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Titel	What Happens to Blood Circulation in the Sauna?
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Short answer: Sauna redistributes the circulation toward the skin. As skin and core temperature rise, cutaneous blood vessels dilate and skin blood flow increases so that heat can be transported from the body's interior toward the surface. This lowers systemic vascular resistance. To maintain arterial pressure and supply the enlarged skin circulation, heart rate and cardiac output increase. At the same time, sweating progressively reduces plasma volume, while upright posture and peripheral vasodilation can reduce central blood volume and venous return. Blood pressure therefore does not follow one universal pattern: it reflects the balance between falling vascular resistance, increasing cardiac output, fluid loss, posture and individual cardiovascular regulation. Sauna circulation is best understood as an integrated redistribution of blood flow—not simply as 'the heart beating faster'.

The circulation has a central role in human thermoregulation. Blood does not merely deliver oxygen and nutrients; it also transports heat. During sauna bathing, this transport function becomes particularly visible. Blood is redistributed from deeper tissues toward the skin, where heat can be transferred to the environment.

This requires a coordinated cardiovascular response. Skin vessels dilate, peripheral resistance falls, the heart beats faster and cardiac output rises. Meanwhile, sweating removes fluid from the circulation. The result is a dynamic balance between thermoregulation and maintenance of blood pressure.

In the sauna, the circulation becomes part of the body's heat-transport system.

Why does skin blood flow increase?

The body must move internally produced and absorbed heat toward the skin before that heat can be dissipated. Heat stress therefore produces cutaneous vasodilation: resistance vessels in the skin widen and a much larger fraction of cardiac output can be directed to the body surface.

Human heat-stress research shows that skin blood flow can rise from a few hundred millilitres per minute in thermoneutral conditions to several litres per minute during severe whole-body heating [1–3]. The exact value in a sauna depends on thermal dose, posture, hydration and the individual.

This increased skin perfusion is one reason the skin becomes red and warm during sauna bathing.

What controls cutaneous vasodilation?

Cutaneous circulation is controlled by sympathetic neural mechanisms and local vascular factors. During passive heat stress, withdrawal of sympathetic vasoconstrictor activity is followed by activation of an active vasodilator system [1,2].

Nitric oxide contributes to this active vasodilation, but it is not the only mediator. The response is a coordinated thermoregulatory mechanism rather than a simple passive 'opening' of blood vessels.

Why does vascular resistance fall?

When a large vascular bed such as the skin dilates, resistance to blood flow through the systemic circulation decreases. This is commonly described as a fall in systemic or total peripheral vascular resistance.

Classic sauna studies observed a substantial reduction in total peripheral resistance during heating [4]. Modern passive-heating research confirms the same general haemodynamic pattern: cutaneous vasodilation lowers vascular resistance while the cardiovascular system compensates by increasing cardiac output [2,3].

> **The sauna does not simply make the heart work harder. It changes where the blood is going and how much resistance the heart pumps against.**

Why does heart rate rise?

Heart rate rises progressively as thermal strain increases. Several mechanisms contribute: the need to maintain cardiac output despite peripheral vasodilation, changes in autonomic balance, rising body temperature and changes in central blood volume.

In classic Finnish sauna conditions, heart rate commonly rises into ranges comparable with light or moderate physical activity, although the skeletal muscles are not performing equivalent mechanical work [5,6].

The heart-rate response therefore reflects cardiovascular thermoregulation, not exercise in the usual metabolic sense.

What happens to cardiac output?

Cardiac output is the volume of blood pumped by the heart each minute. It is determined by heart rate multiplied by stroke volume. During passive whole-body heat stress, cardiac output can increase markedly, largely to support the enlarged skin circulation [2,3].

In sauna, the increase is commonly driven strongly by the rise in heart rate. Stroke volume may be maintained initially but can fall as heating progresses, particularly when upright posture, sweating and reduced central blood volume limit ventricular filling.

The cardiovascular system therefore compensates dynamically: faster heart rate helps preserve or increase total flow even when the amount ejected with each beat becomes harder to maintain.

What is stroke volume?

Stroke volume is the amount of blood ejected by the left ventricle with each heartbeat. It depends on ventricular filling, myocardial contractility and the resistance against which the heart ejects blood.

During heat stress, reduced central venous pressure and redistribution of blood toward the skin can reduce cardiac filling. The body partly compensates through increased heart rate and contractility.

This is one reason heart rate can continue to rise during prolonged heating even when the external sauna conditions remain unchanged.

What happens to venous return?

Venous return is the flow of blood back to the heart. During sauna bathing, several factors can challenge it. Cutaneous vasodilation increases the vascular volume available in the periphery. Upright posture promotes gravitational pooling in the legs. Sweating progressively reduces circulating plasma volume.

Together, these effects can reduce central blood volume and cardiac filling pressure. Heat-stress experiments show reductions in central venous pressure despite increases in cardiac output [2,3].

The body counters this through tachycardia, sympathetic cardiovascular adjustments and redistribution of flow from less immediately essential vascular beds.

Why posture matters

Lying and sitting in the sauna are not haemodynamically identical. When a person sits or stands, gravity shifts blood toward the lower body. In a heat-dilated circulation this can reduce venous return more than when lying down.

Standing abruptly after a prolonged hot exposure adds an orthostatic challenge at a time when peripheral vessels are dilated and circulating volume may already be reduced. This helps explain why some people feel light-headed when they rise quickly after sauna.

> **Heat dilates the circulation. Standing adds gravity. Sweating removes fluid. Together they can reduce the blood returning to the heart.**

What happens to blood pressure?

Blood pressure is the result of several interacting variables, particularly cardiac output and systemic vascular resistance. Sauna pushes these variables in opposite directions: vascular resistance falls, while cardiac output usually rises.

The resulting blood-pressure response therefore varies with the person and protocol. Blood pressure may remain relatively stable during heating, systolic pressure may rise transiently, or pressure may fall—particularly during recovery. Diastolic pressure often remains stable or decreases as peripheral resistance falls.

A study of 102 adults with at least one cardiovascular risk factor found that after a 30-minute sauna at approximately 73 °C, mean systolic pressure fell from 137 to 130 mmHg and diastolic pressure from 82 to 75 mmHg immediately after sauna. Systolic pressure remained below baseline after 30 minutes of recovery [7].

This does not mean every individual will experience the same response. It demonstrates why 'sauna raises blood pressure' and 'sauna lowers blood pressure' are both oversimplifications.

Why can systolic and diastolic pressure behave differently?

Systolic pressure is strongly influenced by cardiac ejection and arterial properties, whereas diastolic pressure is particularly sensitive to peripheral vascular resistance and heart rate. Because sauna simultaneously increases cardiac activity and dilates peripheral vessels, the two pressures need not move in parallel.

This is physiologically more informative than asking whether 'blood pressure' as a single entity goes up or down.

What happens to plasma volume?

Sweating removes water and electrolytes from the extracellular fluid. As heat exposure continues, plasma volume can decrease. Fluid shifts between interstitial and intravascular compartments partly compensate, but they cannot prevent progressive hypovolaemia if sweat loss is substantial and fluid is not replaced.

Classic sauna research therefore treats fluid balance as an integral part of cardiovascular physiology [8]. Reduced plasma volume can decrease venous return and stroke volume, increasing the need for compensatory tachycardia.

This connects sauna hydration directly to circulatory stability.

Where does the extra skin blood come from?

Cardiac output increases, but redistribution also occurs. During severe heat stress, blood flow to some internal organs can decrease while skin flow rises. Splanchnic and renal vascular beds participate in maintaining arterial pressure and supplying the skin circulation [2,3].

The body is therefore reallocating a limited flow resource. Thermoregulation temporarily becomes a major circulatory priority.

Does the brain receive less blood?

Cerebral blood flow can decrease during substantial passive heat stress, particularly as hyperthermia develops and ventilation changes. This is one factor that may contribute to light-headedness during intense heat exposure [3].

It would be too simple, however, to attribute every episode of sauna dizziness to reduced cerebral flow. Blood pressure, posture, dehydration, hyperventilation, medication and individual susceptibility can all contribute.

What happens when you leave the sauna?

The external heat load falls immediately, but cardiovascular recovery takes time. Skin remains warm, cutaneous vessels remain dilated for a period and sweating may continue.

Cooling progressively lowers skin temperature and changes vascular tone. Cool or cold water causes cutaneous vasoconstriction, increasing peripheral resistance and shifting blood centrally. Blood pressure can therefore rise during strong cold exposure.

This is why heating and cooling should be considered one cardiovascular sequence rather than unrelated rituals.

Why can cold water feel so dramatic after sauna?

The circulation has adapted to heat by opening the skin vascular bed. Sudden cold exposure rapidly reverses that condition. Vasoconstriction reduces skin blood flow and increases systemic vascular resistance.

Classic sauna experiments found decreased peripheral resistance during heating and increased resistance during cold exposure [4]. The transition can therefore produce a substantial haemodynamic stimulus even though the person is no longer in the hot cabin.

Is sauna circulation the same as exercise circulation?

There are similarities: heart rate and cardiac output rise, skin blood flow increases and cardiovascular demand can become substantial. But the distribution of blood flow and metabolic context differ.

During dynamic exercise, working skeletal muscle requires a large increase in blood flow and oxygen delivery. During passive sauna heating, the major additional vascular demand comes from thermoregulation, particularly the skin. The muscles are not producing the same mechanical work.

> **A sauna can produce an exercise-like heart rate without producing an exercise-like circulation.**

What about regular sauna bathing?

Repeated passive heat exposure can produce adaptations including improved heat tolerance, altered sweating responses, plasma-volume expansion and vascular changes. Observational Finnish studies also associate frequent sauna use with lower cardiovascular event rates, although observational associations cannot by themselves establish that the acute circulatory response causes those long-term outcomes [9].

Experimental passive-heating studies provide evidence for vascular adaptations, but protocols vary substantially and long-term clinical conclusions should not be extrapolated from acute vasodilation alone.

What about people with cardiovascular disease?

For many people with stable cardiovascular disease, appropriately conducted sauna bathing may be tolerated, and reviews have discussed potential benefits as well as risks [5]. But the circulatory changes described in this article are precisely why individual medical conditions matter.

Unstable cardiovascular disease, symptomatic hypotension, recent acute cardiac events or conditions in which volume shifts and vasodilation are poorly tolerated require medical assessment. Medication can also modify heart rate, vascular tone, blood pressure and fluid balance.

What determines the circulatory dose?

Air temperature alone is insufficient. Circulatory strain depends on total thermal load: temperature, radiation, humidity, Aufguss, air movement, duration, body position, cooling method, hydration and previous heat exposure.

A strong Aufguss can increase thermal strain without a major rise in thermometer temperature. A longer heat phase allows greater heat storage and fluid loss. Incomplete cooling can leave residual circulatory and thermal strain before the next round.

The cardiovascular response is therefore another reason to think in terms of thermal dose rather than cabin temperature alone.

A simple physiological sequence

The circulatory response to sauna can be understood as a chain. Heat raises skin and core temperature. Skin vessels dilate. Peripheral resistance falls. Blood is redistributed toward the skin. Heart rate and cardiac output rise to maintain flow and arterial pressure. Sweating reduces plasma volume. Venous return and stroke volume may become increasingly challenged. Cooling then changes the direction of vascular regulation.

Each step influences the next, which is why isolated measurements—heart rate alone or blood pressure alone—cannot describe the complete response.

So, what happens to blood circulation in the sauna?

The circulation is reorganised to serve thermoregulation. A large skin vascular bed opens, systemic resistance falls and the heart increases output to supply the skin while maintaining arterial pressure. As sweating and peripheral pooling progress, central blood volume and venous return can decline, increasing the compensatory demand on the heart.

Blood pressure is the result of this balance, not a simple direct effect of heat. It can therefore differ between individuals, phases of the sauna cycle and measurement conditions.

> **Sauna circulation is a redistribution problem: more blood must reach the skin while enough blood must still return to the heart.**

Conclusion

Sauna bathing produces a coordinated cardiovascular response whose purpose is heat transport. Cutaneous vasodilation increases skin blood flow and lowers systemic vascular resistance. Heart rate and cardiac output rise to support this expanded peripheral circulation.

At the same time, sweating reduces plasma volume and heat-induced peripheral pooling can reduce central blood volume and venous return. Blood pressure reflects the interaction of all these changes and cannot be predicted from temperature alone.

Cooling then reverses part of the vascular response through reduced skin temperature and vasoconstriction. The complete sauna cycle is therefore a controlled alternation of circulatory states: heat redistribution, heat dissipation, cooling and recovery.

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Editorial note: This article provides general scientific and educational information. Individual cardiovascular responses to heat vary. People with unstable cardiovascular disease, recurrent fainting, severe blood-pressure disorders or relevant medication should obtain individual medical advice before substantial heat or cold exposure.