapour pressure and dew point permit it, water vapour can condense and release latent heat at the skin.

The net thermal effect is the balance of all four—not one isolated mechanism.

16. A useful heat-balance model

The bather's thermal state can be represented conceptually as:

Net body heat storage = metabolic heat + radiation + convection + condensation − evaporation − other heat losses

The signs are contextual. Convection can either add or remove heat depending on the air-to-skin temperature gradient. Evaporation is a heat-loss pathway. Condensation is the reverse phase change and therefore adds heat locally.

During Aufguss, two terms can shift in the unfavourable direction at once: evaporative heat loss can decrease while convective and, locally, condensation heat gain can increase.

17. Why 'relative humidity' alone is not enough

Relative humidity tells us how close air is to saturation at its current temperature. Because saturation capacity changes enormously with temperature, relative humidity alone cannot describe the physiological meaning of sauna air.

For example, apparently modest relative humidity at 80–100 °C can correspond to substantial water-vapour pressure. Conversely, 100% relative humidity at a much lower temperature describes saturated air but not the same total thermal environment.

For technical interpretation of Aufguss, three quantities should therefore be distinguished:

- Relative humidity (%): degree of saturation at the current air temperature.
- Absolute humidity (g/m³): actual mass of water vapour per volume of air.
- Water-vapour partial pressure (kPa): thermodynamically relevant pressure of water vapour and a direct component of the evaporation gradient at the skin.

18. Why g/m³ is useful for dosing water

Absolute humidity is especially useful for a simple material balance. If 300 g of water were ideally and uniformly converted into vapour in a 30 m³ cabin with no losses, it would represent an additional 10 g/m³.

Real saunas are not closed ideal boxes. Some water remains on stones, some vapour leaves through ventilation, some condenses on walls, ceiling, benches and people, and the distribution is strongly non-uniform.

Nevertheless, expressing water addition relative to cabin volume is much more informative than stating only the number of ladles.

19. Why more water does not produce a proportionally 'better' Aufguss

Once humidity has risen enough to markedly restrict evaporation, additional water can narrow the bather's evaporative reserve further and increase the probability of local condensation. The subjective intensity can therefore rise non-linearly.

At the same time, more water cools the stones and changes subsequent evaporation dynamics. Ventilation continuously removes moisture. The relationship between water quantity and guest exposure is therefore not a simple straight line.

For health-oriented practice, water quantity should be treated as a dose variable, not as a performance score.

20. Why the head and shoulders often feel the Aufguss first

Hot humid air leaving the heater is buoyant and tends to rise. Sauna cabins also have strong vertical temperature gradients. Guests seated high in the room are therefore exposed to warmer air and often encounter the löyly plume more directly.

The head, face and shoulders are additionally rich in thermal and sensory receptors and are commonly the first regions struck by directed towel-generated airflow.

This combination helps explain why a guest may experience an intense facial or shoulder heat pulse before perceiving the same intensity elsewhere.

21. Why the sensation can be stronger than the change in core temperature

Thermal sensation responds quickly to conditions at the skin, whereas core temperature changes more slowly. An Aufguss can therefore produce an immediate, powerful sensation within seconds while the measurable change in deep-body temperature remains small at that moment.

This is not an illusion. The local heat-transfer conditions really have changed. But subjective intensity and core-temperature rise operate on different time scales.

That distinction is important for safety: a dramatic heat sensation does not mean that core temperature has suddenly jumped by several degrees, but repeated or prolonged intense exposure can still increase cumulative thermal strain.

22. Why Aufguss increases cardiovascular strain

As the body gains heat and evaporative cooling becomes less effective, thermoregulation requires continued high skin blood flow and sweating. Heart rate rises to support circulation while blood is distributed toward the skin.

The 2026 Finnish data show that humidity contributed independently to heart-rate and core-temperature responses even after adjustment for several participant characteristics.

This provides a physiological bridge between the physics of water vapour and the cardiovascular experience of a strong Aufguss.

23. The role of dose and recovery

An Aufguss should therefore be understood as an additional thermal dose within an already hot exposure.

The guest may have entered the cabin several minutes earlier, meaning that skin temperature, heart rate and sweating are already elevated when the first water is applied. A second and third Aufguss round occur from progressively different physiological starting points.

This is why identical water quantities do not necessarily represent identical physiological doses across a multi-round Aufguss. Duration, humidity history, fanning and remaining safety reserve matter.

24. Common myths

Myth 1: 'The sauna suddenly becomes much hotter.'

The mean air temperature need not rise substantially. The skin heat balance can change dramatically because humidity and air movement change.

Myth 2: 'The steam penetrates deep into the body.'

The relevant initial processes occur at the skin and boundary layer. Any deeper tissue warming follows ordinary heat transport through tissue and blood flow; it does not require steam molecules to penetrate deeply.

Myth 3: 'More sweat means better cooling.'

Only evaporated sweat provides the large latent-heat cooling effect. High humidity can increase skin wetness while reducing evaporation.

Myth 4: 'Everything wet on the skin is sweat.'

During humid exposure, part of the surface water can be condensate.

Myth 5: 'Wedeln only distributes fragrance.'

Fanning changes air velocity and therefore heat and mass transfer at the skin. It is a thermal intervention as well as a sensory and performance technique.

25. The complete causal chain

The Aufguss heat pulse can be summarised as a causal sequence:

WATER ON HOT STONES → WATER VAPOUR ↑ → VAPOUR PRESSURE ↑ → EVAPORATION GRADIENT FROM SKIN ↓ → SWEAT COOLING ↓

At sufficiently humid local conditions:

DEW POINT ≥ SKIN TEMPERATURE → CONDENSATION POSSIBLE → LATENT HEAT RELEASE AT SKIN

And when the sauna master fans:

AIR VELOCITY ↑ → BOUNDARY LAYER DISRUPTED → HOT HUMID AIR REPLACED AT SKIN FASTER → CONVECTIVE / MASS TRANSFER ↑

Together:

NET HEAT LOAD ↑ → STRONGER THERMAL SENSATION → GREATER THERMOREGULATORY AND CARDIOVASCULAR DEMAND

26. What makes a good Aufguss?

From a physiological perspective, a good Aufguss is not the one that maximises water, humidity or wind speed. It is one in which the additional thermal dose is deliberate, predictable and compatible with the guests' ability to regulate exposure.

The sauna master controls several variables at once: water quantity, timing, distribution, air movement, duration and progression across rounds.

Professional skill therefore consists not only in creating an effect, but in controlling its magnitude.

Conclusion

An Aufguss feels hotter because it changes the physics at the skin.

The added water vapour raises ambient vapour pressure and reduces the evaporation gradient for sweat. The body's most important cooling mechanism in the hot sauna becomes less effective. Under suitable local conditions, water vapour can additionally condense on the cooler skin and release latent heat. Fanning removes the protective boundary layer and rapidly replaces it with hot, humid cabin air, increasing local heat and mass transfer.

The characteristic heat pulse is therefore not explained by one mechanism and not by air temperature alone. It is the combined consequence of water-vapour pressure, evaporation, possible condensation, convection and air movement.

The central principle is:

Aufguss does not simply make the sauna 'hotter'. It changes the balance between heat entering the body and heat the body can release.

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Editorial note: The mechanisms described here are physically established, but their quantitative contribution varies between sauna rooms and Aufguss procedures. Condensation on the skin is possible and experimentally demonstrable, yet recent human data suggest that condensation indices alone do not explain the full physiological response. Humidity, temperature, air movement and exposure time should therefore be considered together. Numerical vapour-pressure values are approximate orientation values and depend on local temperature and saturation conditions.