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SAUNA BATHING AND CARDIOVASCULAR HEALTH: PHYSIOLOGICAL MECHANISMS, CLINICAL BENEFITS, AND PREVENTIVE IMPLICATIONS – A LITERATURE REVIEW

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ABSTRACT

Introduction: Sauna bathing has evolved from a traditional cultural practice into a scientifically recognized lifestyle intervention with potential cardiovascular benefits. This literature review critically evaluates current evidence regarding the physiological mechanisms, clinical outcomes, and preventive implications of sauna use for cardiovascular health.
Methods: A comprehensive search of PubMed, Scopus, Web of Science, and Google Scholar was conducted to identify studies published between 2007 and 2026, including observational cohorts, randomized controlled trials, and systematic reviews.
Results: Findings show that short-term effect of Finnish sauna session on cardiovascular health include increased heart rate, enhanced cardiac output and peripheral vasodilation, mimicking physiological adaptations observed during moderate-intensity exercise.
Long-term and repeated sauna use is associated with reductions in arterial stiffness, improved endothelial function, decreased systolic blood pressure, and lower risks of cardiovascular morbidity and mortality. These benefits are mediated through enhanced nitric oxide bioavailability, heat shock protein induction, anti-inflammatory effects, and improved autonomic regulation. Combining sauna bathing with other healthy behaviors, such as exercise, adequate sleep, hydration, and balanced nutrition, amplifies cardiovascular benefits.
Data summary of the studies support use of the long-term sauna association with reduced arterial stiffness, improved endothelial function, lower blood pressure, lower risk of cardiovascular morbidity and mortality. These effects thought to be mediated by multiple biological mechanisms, including increased nitric oxide bioavailability, modulation of heat shock proteins, reduction of systemic inflammation, and improved autonomic balance.
Conclusions: Sauna bathing is a promising, low-cost, and culturally adaptable adjunct to lifestyle-based cardiovascular prevention strategies. It should be integrated into holistic health programs, with attention to safety and individualized recommendations. Future research should establish standardized protocols, clarify dose-response relationships, and explore long-term clinical and public health impacts.

KEYWORDS

Sauna Bathing, Cardiovascular Health, Cardiovascular Disease Prevention, Heat Therapy, Arterial Stiffness, Endothelial Function

CITATION

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1. Introduction

Cardiovascular diseases (CVDs) remain the leading cause of morbidity and mortality globally. The number of CVD-related deaths increased by 60%, from 12.1 million in 1990 to 20.5 million in 2021, accounting for an estimated 17.9 million deaths in 2019 alone [1].

Despite advanced pharmacological treatments and sophisticated interventional cardiology, the global burden of CVDs continues to rise. Further healthcare systems can expect a sharp increase in overall cardiovascular mortality, driven by the aging of the global population. The continued increase in the burden of cardiovascular disease will be largely attributed to atherosclerotic disease [2]. Vast majority of increasing in CVDs is due to aging populations, urbanization, sedentary lifestyle, stress and spike in metabolic disorders [2].

In recent years, we observed a paradigm shift toward preventive medicine, emphasizing modifiable lifestyle factors as primary determinants of cardiovascular health and highlighting their role in prophylaxis [3]. Within this context, passive controlled heat exposure, particularly sauna bathing, has emerged as a promising, yet underexplored, lifestyle intervention with potential cardiovascular benefits [4].

Sauna bathing practice, deeply rooted in Nordic traditions, has evolved in past few decades into a globally practiced activity which increasingly draws scientific attention. Traditionally associated with relaxation, detoxification, and social interaction, sauna use is now being investigated for its systemic physiological effects, particularly on the cardiovascular system [5] and its impact on mental health [6].

The most widely studied and arguably most significant type in terms of health evidence is the traditional Finnish sauna. This type of sauna uses a stove, which is either wood-burning or electric, to heat stones, producing air temperatures typically between 70°C and 100°C. Humidity is usually low but can be temporarily increased by pouring water over the heated stones, creating bursts of steam [4,7].

The specific combination consisting of high temperature and controlled humidity produces a strong physiological response, including increased heart rate, peripheral vasodilation, and profuse sweating. These effects contribute to improved vascular function, partly through increased production of nitric oxide (NO), which promotes vasodilation and endothelial health. Heat exposure also induces the expression of heat shock proteins (HSPs), which stabilize a range of other proteins important for cardiovascular function, including those that enhance NO signaling [8]. Traditional saunas are also the primary setting in which most long-term epidemiological evidence has been collected, linking regular use to reduced cardiovascular risk [9].

Traditional wood-burning saunas and electric saunas are variations of the same core concept. Wood-burning saunas provide a more natural and often more variable heat source, with the added sensory experience of fire and wood, while electric saunas offer greater convenience and temperature control. Both types of saunas are widely used and fall under the broader category of traditional dry saunas, meaning that much of the existing evidence on sauna health benefits applies to them. These include associations with reduced risk of coronary artery disease and stroke, as well as improvements in vascular function and blood pressure regulation [4,9].

Sauna bathing induces a controlled state of hyperthermia, activating a complex network of thermoregulatory, cardiovascular, and neuroendocrine responses. These responses include increased heart rate, vasodilation, sweating, and redistribution of blood flow, which collectively impose a form of passive cardiovascular stress [7].

Importantly, the physiological effects of sauna exposure resemble those of moderate-intensity aerobic exercise, suggesting its potential role as an adjunct or alternative intervention for individuals with cardiovascular risks or diseases who are unable to engage in traditional physical activities for some reasons [3].

From a public health perspective, sauna bathing offers several advantages: it is non-invasive, relatively inexpensive, widely accessible, and culturally acceptable by many. Furthermore, its integration into daily routine and extra benefit as socialization and effect on wellbeing may enhance adherence to healthy lifestyle behaviors and have positive benefits for mental health [6].

The aim of our review is to provide a comprehensive and critical evaluation of the current literature on sauna bathing and cardiovascular health, focusing on physiological mechanisms, clinical evidence, and implications for public health and preventive medicine.

2. Methods

This literature review followed a structured narrative approach with elements of systematic searching. A comprehensive search was conducted in PubMed, Scopus, Web of Science, and Google Scholar to identify relevant studies published between January 2015 and March 2026.

The search strategy combined the following keywords: “sauna bathing”, “Finnish sauna”, “cardiovascular health”, “cardiovascular disease prevention”, “heat therapy”, “passive heat stress”, “endothelial function”, “arterial stiffness”, “blood pressure”, “heart rate”, “heat shock proteins”, “systemic inflammation”, “autonomic function”, “exercise”, “sleep”, “hydration”, “nutrition”, and “public health”. Boolean operators and combinations were applied to capture studies examining the physiological, clinical, and lifestyle-related aspects of sauna bathing.

Eligible studies included meta-analyses, observational cohort studies, randomized controlled trials, systematic reviews, clinical guidelines, expert consensus statements, and case reports. Exclusion criteria were studies conducted in non-human or in vitro models, articles not published in English, and studies without cardiovascular or lifestyle-related outcomes.

Data were synthesized qualitatively, focusing on themes of cardiovascular physiology, mechanistic pathways, clinical outcomes, preventive and public health implications, and integration with healthy lifestyle behaviors. Emphasis was placed on the consistency of findings, methodological quality, and relevance to real-world lifestyle interventions.

3. Research results

3.1 Physiological and Molecular Mechanisms

Available evidence consistently demonstrates that sauna bathing induces a multi-system physiological response characterized by thermoregulation, cardiovascular adaptation, and neurohormonal activation. Repeated sauna exposure has been associated with reduced neurohormonal stress on the body. Regular sauna exposure has been shown to decrease sympathetic nervous system activity, circulating catecholamine levels over time, and promote a shift toward a more parasympathetic-dominant state, which is associated with improved recovery and lower resting heart rate [5,7,10,11].

These adaptations suggest that regular heat exposure promotes a more favorable autonomic balance, which is recognized as a key factor in cardiovascular risk reduction [5,10,11].

3.2 Thermoregulatory Responses

Exposure to high temperature during sauna bathing triggers peripheral vasodilation and increased cutaneous blood flow. This facilitates heat dissipation and contributes to reduced systemic vascular resistance. These acute thermoregulatory adjustments reflect coordinated cardiovascular and autonomic responses to passive heat stress [5,7,10-12,13]. The increase in skin blood flow also enhances convective and radiative heat loss, helping to maintain core body temperature within safe physiological limits. Simultaneously, sweating is activated, contributing further to evaporative cooling and the removal of metabolic byproducts. The combined effects of vasodilation and sweating reduce cardiac afterload and support maintenance of blood pressure during heat exposure.

Repeated sauna sessions have been associated with improved thermoregulatory efficiency over time. Habitual sauna users demonstrate faster onset of sweating, enhanced cutaneous blood flow, and lower core temperature responses during subsequent heat exposures [5,7,10,12-14].

3.3Cardiovascular Adaptation

During a sauna session, heart rate increases significantly, reaching on average 100–150 bpm, while stroke volume and cardiac output also rise. These responses resemble those observed during moderate aerobic exercise [3,5,7,10,12]. Regular sauna use leads to a lower resting heart rate, improved stroke volume, and reduced cardiac workload at rest. As a result, the heart pumps more efficiently with each beat [5,7,9,10]. In habitual sauna users, better ventricular relaxation and improved filling during diastole are observed. This effect is particularly relevant in preventing heart failure with preserved ejection fraction [14-17]. Persistent vascular adaptations lead to lower arterial stiffness and reduced blood pressure. Consequently, the heart pumps against less resistance, easing strain on the left ventricle and thereby reducing afterload [5,7,12,13,18].

3.4 Endothelial Function and Nitric Oxide (NO)

Sauna exposure enhances nitric oxide (NO) production, a key regulator of vascular tone and endothelial function. Increased NO bioavailability contributes to vasodilation and improved endothelial function.

Flow-mediated dilation (FMD) is a common clinical measure of endothelial health and is improved following repeated sauna use, indicating greater arterial function and adaptability [5,7,10,12,16,18,19].

Sauna bathing has been shown to increase FMD, meaning arteries respond better to increased blood flow. This suggests healthier, more responsive blood vessels with reduced stiffness, which is crucial for prevention of hypertension.

3.5Heat Shock Proteins (HSPs)

Heat stress proteins, commonly known as heat shock proteins (HSPs) or stress proteins, are a group of specialized proteins. Their primary role is to act as molecular chaperones, ensuring other proteins are correctly shaped and functional, especially when the cell is under stress [8,15,20-22]. HSPs are essential for maintaining cellular homeostasis and perform several critical functions. They help newly formed proteins fold into the correct three-dimensional conformation necessary for proper function and facilitate the refolding of denatured or damaged proteins caused by heat or other stressors. HSPs also inhibit damaged proteins from forming toxic aggregates, and, if proteins are irreparably damaged, certain HSPs, including ubiquitin-related chaperones, tag them for degradation via the proteasome [8,16,23-25]. In addition, HSPs protect cardiomyocytes from ischemic stress, stabilize protein structures and reduce apoptosis. Their activation enhances cellular repair, improves cardiac resilience, and may provide protection against cardiomyopathy progression [5,8,14,15,23]. These properties are one reason sauna therapy is sometimes investigated in cardiac rehabilitation and cardiovascular protection studies [5,8,14,15]. The concept of “protective stress” refers to HSP activation as part of hormesis, where small stressors induce adaptive responses, whereas large or chronic stress can cause damage. The appropriate level of HSP activation is beneficial for the heart and provides protection in cardiomyopathy.

3.6 Inflammation and Oxidative Stress

Regular sauna bathing is associated with lower levels of inflammatory markers such as C-reactive protein (CRP) and with improved oxidative stress balance, indicating a reduction in chronic cardiovascular inflammation [5,7,10,12,15,18,22,24]. This effect is especially important for primary and secondary prevention of ischemic heart disease (IHD) [2,4,10]. Chronic inflammation is also a driver of hypertension, while lower oxidative stress is linked to improved mitochondrial function, leading to more efficient ATP production in cardiac muscle, increased metabolic efficiency, and reduced activation of nuclear factor kappa B (NF-κB) and proinflammatory cytokines including interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α) [5,7,10,12,15,18,22,25,26].

4. Acute Cardiovascular Effects

Acute sauna exposure induces increased heart rate, enhanced cardiac output, reduced peripheral resistance, and a temporary drop in blood pressure. These responses reflect a controlled cardiovascular stressor that may promote adaptive physiological mechanisms [7,12,18]. Experimental studies have shown that single sauna sessions lead to reductions in systolic and diastolic blood pressure, decreased arterial stiffness as evidenced by lower pulse wave velocity, and transient increases in heart rate similar to moderate aerobic exercise [7,12,17–18]. In a study involving 102 participants (mean age [SD]: 51.9 [9.2] years, 56% men) with at least one cardiovascular risk factor, a single 30-minute sauna session (temperature: 73°C, humidity: 10–20%) resulted in significant hemodynamic improvements. Mean pulse wave velocity in the carotid and femoral arteries decreased from 9.8 (2.4) m/s before sauna exposure to 8.6 (1.6) m/s immediately post-sauna ($p < 0.0001$). Systolic blood pressure dropped from 137 (16) to 130 (14) mmHg ($p < 0.0001$) and diastolic blood pressure from 82 (10) to 75 (9) mmHg ($p < 0.0001$). Systolic blood pressure remained lower than baseline after 30 minutes of recovery. Plasma creatinine showed a slight post-sauna increase, while sodium and potassium remained stable. These findings indicate that acute sauna exposure reduces arterial stiffness, modulates blood pressure, and positively affects select blood biomarkers, potentially contributing to long-term cardiovascular adaptations [7,12,17–18].

5. Long-Term Cardiovascular Benefits

5.1 Cardiovascular Mortality and Cardiorespiratory Function

Large cohort studies demonstrate a dose-response relationship between sauna frequency and reduced cardiovascular mortality. In the Kuopio Ischemic Heart Disease cohort, middle-aged men were followed for approximately 20 years and categorized according to sauna frequency. Frequent sauna users exhibited significantly lower rates of coronary artery disease, sudden cardiac death, and fatal cardiovascular events, with the strongest reductions observed among those using the sauna 4–7 times per week had a 47% reduced probability of developing hypertension compared to those using it only once per week (HR = 0.54; 95% CI: 0.32–0.91) [27]. Regular sauna exposure also lowers both systolic and diastolic blood pressure and reduces long-term hypertension risk. Higher frequency and duration of sauna bathing are each strongly, inversely, and independently associated with fatal cardiovascular events in middle-aged to elderly men and women. The frequency of sauna bathing improves the prediction of long-term risk for cardiovascular mortality [9,27].

In addition to mortality benefits, frequent sauna bathing is associated with improved cardiorespiratory fitness (CRF), independent of physical activity levels. In a cohort of men aged 42–61 years, each additional weekly sauna session was linked to an increase in CRF of 0.30 ml/kg/min (SE: 0.14; $P = 0.034$). Participants engaging in 2–3 and 4–7 sauna sessions per week had higher CRF levels by 0.84 ml/kg/min (SE: 0.32; $P = 0.008$) and 1.17 ml/kg/min (SE: 0.57; $P = 0.041$), respectively. Longitudinally, over 11 years, frequent sauna use was associated with maintenance or modest improvement in CRF, with a statistically significant effect for 2–3 sessions per week versus a single session per week (1.22 ml/kg/min; SE: 0.59; $P = 0.038$). Session duration was not significantly related to CRF in either cross-sectional or longitudinal analyses. These findings suggest that regular sauna bathing may contribute to preserved and enhanced cardiorespiratory function, providing additional cardiovascular benefits independent of exercise habits [28].

5.2 Hypertension

Regular sauna use is associated with a significant reduction in the incidence of hypertension. It is observed that after a single sauna session, blood pressure can remain lower for several hours. Regular sauna bathing sessions are linked to a lower risk of developing hypertension, resulting in meaningful long-term reductions in both systolic and diastolic blood pressure. These cardiovascular effects are not entirely understood, and are managed by several mechanisms such as improved endothelial function, reduced vascular resistance, better autonomic balance, chronic vasodilation. Regular sauna bathing may therefore contribute to reduced risk of hypertension, which could partly explain the decreased cardiovascular risk observed in frequent sauna users. Further epidemiological and experimental studies could help elucidate the effects of sauna bathing on cardiovascular function [27].

5.3 Endothelial Function

The lipid-endothelium relationship is a core mechanism in cardiovascular disease. High LDL contributes to endothelial injury, endothelial dysfunction promotes futher more lipid buildup, and HDL exerts protective and restorative effect. Maintaining both healthy lipid levels and endothelial function is essential to prevent atherosclerosis. After two weeks of repeated sauna session, some changes in total cholesterol and LDL-C concentration were observed, while concentration of HDL-C increased after the seventh sauna bath in group I. These kinds of changes may be favorable prognoses of ischemic heart disease prevention, but further research on the influence of sauna on fat metabolism is needed [25].

5.4 Arterial Stiffness

Arterial stiffness refers to reduced elasticity of arteries, particularly the aorta, and is commonly assessed by pulse wave velocity (PWV) and augmentation index. Increased arterial stiffness is associated with higher systolic blood pressure, greater cardiac workload, and and elevated risk of cardiovascular disease.

Following a single sauna session, PWV decreases, indicating improved arterial compliance. Vascular relaxation is enhanced, and wave reflection is reduced. Interestingly, these effects can last for several hours post-sauna bath session [29].

5.5 Epidemiological Evidence on Cardiovascular Outcomes

Frequent sauna use is strongly associated with reduced cardiovascular risk. Middle-aged men attending sauna sessions 4–7 times per week had a 63% lower risk of sudden cardiac death (HR: 0.37) and a 50% lower risk of fatal cardiovascular disease (HR: 0.50) compared to infrequent users. Synergistic benefits are observed when high cardiorespiratory fitness is combined with regular sauna exposure, resulting in a 69% lower risk of sudden cardiac death (HR: 0.31). These protective effects are mediated by enhanced autonomic regulation, improved endothelial function, reduced oxidative stress, and favorable inflammatory profiles.

5.6 Storke prevention

Regular sauna bathing provides neurovascular protection and reduces the risk of cerebrovascular events. It is reported that middle-aged adults who used the sauna 4–7 times per week had a 61% lower risk of incident stroke (HR: 0.39) over a 15-year follow-up, with the strongest effects observed for ischemic stroke. This protective effect is likely mediated by reductions in blood pressure, improved endothelial function, and decreased arterial stiffness [28].

5.7 Heart Failure

Sauna therapy, particularly repeated mild sauna exposure such as Waon therapy, has demonstrated clinical improvements in patients with chronic heart failure (CHF). In heart failure, reduced cardiac output leads to elevated vascular resistance, fluid overload, and neurohormonal activation (sympathetic nervous system and RAAS). Waon therapy induces acute hemodynamic changes including systemic vasodilation, reduced preload and afterload, and modest improvements in cardiac output, collectively reducing the workload on the failing heart [31].

Chronic adaptations with repeated sauna sessions documented in clinical studies include: improved endothelial function mediated by nitric oxide [22,18], reduced cardiac preload and congestion via peripheral vasodilation, heat shock protein–mediated cardioprotection with reduced apoptosis and enhanced cellular repair [8; 23], autonomic modulation with increased parasympathetic tone [11,20], anti-inflammatory and anti-remodeling effects [19,23], and improved vascular compliance [29].

Clinical evidence from the multicenter WAON-CHF study demonstrated that Waon therapy significantly improved NYHA functional class, 6-minute walk distance, and cardiothoracic ratio in patients with advanced HF, without serious adverse events, supporting its safety and efficacy in stable patients [31]. Similarly, smaller cohort studies have shown improvements in left ventricular ejection fraction, exercise tolerance, and vascular endothelial function following repeated thermal therapy in CHF patients [32,14].

These findings suggest that sauna therapy can be a beneficial adjunct in carefully selected stable heart failure patients, facilitating symptom relief, improved functional capacity, and favorable cardiovascular adaptations.

5.8 Peripheral Artery Disease (PAD)

Peripheral artery disease (PAD) is characterized by arterial narrowing and reduced blood flow, leading to ischemia, claudication, cold extremities, and poor wound healing. Controlled thermal therapy such as Waon therapy has been associated with improvements in microcirculation, increases in ankle-brachial index (ABI), extended pain-free walking distance, and reduced pain scores in PAD patients [30].

Mechanistically, these improvements are mediated by peripheral vasodilation, increased skin and muscle perfusion, enhanced angiogenesis possibly via upregulation of endothelial progenitor cells, and reduced oxidative stress [30,31]. Although high-quality randomized data are limited, these findings support sauna therapy as a promising adjunct to standard PAD management, particularly for improving functional capacity and quality of life.

5.9 Rehabilitation and Post-Myocardial Infarction Support

Sauna therapy may serve as a supportive modality within cardiac rehabilitation programs, complementing traditional interventions such as supervised exercise, risk factor control, and patient education. In post-MI settings, sauna exposure has been associated with improved endothelial function [3,18], reduced cardiac workload through peripheral vasodilation and afterload reduction [3,7], enhanced autonomic balance with reduced sympathetic activity [11,20], anti-inflammatory effects [19, 23], and cellular protection via heat shock proteins [8,23]. These factors collectively may contribute to improved vascular efficiency and reduced arrhythmic risk. While observational evidence suggests lower cardiovascular mortality and enhanced exercise tolerance in stable patients incorporating sauna therapy [9,26], this approach remains an adjunct rather than a substitute for core cardiac rehabilitation [31,32].

Safety considerations are paramount: sauna bathing should be avoided early after MI, during decompensation, hypotension, or uncontrolled arrhythmias, and introduced only after clinical stabilization and medical approval. Typical safe protocols involve moderate temperatures (60-70°C), shorter durations (10-15 minutes), and appropriate hydration, emphasizing gradual progression [3,5,6].

5.10 Other health benefits

In addition to cardiovascular protection, regular sauna bathing has been associated with improvements in mental health and neurocognitive function. Frequent sauna use has been linked to a lower risk of neurodegenerative diseases, including dementia and Alzheimer's disease, with reductions of 66% and 65%, respectively, in high-frequency users [33]. The proposed mechanisms include enhanced cerebral blood flow, upregulation of brain-derived neurotrophic factor (BDNF) due to heat stress, and reduced oxidative stress, all of which support neuronal health and cognitive resilience. Moreover, sauna bathing may alleviate symptoms of stress, anxiety, and depression by promoting parasympathetic activation, improving sleep quality, and supporting overall mental well-being [6]. These findings highlight sauna therapy as a potential non-pharmacological intervention for maintaining mental health alongside its cardiovascular benefits.

A global cross-sectional survey of regular sauna users found that the principal motivations for sauna bathing were relaxation and stress reduction, with 83,5 % of respondents reporting improved sleep quality after sauna sessions and more frequent sauna use associated with higher mental well-being scores, suggesting potential psychosocial benefits beyond cardiovascular effects [34].

6. Discussion

The results of the reviewed studies demonstrate that regular sauna bathing has consistent effects on cardiovascular physiology, ranging from acute hemodynamic responses to long-term vascular and clinical adaptations. These results align with the growing body of evidence suggesting that passive heat exposure may represent a meaningful adjunctive strategy in the prevention and management of cardiovascular diseases [3-5,10]. A central and consistent finding across the reviewed literature is the sustain decrease in arterial stiffness, improved aortic elasticity and improvement in endothelial function. As outlined in the Results section, both acute and repeated sauna exposure lead to measurable decreases in pulse wave velocity and improvements in flow-mediated dilation, indicating enhanced arterial compliance and vascular responsiveness [7,29]. These effects are largely mediated by increased nitric oxide (NO) bioavailability, which promotes vasodilation and reduces vascular smooth muscle tone [18,22]. Importantly, repeated exposure appears to sustain these benefits, contributing to improved aortic elasticity and a more favorable vascular aging profile [21,29].

The molecular mechanisms known to be contributing to arterial stiffness reduction are multifactorial and mutually reinforcing. Increased NO production, stimulated by shear stress during heat exposure is vital in endothelial signaling, similarly to mechanisms observed in exercise-induced vascular adaptation [17]. Concurrently, reductions in oxidative stress decrease reactive oxygen species, thereby preserving NO availability and protecting endothelial cells and elastin, which improves structural flexibility of arteries [25].

Anti-inflammatory effects, including decreasing nuclear factor kappa B and proinflammatory cytokines, further contribute to improved vascular integrity [10,19].

In addition, regular heat exposure may influence heat-induced vascular remodeling by limiting excessive collagen deposition and preserving elastin function, which together enhance the structural flexibility of arterial walls and better vessel compliance [4,5]. These mechanistic pathways provide strong biological plausibility for the observed reductions in arterial stiffness and blood pressure.

The hemodynamic response to sauna exposure involves an increase in core body temperature, which leads to enhanced skin blood flow and reduced vascular resistance. This process generates shear stress on the vascular endothelium and stimulates the production of nitric oxide. Both shear stress and nitric oxide are key contributors to the reduction of arterial tone. Over time, these adaptations lead to both functional and structural improvements in cardiovascular efficiency [7,16,18].

Sauna bathing, in comparison with exercise, reduces arterial stiffness and improves endothelial function. However, sauna works via passive heat stress and provides heat shock protein-mediated protection [3,8,15]. The best cardiovascular health benefits occur when aerobic exercise is combined with a regular sauna session [3].

From a clinical perspective, the observed physiological adaptations translate into meaningful health outcomes, including reductions in blood pressure, reduced left ventricular afterload, improved coronary perfusion, improved autonomic balance, and enhanced vascular function. Prospective cohort studies have demonstrated dose-response relationships between sauna frequency and cardiovascular outcomes.

Frequent Finnish sauna users have been shown to experience 30–63% lower risks of adverse cardiovascular events. Specifically, middle-aged men using the sauna two to three times per week exhibited a 47% lower risk of hypertension compared to once-weekly users (HR 0.54, 95% CI 0.32–0.91), independently of BMI, smoking, and baseline SBP, an effect attributed to vasodilation and improved endothelial function [27]. Men using the sauna four to seven times per week had a 63% lower risk of sudden cardiac death (HR 0.37) and a 50% lower risk of fatal cardiovascular disease (HR 0.50), mediated by improved autonomic regulation and reduced inflammation [27]. Adults with high cardiorespiratory fitness and frequent sauna use demonstrated a 69% lower risk of sudden cardiac death (HR 0.31) compared to low fitness and infrequent users, suggesting a synergistic effect with exercise [27]. In men with high systolic blood pressure (≥140 mmHg), infrequent sauna use was associated with an 81% higher risk of cardiovascular mortality (HR 1.81), whereas regular sauna bathing attenuated this risk (HR 1.52), indicating that frequent heat exposure can mitigate the adverse impact of hypertension [27,28]. Physiological studies further support these findings, showing improvements in endothelial function, increased nitric oxide, reduced oxidative stress, and decreased SBP, with effects comparable to moderate exercise [7,16,18].

There is accumulating evidence that Finnish sauna bathing is a viable intervention for improving cardiovascular outcomes, particularly by reducing SBP and the risk of hypertension. The cardioprotective effects result from hemodynamic adaptations, including enhanced endothelial function, arterial compliance, and autonomic balance, that mimic the effects of moderate intensity exercise. Crucially, frequent sauna use attenuates the prognostic risks of elevated SBP, with high-risk individuals demonstrating 30% lower CVD mortality when engaging in regular sessions. However, there are still strict contraindications for patients with unstable cardiovascular conditions, as thermal stress could cause ischemia or hemodynamic collapse. Clinicians should advocate for personalized regimens that prioritize gradual cooling and hydration, as well as avoiding alcohol. Future randomized controlled trials are imperative to establish causality, optimize temperature-duration thresholds, and validate protocols in diverse populations, including those with implantable cardiac devices. Until then, sauna bathing should be included in lifestyle recommendations for reducing cardiovascular risk, depending on the individual's risk level and their level of education [33].

From a broader public health perspective, sauna bathing also offers benefits in terms of mental health and well-being. It is associated with reduced stress, improved sleep quality, and enhanced relaxation [34], all of which are important determinants of population health.

7. Conclusions

Regular Finnish sauna bathing is a promising, evidence-supported lifestyle intervention with beneficial effects on cardiovascular health. While current evidence is compelling, further high-quality research is required to establish its role in clinical and public health practice as an effective prevention and treatment method of cardiovascular diseases. Sauna bathing has emerged as a widely studied lifestyle behaviour with growing evidence for its role in cardiovascular and overall health.

While traditionally associated with cultural and recreational use, modern research has explored its physiological effects, clinical applications, and public health implications. The current evidence suggests that sauna bathing is a beneficial adjunct to a healthy lifestyle, particularly in relation to cardiovascular outcomes, though it is not a substitute for established medical therapies.

Sauna works best when incorporated into a cluster of healthy behaviours. When combined with regular exercise, it provides complementary cardiovascular benefits, as sauna induces passive heat stress while exercise imposes active stress, leading to synergistic improvements in vascular function. Sauna may also improve sleep quality, especially when used earlier in the evening, support adequate hydration, and complement—but not replace – a healthy diet in the primary prevention of cardiovascular disease.

A substantial body of evidence comes from large observational cohort studies. These studies demonstrate a clear association between frequent sauna bathing and reduced risk of cardiovascular disease, including lower incidence of coronary artery disease, reduced risk of stroke, and decreased cardiovascular mortality.

The physiological mechanisms underlying these benefits are well characterized and include improved endothelial function, enhanced arterial compliance, increased nitric oxide bioavailability, reduced oxidative stress, decreased systemic inflammation, and activation of cellular stress responses such as heat shock proteins. These mechanisms provide strong biological plausibility for the observed reductions in blood pressure, arterial stiffness, and cardiovascular risk. Substantial epidemiological evidence demonstrates a strong inverse association between frequent sauna bathing (4–7 sessions per week) and the risk of incident hypertension, stroke, sudden cardiac death, and all-cause mortality.

Despite these positive findings, there are important limitations and methodological challenges. Most evidence comes from observational studies with heterogeneous protocols, confounding lifestyle factors, and a lack of randomized controlled trials, which limits the ability to establish causality. Evidence from patients with advanced coronary artery disease suggests that the therapeutic window for vascular benefit may be limited in severe disease states or that longer intervention durations are necessary.

From a public health perspective, sauna bathing is an attractive intervention due to its low cost, scalability, and non-pharmacological nature. However, its accessibility varies globally, and the majority of evidence is derived from observational studies within specific populations, limiting generalizability. Further randomized controlled trials are needed to better define causality, optimal usage parameters, and specific clinical indications.

In conclusion, Finnish sauna bathing represents a promising and increasingly evidence-supported behaviour within public health. It is associated with reduced cardiovascular morbidity and mortality, improved endothelial function, and enhanced psychological well-being, with strong biological mechanisms supporting these associations. However, its role is best understood as complementary rather than primary, and its implementation must consider safety, accessibility, and existing health inequalities. Future research, particularly randomized controlled trials, will be important in clarifying its causal effects and defining its place within comprehensive public health strategies.

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