

Cardiovascular and Other Health Benefits of Sauna Bathing: A Review of the Evidence



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Abstract

Sauna bathing, an activity that has been a tradition in Finland for thousands of years and mainly used for the purposes of pleasure and relaxation, is becoming increasingly popular in many other populations. Emerging evidence suggests that beyond its use for pleasure, sauna bathing may be linked to several health benefits, which include reduction in the risk of vascular diseases such as high blood pressure, cardiovascular disease, and neurocognitive diseases; nonvascular conditions such as pulmonary diseases; mortality; as well as amelioration of conditions such as arthritis, headache, and flu. The beneficial effects of sauna bathing on these outcomes have been linked to its effect on circulatory, cardiovascular, and immune functions. It has been postulated that regular sauna bathing may improve cardiovascular function via improved endothelium-dependent dilatation, reduced arterial stiffness, modulation of the autonomic nervous system, beneficial changes in circulating lipid profiles, and lowering of systemic blood pressure. This review summarizes the available epidemiological, experimental, and interventional evidence linking Finnish sauna bathing and its effects on cardiovascular outcomes and other disease conditions on the basis of a comprehensive search for observational studies, randomized controlled trials, and non-randomized controlled trials from MEDLINE and EMBASE from their inception until February 24, 2018. An overview of the postulated biological mechanisms underlying the associations between sauna bathing and its health benefits, areas of outstanding uncertainty, and implications for clinical practice is also provided.

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Finnish sauna bathing has been used for the purposes of pleasure, wellness, and relaxation. It is a tradition embedded in the culture of Finland, and it is basically accessible to everyone.^{1,2} Beyond its use for pleasure, emerging evidence suggests that sauna bathing might offer a multitude of health benefits.

Accumulating evidence suggests that regular sauna bathing may alleviate and prevent the risk of both acute and chronic disease conditions. During the past decade, a considerable amount of research data from various countries on the potential health benefits of sauna bathing as well as the putative biological pathways underlying these effects have been reported. Given the mixed evidence from the literature, there is a need to aggregate data to enable appropriate interpretation. This review summarizes the available epidemiological, experimental, and interventional evidence linking sauna bathing, cardiovascular outcomes, and other health benefits; the postulated biological mechanisms

underlying these associations; areas of outstanding uncertainty; and implications for clinical practice. Given that there are different forms of passive heat therapy (eg, repeated hot water immersion, infrared sauna, Waon therapy, and Turkish bath), this review focuses only on the evidence from the traditional Finnish saunas because they are the most widely studied to date.

We searched observational (prospective cohort, nested case-control, or case-control, retrospective cohort) studies, randomized controlled trials (RCTs), and non-RCTs from MEDLINE and EMBASE from their inception until February 24, 2018, with particular emphasis on Finnish sauna baths. Search terms included *sauna bath*, *Finnish*, *cardiovascular disease*, *coronary heart disease*, *sudden cardiac death*, *heart failure*, *hypertension*, *blood pressure*, *dementia*, *depression*, *pulmonary disease*, *mortality*, *lipids*, *natriuretic peptides*, *hormones*, *endothelial function*, *inflammation*, *oxidative stress*, *arterial stiffness*, *arterial*

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ARTICLE HIGHLIGHTS

- Finnish sauna bathing, which is characterized by exposure to high environmental temperature (80°C-100°C) for a brief period, has traditionally been used for the purposes of pleasure and relaxation.
- Beyond pleasure and relaxation, emerging evidence suggests that sauna bathing has several health benefits, which include reduction in the risk of vascular diseases such as high blood pressure, cardiovascular disease (CVD), stroke, and neurocognitive diseases; nonvascular conditions such as pulmonary diseases including common flu; mortality; treatment of specific skin conditions; as well as pain in conditions such as rheumatic diseases and headache.
- The physiological responses produced by an ordinary sauna bath correspond to those produced by moderate- or high-intensity physical activity such as walking.
- The beneficial effects of sauna baths on CVD and mortality may be mediated via reduction in blood pressure, improvement in endothelial function, reduction in oxidative stress and inflammation, beneficial modulation of the autonomic nervous system, improved lipid profile and arterial compliance, and improvement in the cardiorespiratory system.
- Sauna bathing is a safe activity and can even be used in patients with stable CVD, provided it is used sensibly for an appropriate period of time.

compliance, and intima media thickness. Studies were limited to those conducted in adult humans and written in English.

SAUNA BATHING

Sauna bathing is a form of passive heat therapy that is characterized by exposure to high environmental temperature for a brief period. The typical Finnish sauna is characterized by dry air and relatively high temperature. Temperature and humidity can be temporarily increased by throwing water on the hot rocks of the sauna heater, which is the heating source with temperature settings from 80°C to 100°C in sauna. The sauna is usually made of log or wood with wooden benches well above the floor for bathers to sit on. The recommended temperature for a sauna bath is from 80°C to 100°C at the level of the bather's head, but it is lower at the floor

level, which ensures efficient ventilation and makes sure the conditions are comfortable for sauna bathers.³ The relative humidity of sauna usually varies from 10% to 20%. Typical sauna sessions consist of short stays in the sauna room, which is interspersed with cooling-off periods (swim, shower, or a cooling-off period at room temperature). The duration of stay in the sauna room depends on the comfort and temperature of the sauna bather, but it usually ranges from 5 to 20 minutes, although longer sauna bathing sessions may be used depending on the individual.⁴ Sauna bathing habits may have changed over time, but still a typical Finnish person has a sauna bath at least once per week, with the average habitual frequency being 2 to 3 times/wk.⁵⁻⁷

During a sauna session, the heart rate may increase from baseline up to 120 to 150 beats/min. There is no active function of skeletal muscles during sauna bathing, which is in contrast to the training response experienced during physical activity. A part of blood volume is diverted from the internal organs to body peripheral parts with decreasing venous return, which is not facilitated by active skeletal muscle work.⁸ However, it has been proposed that muscle blood flow may increase, at least to some extent, in response to heat stress.⁹

SAUNA BATHING AND VASCULAR OUTCOMES

Blood Pressure or Hypertension

Evidence from a number of experimental and epidemiological studies implicates sauna bathing to have a positive effect on blood pressure (BP) modulation. However, it appears that most of these reports were conducted in patients with preexisting vascular disease and/or evaluated only the short-term effects of sauna exposure on BP.^{10,11} Two recent experimental studies by Lee et al⁷ and Laukkanen et al¹² in 100 men and women (56% men; age, 32-75 years) with at least 1 cardiovascular risk factor reported reductions in both systolic BP and diastolic BP after 30-minute sauna bathing sessions. In addition to reductions in BP, sauna bathing led to positive alterations in measures of arterial stiffness such as pulse wave velocity.¹² The mean carotid-femoral

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