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THE EFFECTS OF SAUNA BATHING ON SELECTED HEALTH OUT-COMES AND POST-EXERCISE RECOVERY: A NARRATIVE REVIEW

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ABSTRACT

Background: Sauna bathing is a form of passive heat exposure that is increasingly being studied for its potential effects on human health and post-exercise recovery. Despite a growing number of studies on this topic, the evidence remains incomplete due to differing methodologies and results that are difficult to compare.

Objective: This narrative review aimed to synthesize current evidence on the effects of sauna bathing on selected aspects of health and post-exercise recovery.

Methods: A qualitative analysis of observational and interventional studies was conducted, focusing on outcomes related to the cardiovascular, respiratory, musculoskeletal, and neurocognitive systems, as well as acute and chronic adaptations relevant to physically active individuals.

Results: The most consistent evidence relates to cardiovascular health. Frequent sauna bathing is associated with reduced risk of cardiovascular disease, sudden cardiac death, and all-cause mortality. Interventional studies indicate improvements in blood pressure, lipid profile, and endothelial function. Limited but supportive evidence suggests beneficial effects on respiratory health and symptom relief in rheumatic conditions. In the context of exercise recovery, infrared sauna bathing may enhance neuromuscular recovery and reduce perceived muscle soreness, whereas high-temperature exposure immediately after intense exercise may temporarily impair short-term performance. Repeated post-exercise sauna use may promote endurance adaptations via plasma volume expansion.

Conclusions: Sauna bathing appears to be a safe and potentially beneficial complementary strategy for health promotion and selected training adaptations; however, further standardized randomized controlled trials are required.

KEYWORDS

Sauna Bathing, Passive Heat Exposure, Cardiovascular Health, Post-Exercise Recovery, Endurance Adaptation, Infrared Sauna

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1. Introduction

Sauna bathing is a form of passive exposure to heat, known for centuries and originating in the Nordic countries, where it is an integral part of the culture, but also a component of a healthy lifestyle (Peräsalo, 1988; Valtakari, 1988). In recent years, the use of saunas has grown in popularity in many countries, and sauna cabins have become available in fitness centers, sports facilities, and wellness institutions (Karol et al., 2026). This growing popularity has contributed to increased interest in this topic among researchers.

Regular exposure to heat causes significant physiological reactions in the body, such as increased heart rate, increased cardiac output, and dilation of blood vessels (Hannuksela & Ellahham, 2001; J. A. Laukkanen et al., 2018). There are large prospective cohort studies suggesting an association between sauna frequency and reduced risk of cardiovascular disease, sudden cardiac death, and all-cause mortality (T. Laukkanen et al., 2015), as well as a lower incidence of respiratory diseases (Kunutsor et al., 2021; Kunutsor & Laukkanen, 2021) and neurocognitive disorders (T. Laukkanen et al., 2017).

In addition, passive heat exposure has been recognized by the sports community as a potential strategy for improving recovery after physical exertion, promoting heat acclimatization, and improving endurance performance (Ahokas et al., 2023; Mero et al., 2015; Scoon et al., 2007).

The amount of evidence regarding the impact of saunas on health and physical performance is constantly growing, but these topics are often discussed separately. Moreover, differences in research methodology, including differences in sauna type, temperature, duration, and timing in relation to physical exercise, make it difficult to interpret the results (Ahokas et al., 2023; Hannuksela & Ellahham, 2001). Therefore, the aim of this narrative review is to attempt to gather current evidence on the effects of sauna bathing on selected aspects of health and recovery after physical exercise, with particular emphasis on cardiovascular adaptation, musculoskeletal responses, and training outcomes.

2. Methodology

An electronic literature search of the PubMed® and Google Scholar® database was conducted. Search criteria included keywords: ‘sauna bathing’; ‘passive heat exposure’; ‘cardiovascular health’; ‘post-exercise recovery’; ‘endurance adaptation’; ‘infrared sauna’ and their combinations. Studies published up to January 2026 were considered. Inclusion criteria encompassed original studies, reviews, systematic reviews and meta-analyses, specifically related to sauna bathing and its impact on health and post-exercise recovery. Articles in a language other than English were excluded.

3. The impact of saunas on health and post-workout recovery

Sauna bathing is a practice known for thousands of years, originating in the Nordic countries and forming an integral part of Finnish culture in particular. The use of saunas is a tradition passed down from generation to generation in Nordic societies (Peräsalo, 1988; Valtakari, 1988). From the very beginning, however, visits to the sauna were not only a space for social gatherings, cleansing rituals, or forms of relaxation, but also an element of health-promoting activities. It is therefore not surprising that, with the popularization of a healthy lifestyle, sauna bathing has become known throughout the world, and sauna cabins are now a basic feature of many fitness clubs, swimming pools, and wellness centers (Karol et al., 2026). The prevalence of this phenomenon raises many questions about its safety, its impact on human health, but also its potential use as a means of supporting recovery after physical exertion.

There are currently several types of saunas, including the traditional Finnish sauna, Turkish bath, and infrared sauna. However, the most thoroughly researched type remains the Finnish sauna, which is characterized by high temperature and low humidity. Typically, in such a sauna, the temperature reaches 80°C to 100°C at the user's face level, and the humidity in the room is usually between 10% and 20% (Ahokas et al., 2023; Elias et al., 2025; Hannuksela & Ellahham, 2001; J. A. Laukkanen et al., 2018). A typical sauna session consists of several short periods of heating the body, usually lasting from 5 to 20 minutes, between which there is a mandatory period of cooling down, resting, and replenishing fluids (Hannuksela & Ellahham, 2001; Karol et al., 2026; Kukkonen-Harjula & Kauppinen, 2006).

3.1. The impact of saunas on selected aspects of health

3.1.1 The effects of sauna bathing on the cardiovascular system

Many scientific studies on the benefits of regular sauna bathing focus on their impact on the functioning of the cardiovascular system. One of the more recent studies on this topic is Earric Lee's 2022 paper. The study involved 48 participants who were randomly divided into three groups: a control group (CON), a group engaging in physical activity (EXE), and a group engaging in the same physical activity but also regularly using a sauna (EXS). In this way, cardiovascular disease risk factors were studied for 8 weeks. The results showed that both systolic blood pressure and total cholesterol levels were lower in the group of physically active people who used the sauna than in the group of physically active people only, which means that the EXS group had a reduced risk of cardiovascular disease (Lee et al., 2022). In contrast, a 2015 prospective cohort study involving 2,315 men aged 42 to 60, with a follow-up of more than 20 years on average, showed that regular sauna use significantly reduces the risk of sudden cardiac death (SCD), coronary heart disease (CHD), and death from cardiovascular disease (CVD). Furthermore, by dividing participants into groups based on the frequency of sauna use, it was proven that more frequent sauna use can significantly reduce the risk of death from cardiovascular causes (T. Laukkanen et al., 2015). In addition, studies conducted by Laukkanen reported a reduction in blood pressure, improved arterial elasticity, and a temporary increase in blood parameters such as hemoglobin level, white blood cell count, and platelet count. These changes may promote long-term protection against arterial stiffness and, consequently, reduce the risk of cardiovascular disease and mortality (T. Laukkanen et al., 2018). In addition, there are studies showing that regular sauna use: increases left ventricular ejection fraction and shortens ejection time (Lee et al., 2018; Ohori et al., 2012), improves vascular endothelial function, as evidenced by an increase in the number of circulating endothelial progenitor cells (CD34+) and improved flow-dependent vasodilation (Ohori et al., 2012), improves vascular endothelial function by increasing the production of nitric oxide (NO), which dilates blood vessels, inhibits platelet aggregation, and slows the development of atherosclerosis, and also the use of a sauna leads to a significant reduction in both total cholesterol and LDL cholesterol, which has a beneficial effect on cardiovascular health and prevents the development of diseases such as atherosclerosis and hypertension (Gryka et al., 2014; Lee et al., 2022; Pilch et al., 2010).

3.1.2. The effects of sauna bathing on the musculoskeletal system

There are also studies showing the positive effects of sauna use on alleviating symptoms in people with rheumatoid diseases. In 2009, a study was conducted to assess the effect of heat sessions on reducing pain and joint stiffness in patients with rheumatoid arthritis (RA) and ankylosing spondylitis (AS). The study involved people with stable chronic diseases whose health had not changed significantly over the previous three months. The results showed that after incorporating sauna therapy into the treatment of patients with RA, pain was reduced by 40% and stiffness by 50%. In patients with AS, both pain and stiffness were reduced by 60%. In addition, over 80% of participants reported a significant improvement in their well-being, which translated into an improvement in their quality of life (Oosterveld et al., 2009). These results were consistent with other studies, which also showed a positive effect of saunas on the musculoskeletal system, psychoemotional state, and pain relief in patients with RA (Matveikov & Marushchak, 1993).

3.1.3 The effects of sauna bathing on the respiratory system

Due to the conditions prevailing in a sauna, it causes the airways to dilate, which facilitates breathing and may help alleviate the symptoms of certain respiratory diseases, such as asthma, chronic obstructive pulmonary disease, and pneumonia, as well as reduce the risk of developing them (Kunutsor et al., 2017, 2021, 2022; Kunutsor & Laukkanen, 2023; Preisler et al., 1990). A 2021 study showed a correlation between the frequency of sauna use and a reduced risk of pneumonia. The study was conducted on a group of 1,935 middle-aged men, who were divided into three groups according to the frequency of sauna use (1, 2–3, and 4 times a week). The results showed that people who used the sauna 2-3 times a week had a 28% lower risk of pneumonia, and those who used it 4 times a week had a 37% lower risk (Kunutsor et al., 2021). Furthermore, a 2021 study found that in the general Caucasian male population, a combination of high physical fitness and frequent sauna bathing can reduce the risk of pneumonia by 38%, and is also associated with a significant reduction in the risk of future pneumonia compared to each of these methods used separately (Kunutsor & Laukkanen, 2021).

3.1.4 The impact of saunas on other aspects of health

Another interesting aspect of the beneficial effects of regular sauna bathing is its positive impact on neurocognitive functioning. In 2017, a study was published that examined whether the frequency of sauna use is associated with the risk of developing Alzheimer's disease and dementia. The study included 2,315 apparently healthy men aged 42-60, who were divided into three groups according to the frequency of sauna use (1, 2-3, and 4-7 times a week), and the average follow-up time in the study was over 20 years. The number (percentage in each group) of dementia cases was 59 (10%), 137 (9%), and 8 (4%) in the three groups of sauna frequency, respectively. The corresponding number (percentage) of Alzheimer's disease cases was 34 (6%), 84 (6%), and 5 (3%), respectively. Therefore, it was concluded that in this male population, moderate to high frequency of sauna use was associated with a reduced risk of dementia and Alzheimer's disease. The likely mechanism for this effect is increased blood flow in the brain, as well as the general state of relaxation during a heat session, but the exact mechanism has not been investigated, so further research in this area is warranted (T. Laukkanen et al., 2017).

3.2. The impact of saunas on post-workout recovery

Activities aimed at warming the entire body, such as sauna baths or immersion in hot water (HWI), have recently gained popularity. In 2022, a survey showed that as many as 62% of athletes from several different sports used heating strategies during training (Menzies et al., 2022). These strategies are particularly used in combat sports, mainly to accelerate weight loss (Brito et al., 2012). However, heat exposure has also begun to be used in endurance and team sports, not only for weight reduction, but also for recovery, rehabilitation, acclimatization, and warm-up (Altarriba-Bartes et al., 2021; Brito et al., 2012). In addition, there is also growing interest in the use of saunas and HWI for passive heat acclimatization, as these methods may be more accessible and effective than methods focusing on physical exercise (McIntyre et al., 2021).

3.2.1 The effects of sauna bathing on acute post-workout recovery

In 2015, a research study was published with the aim of demonstrating, among other things, the effect of far-infrared sauna (FIRS) on recovery after strength and endurance training. The study involved 10 healthy, physically active men who underwent 60 minutes of strength training (STS) or approximately 40 minutes of endurance training (ETS) on different days. Each workout was followed by a 30-minute bath in a FIRS sauna at a temperature of 35-50°C and humidity of 25-35%, and a 30-minute rest at room temperature or rest only. After this time, performance tests were conducted, including maximum isometric bench press and leg press, counter-movement jump (CMJ), and maximum oxygen uptake on a treadmill. The results showed that after

STS during recovery, there were no differences in any of the variables between FIRS and no sauna bathing, while during recovery 30 minutes after ETS, CMJ was significantly higher after FIRS bathing than after resting without a sauna. This led to the conclusion that deep infrared heat penetration during FIRS bathing appears to promote neuromuscular recovery after maximal endurance exercise (Mero et al., 2015).

Similar results were presented in 2022, when the effect of a single infrared sauna (IRS) session was tested on the regeneration of neuromuscular performance after physical exercise and muscle soreness in male basketball players. In a randomized crossover design, participants performed two tests consisting of a complex resistance exercise protocol, followed by a 20-minute session in an IRS sauna at approximately 43°C or passive recovery. There was a one-week interval between tests. Recovery of neuromuscular performance was assessed using 20 m maximum sprint, counter-movement jump (CMJ), and isometric leg press tests performed 14 hours after exercise. It was established that exposure to IRS improves CMJ height recovery after complex resistance training, but does not improve results in isometric leg press or 20 m sprint. In addition, it has a positive effect on subjective muscle pain, which may contribute to improving the athlete's mood, readiness, and physical performance (Ahokas et al., 2023).

On the contrary, a study conducted in 2019 concluded that sauna bathing after intense training may have a negative short-term effect on swimming performance recovery. The study involved 20 young professional swimmers and triathletes, including 3 women and 17 men. The participants underwent intensive training and then, in random order, either a placebo treatment consisting of an oil massage with passive rest at room temperature or a sauna treatment consisting of three 8-minute sessions at 80-85°C. Before training, the swimmers completed a 4 × 50 m swimming test at maximum effort, which was repeated the following morning. The results showed that the athletes achieved significantly worse results after the sauna treatment, with the smallest significant change in swimming results being an increase in time of more than 1.2 seconds, which is a significant decline for professional athletes. Therefore, coaches and athletes should be particularly cautious when using the sauna if intensive training or competition is planned for the next day (Skorski et al., 2019).

3.2.2 The impact of sauna bathing on training adaptation

In line with the thesis that physiological adaptation to sauna bathing can have a positive effect on endurance performance, a study was carried out in 2006 involving six long-distance male runners. For three weeks, four times a week after training, the athletes regenerated in a humid sauna at an average temperature of 89.9°C for about 31 minutes. After a three-week break, they underwent three weeks of control training without regeneration methods. A performance test consisting of running on a treadmill to exhaustion at the runner's current best speed over a distance of 5 km was conducted on the first and second days after the control training period and the training period with regeneration in the sauna, and the times from these tests were averaged. The results showed that sauna bathing increased the running time to exhaustion by 32% in the endurance test. Plasma and red blood cell volume increased by 7.1% and 3.5%, respectively, after the study period compared to the control period. It was therefore concluded that three weeks of sauna bathing after physical exercise resulted in a significant improvement in running performance, probably through an increase in blood volume (Scoon et al., 2007).

In another randomized controlled trial, which aimed to investigate the effect of sauna use after exercise on gut bacteria inflammation and intestinal barrier function in young men undergoing endurance training, it was proven that passive heat exposure has no measurable effect on the intestinal microflora. The study involved 15 young men who were randomly assigned to two groups. One group of participants exercised for 60 minutes, 3 times a week, on an ergometric bike, and then underwent a 30-minute Finnish sauna treatment. The second group was a control group that participated in the same training program without sauna treatments. In addition, this study demonstrated that changes in body weight, percentage body fat, and VO_{2peak} in a graded ergometric test on a stationary bike did not differ between the groups (Karolkiewicz et al., 2022).

3.2.3 The impact of saunas in the context of other health aspects related to sports

Several interesting scientific studies have been conducted which prove that prolonged exposure to heat without physical training can cause increased skeletal muscle hypertrophy (Goto et al., 2011), and increase maximum strength (Goto et al., 2011; Kim et al., 2020; Racinais et al., 2017). However, these studies were conducted on healthy individuals with a sedentary lifestyle, so it is possible that these results will not be achieved by individuals who exercise due to existing adaptations caused by training (Horgan et al., 2023).

In 2022, a study was published examining the effect of sauna bathing after exercise on hematological adaptations. A randomized crossover study with two interventions lasting 4 weeks each, with a 10-week break in between, was conducted on a group of 13 male physical education students. During the intervention, participants underwent 60 minutes of stationary cycling training three times a week, followed by a 30-minute

sauna bath after training. The participants did not consume any fluids during either the training or the sauna bath. The results showed that regardless of the type of intervention, tHb mass increased while ferritin concentration decreased, but the changes in tHb mass were within the typical error range (<1.8%). For this reason, it was concluded that the use of a sauna after physical exercise with fluid intake restrictions does not provide any additional benefits in the variables studied compared to endurance training alone (Sitkowski et al., 2022).

Meanwhile, another study examining the effect of Finnish saunas on, among other things, the white blood cell profile of athletes and non-athletes showed that the group of athletes had a greater increase in leukocytes and monocytes after a sauna session compared to non-athletes. The study involved 9 trained middle-distance runners and 9 men who were not athletes. Both groups participated in 15-minute sauna sessions until their body temperature rose by 1.2°C, and then cooled down for 2 minutes. Blood samples were taken before and after the session for testing. The results allowed us to conclude that sauna bathing stimulated the immune system to a greater extent in the group of athletes compared to non-athletes (Pilch et al., 2013).

4. Discussion

The presented review of studies and scientific papers clearly demonstrates the wide range of effects of sauna bathing on aspects of general health, as well as the body's adaptation to physical exertion. The most consistent and strongest evidence of the beneficial impact of heat exposure on the body exists in relation to the cardiovascular system. Prospective cohort studies conducted on a large number of participants have shown that regular sauna use is associated with a reduced risk of sudden cardiac death (SCD), coronary heart disease (CHD), and death from cardiovascular disease (CVD), but also linked the frequency of sauna bathing to its benefits (J. A. Laukkanen et al., 2018; T. Laukkanen et al., 2015). Repeated exposure to heat triggers physiological mechanisms in the body that result in the dilation of peripheral blood vessels and improved endothelial function (J. A. Laukkanen et al., 2018; Ohori et al., 2012). It has also been shown that regular sauna bathing can contribute to reducing blood pressure and improving the lipid profile (Gryka et al., 2014; Lee et al., 2022). All these changes may explain the benefits for cardiovascular function described in the studies.

In addition, other mentioned studies show that using a sauna affects not only the cardiovascular system, but also the respiratory and musculoskeletal systems. A study by Oosterveld et al., 2009 showed that exposure to heat reduced pain and joint stiffness in patients with rheumatoid arthritis and ankylosing spondylitis. However, observational evidence indicates a relationship between the frequency of sauna bathing and the risk of developing pneumonia (Kunutsor et al., 2017, 2021; Kunutsor & Laukkanen, 2023). This is likely related to mechanisms involving improved respiratory function and potential modulation of the immune response (Pilch et al., 2013; Preisler et al., 1990).

The next part of this review attempts to demonstrate the evidence of the sauna's impact on recovery after physical exertion. However, the results regarding this correlation remain inconclusive. Infrared sauna baths as a method of recovery after physical exercise seem to improve neuromuscular function and reduce muscle pain (Ahokas et al., 2023; Mero et al., 2015). On the other hand, it has been proven that exposure to high temperatures in a Finnish sauna after intense exercise can impair performance the next day (Skorski et al., 2019). The inconsistencies in the results suggest that other factors, such as time, temperature, hydration status, and type of activity, also influence post-workout recovery.

Repeated exposure to a sauna after physical exercise may also promote endurance adaptation, as demonstrated in a study by Scoon et al., 2007, in which several weeks of post-training sauna use in trained runners resulted in increased plasma volume and improved time to exhaustion. However, another study (Sitkowski et al., 2022) did not confirm any additional hematological benefits beyond those induced by endurance training alone. In addition, many studies are characterized by short intervention times and small sample sizes, which further limits the strength of the conclusions.

In summary, the main limitation of the current evidence base is that many of the strongest associations come from observational studies conducted on a group of middle-aged Finnish men (T. Laukkanen et al., 2015, 2017). This significantly limits the ability to generalize the results and use them in the context of populations that differ in age, gender, or origin. In addition, different sauna protocols and methodologies were used in individual studies, including training interventions and performance measures, which also makes it difficult to compare the results obtained. Therefore, in order to better understand the long-term physiological effects of sauna use and to be able to identify optimal exposure parameters, standardized randomized controlled trials are necessary.

5. Conclusions

Regular sauna bathing can be an additional health-promoting factor, especially with regard to the cardiovascular system. It also appears to support certain aspects of post-workout recovery. To date, the most well-documented effect is the reduction in the risk of cardiovascular disease and mortality. In addition, a beneficial effect on the respiratory and musculoskeletal systems has been demonstrated, but these results are supported by more limited data.

In terms of recovery after physical exercise, exposure to heat in a sauna may improve neuromuscular function recovery, reduce muscle pain, and improve subjective feelings. However, it is important to remember to adjust the duration and protocol of sauna use correctly, as there are studies indicating that exposure to high temperatures immediately after intense training may temporarily impair short-term performance.

Finally, taking all of the above information into account, it can be concluded that sauna bathing is a safe and potentially effective additional element of both a healthy lifestyle and a training program for healthy individuals. Nevertheless, randomized controlled trials with standardized sauna protocols, involving larger groups of participants and participants from different populations, are necessary to determine the long-term effects of sauna bathing and to establish optimal exposure conditions.

Disclosure

Conceptualization: Magdalena Baranowska

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