

ORIGINAL RESEARCH ARTICLE



## Sauna bathing in northern Sweden: results from the MONICA study 2022

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### ABSTRACT

Frequent sauna bathing has been associated with a reduced risk of cardiovascular disease and proposed as a mediator for improved health. Therefore, the aim was to describe and compare sauna bathers with non-sauna bathers in northern Sweden based on their demographics, health and life attitudes, and to describe sauna bathers' sauna habits. Questions on sauna bathing habits were included in the questionnaire for the participants in the Northern Sweden MONICA (multi-national monitoring of trends and determinants in cardiovascular disease) study, conducted during spring of 2022, inviting adults 25–74 years living in the two northernmost counties of Sweden (Norrbotten and Västerbotten), randomly selected from the population register. Of the 1180 participants in MONICA 2022, 971 (82%) answered the question about sauna bathing. Of these, 641 (66%) were defined as sauna bathers. Sauna bathers reported less hypertension diagnosis and self-reported pain. They also reported higher levels of happiness and energy, more satisfying sleep patterns, as well as better general and mental health. Sauna bathers were younger, more often men and found to have a healthier life-profile compared to non-sauna bathers. Additionally, the results suggest that the positive effects associated with sauna bathing plateaued from 1–4 times per month.

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## Introduction

Sauna bathing is a form of passive heat therapy [1] and a traditional Finnish activity that is mainly used for the purposes of relaxation and wellness [2]. The term “sauna” is a Finnish word, and it typically refers to an unpainted spruce or pine-panelled heated room, with wooden benches made of aspen, spruce or obeche [3]. Sauna bathing appears to be associated with a substantial reduction in the risk of sudden cardiac arrest [4], and frequent sauna bathing has been linearly associated with reduced risk for cardiovascular disease (CVD) [5]. It has also been proposed as a mediator for improved health [6,7], although this remains to be validated by robust experimental evidence.

Increased sweating during sauna bathing is accompanied by an increase in body temperature [1] and subcutaneous blood circulation [8], with similar acute effects in heart rate and blood pressure as moderate intensity physical exercise [9]. Indeed, a recent review

suggested an overlap in effects between aerobic exercise and heat therapy modalities such as sauna bathing [10]. Moreover, Lee et al. [11] found that sauna bathing improved arterial compliance and lowered systemic blood pressure after one session.

According to the literature, sauna bathing accelerates the process of muscle recovery after physical exertion [12], improves quality of life and well-being [13] and reduces the risk of CVD [14]. Furthermore, sauna bathing is an effective complementary therapy for rehabilitation of patients with heart disease [15], musculoskeletal diseases [16], low back pain [17] and other similar ailments [18]. Indeed, a recent study found beneficial long-term adaptations in cardiorespiratory fitness and blood pressure via a combination of regular exercise and post-exercise sauna bathing [19]. These encouraging results demonstrate the potential of sauna bathing as a viable therapeutic tool.

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The present experimental evidence suggests that frequent sauna bathing may augment the salutary effects of protective risk factors, such as regular physical activity. Regular sauna bathing has also been postulated to attenuate or offset the adverse effects of other risk factors, such as high blood pressure and systemic inflammation [20].

However, it is worth noting that data from several of the sauna bathing studies [12, 21] were based on a single homogeneous Finnish cohort [22], in a country with a relatively small population [23]. This may not accurately represent other populations. In northern Sweden, there is a similarly long tradition of sauna bathing, but there is a lack of information about the characteristics of these users, and what their sauna bathing habits are. Therefore, the aim was to describe and compare sauna bathers with non-sauna bathers in northern Sweden based on their demographics, health and life attitudes and to describe sauna bathers' sauna habits.

## Materials and methods

### Study population

The participants in this study took part in the 8th screening in the MONItoring of trends and determinants in CARdiovascular disease (MONICA) study, conducted in the two northernmost counties of Sweden, Norrbotten and Västerbotten, during the spring 2022.

The Northern Sweden MONICA study was originally part of a World Health Organization multinational study, and the first survey was performed in 1986. At each survey, 2500 persons aged 25–74 years were randomly selected from the population, stratified for age group, and sex (except for 1986 and 1990, when 2000 persons aged 25–64 years were invited) [24–26]. The participation rate declined from 81% in 1986 to 47% in 2022.

At each survey, participants were asked to complete a questionnaire covering living conditions, lifestyle and health, and anthropometry and blood pressure were measured. The majority had an oral glucose tolerance test (OGTT) and blood samples were collected for direct analysis of glucose and lipids and for storage for future research. In 2022, the questionnaire was largely revised and digitalised using the system REDCap [27]. This enabled the retrieval of questionnaire data also from participants who did not attend the study site.

### Questionnaire data in detail

The following questions on sauna habits were included: How often did you sauna bathe during the

last year?" Answer options were "never", "less than once per month", "1–3 times/month", "once a week", "2–3 times/week", and "4–7 times/week". For those indicating sauna bathing 1–3 times/month or more often, additional questions addressed usual time spent in the sauna ("less than 15 minutes", "15–20 minutes", ">20 minutes"), times in and out of the sauna at each occasion ("1–2 bouts", "3 bouts", ">3 bouts"), temperature in the sauna ("<60 °C", "60–80 °C", ">80 °C"), company in sauna ("usually alone", "usually one more person", "usually several more persons"), type of sauna ("electric", "infrared", "smoke", etc.) and cold water (ice) swimming in connection with sauna bathing the last year ("never", "1–3 times", ">3 times").

### Socioeconomic factors

Cohabiting ("yes", "no"), size of residence ("> 15 000 inhabitants", "1000–15 000 inhabitants", "less than 1000 inhabitants").

Highest attained educational level ("compulsory school", "upper secondary school", "university"). Employment situation ("professional", "leave of absence", "student", "unemployed", "retiree", "long-term sick leave").

### Alcohol and tobacco

Frequency of alcohol consumption (from never to four or more times a week), smoking habits ("yes", "regularly (≥one cigarette a day)", "sometimes (<one cigarette a day)", "no") and snuff use ("current use", "previous use", "never used") and number of snuff boxes per week.

Physical activity: The question "How often did you exercise in the last three months, with the goal to improve your health and/or to feel good?" was used with the answer options "never", "not regularly", "1–2 times/week", "2–3 times/week", "> 3 times/week".

### Co-morbidities and symptoms

Hypertension ("yes", "no"), pain ("no pain", "moderate pain", "severe pain"), and anxiety/depression ("no anxiety/depression", "anxiety or depression to some extent", "severe anxiety or depression"). In addition, a five-point Likert scale ranging from very dissatisfied to very satisfied was used to gather responses on satisfaction of sleep pattern, general health condition and mental health. Finally, participants were asked to indicate their energy, stress, and happiness levels using a 0 to 100 scale.

### Ethics and consent

The Swedish Ethical Review Authority approved the 8<sup>th</sup> MONICA survey (2021 -06,369-02, 22 December 2021). All participants gave their written informed consent.

## Data analysis

Data are presented as mean and standard deviation (SD) for continuous variables. Categorical variables are shown as count and percentages (%). Student's t-test and Pearson's chi-square test were used for comparisons between sauna bathers and non-sauna bathers. Any statistically significant differences between the two groups were further examined stratified for the frequency of sauna bathing (less than once per month, 1–4 times a month and 2–7 times a week) with one-way ANOVA with post-hoc Bonferroni correction. Statistical significance was set at  $p \leq 0.05$ . SPSS version 28.0.0.0 (SPSS Inc., Chicago, IL, USA) was used for all the analyses.

## Results

Of the 1180 northern Sweden participants in MONICA 2022, 971 (82%) answered the question about sauna bathing and were included in this analysis; 641 (66%) of these were defined as sauna bathers (sauna bathing  $\geq$  once per month). Participants who sauna bathed at least once a month were younger compared to those who did not (mean age 51.1 vs. 55.1 years,  $p < 0.001$ ) and were more often men (72.7% of the men were sauna bathers vs. 60.8% of the women ( $p < 0.001$ )) (Table 1).

While sauna bathers were more often professionals, physically active and smoked less, they had greater monthly alcohol consumption than non-sauna bathers. Body mass index (BMI), cohabitation, place of residence, education level or snuff use did not differ significantly. Sauna bathers reported less hypertension and less physical pain, and they were more satisfied with their sleep patterns. They also reported higher general health and mental health, energy levels and happiness. Sauna bathers reported lower anxiety/mildly depressed scores compared to non-sauna bathers (Table 1).

Participants sauna bathing 1–4 times a month and 2–7 times a week scored their mental health and energy levels statistically higher than participants who used the sauna less than once a month. However, mental health and energy levels did not increase with more frequent bathing than 1–4 times a month. There was an increase in happiness scores among participants using the sauna one to four times a month as compared to less or more frequent sauna bathing. Frequency of sauna bathing was not associated with sleep pattern satisfaction or general health (Table 2).

Most sauna bathers spent 15–20 minutes in the sauna, had 1–2 bouts, with a sauna temperature between 60 and 80 degrees Celsius. A majority used

a sauna powered by an electric stove. The majority also bathed together with others, but cold-water swimming was reported by a minority (Table 3).

## Discussion

In this study in Northern Sweden, sauna bathers were younger and more often men and had a healthier lifestyle, based on higher levels of physical activity and a lower prevalence of smoking, compared to non-sauna bathers. As for alcohol consumption, the sauna-group had a higher intake, but only up to moderate levels (2–3 times/week).

Globally, most sauna bathers exercise regularly for at least 30–60 min daily at varying levels of intensity [28]. Kunutsor and Laukkanen [20] suggested that the effects of sauna bathing are independent of physical activity. Furthermore, they postulated that sauna bathing used complementarily with physical activity, could elicit more benefits than physical activity alone, which has also been shown experimentally [19,29]. For people who are unable to meet the requirements of physical activity, the use of sauna bathing may be able to confer at least some salutary effects.

We found that sauna bathers reported less hypertension than non-sauna bathers. This is consistent with earlier studies that suggest that regular sauna bathing is associated with a reduced risk of hypertension [30,31]. This may be due to the acute mechanistic responses of sauna bathing. Indeed, Gayda et al. [32] found that the reduction of total peripheral resistance was maintained 15 and 120 min after sauna in untreated hypertensive patients. Lee et al. [11] showed that pulse wave velocity, systolic blood pressure, diastolic blood pressure, mean arterial pressure, left ventricular ejection time and diastolic time decreased immediately after a 30-min sauna session in a population with CVD risk factors. Reductions in systolic blood pressure and left ventricular ejection time were also sustained during the 30-min recovery phase. Decreased blood pressure and heart rate after a 25-min sauna session has also been reported in a healthy population by Ketelhut & Ketelhut [9].

Regular sauna bathers in our study reported less moderate to severe pain. This is in line with a study where participants with back/musculoskeletal pain, reported the greatest improvements in their conditions with sauna-bathing [28]. Another study from Korea also showed that sauna therapy may be useful to reduce pain and improve quality of life in patients with low back pain [17]. Sauna therapy has shown efficacy in the treatment of pain in patients with other diagnosis such as fibromyalgia [33] and rheumatoid arthritis and

**Table 1.** Participant characteristics among sauna and non-sauna bathers.

Variable	Sauna bathers (n = 641)	Non-sauna bathers (n = 330)	p-value
Age mean (SD)	51.1 (13.4)	55.1 (13.8)	<0.001
Range in years (min–max)	24–74	24–74	
Sex n (%)			<0.001
-Male	309 (48.2)	116 (35.2)	
-Female	332 (51.8)	214 (64.8)	
-Missing			
Body mass index (BMI)	27.0 (4.7)	27.6 (5.8)	0.08
Cohabitation n (%)			0.07
-Yes	485 (78.9)	236 (73.5)	
-No	130 (21.1)	85 (26.5)	
-Missing	26	9	
Inhabitants place of residence n (%)			0.65
—>15 000	395 (63.6)	200 (62.1)	
—≤15 000	226 (36.4)	122 (37.9)	
—Missing	20	8	
Education n (%)			0.18
-Compulsory school	73 (11.8)	43 (13.5)	
-Upper secondary school	253 (40.8)	145 (45.5)	
-University	294 (47.4)	131 (41.1)	
-Missing	21	11	
Employment n (%)			<0.001
-Professional	424 (73.0)	166 (56.0)	
-Leave of absence	7 (1.2)	6 (2.0)	
-Students	17 (2.9)	4 (1.3)	
-Unemployed	2 (0.3)	7 (2.4)	
-Retiree	118 (20.3)	102 (34.3)	
-Long-term sick leave	13 (22.0)	12 (4.0)	
-Missing	60	33	
Alcohol consumption n (%)			<0.001
-Never	53 (8.5)	75 (23.4)	
-Once a month or less often	168 (27.1)	105 (32.2)	
-2–4 times in a month	301 (48.5)	103 (32.1)	
-2–3 times in a week	92 (14.8)	34 (10.6)	
-4 times or more in a week	7 (1.1)	4 (1.2)	
-Missing	20	9	
Smoking cigarette n (%)			0.04
-Yes	25 (4.0)	23 (7.2)	
-No or < once a day	594 (96.0)	298 (92.8)	
-Missing	22	9	
Using snuff n (%)			0.97
-Yes	98 (15.8)	51 (15.9)	
-No	522 (84.2)	270 (84.1)	
-Missing	21	9	
Physical activity n (%)			<0.001
-Once a week or more	330 (53.1)	97 (30.4)	
-Never or irregularly	291 (46.9)	222 (69.6)	
-Missing	20	11	
Hypertension diagnosis n (%)			0.02
-Yes	139 (31.9)	93 (41.0)	
-No	297 (68.1)	134 (59.0)	
-Missing	205	103	
Pain n (%)			<0.001
-Moderate/severe	364 (56.9)	225 (68.2)	
-None	276 (43.1)	105 (31.8)	
-Missing	1		
Anxiety/mildly depressed n (%)			0.05
-To some or large extent	257 (40.2)	154 (46.7)	
-None	382 (59.8)	176 (53.3)	
-Missing	2		
Satisfaction sleep pattern <sup>a</sup> mean (SD)	3.42 (1.06)	3.17 (1.05)	<0.001
-Missing			
General health <sup>a</sup> mean (SD)	3.76 (.88)	3.56 (.95)	<0.001
-Missing	20	9	

(Continued)

**Table 1.** (Continued).

Variable	Sauna bathers ( <i>n</i> = 641)	Non-sauna bathers ( <i>n</i> = 330)	<i>p</i> -value
Mental health <sup>a</sup> mean (SD) -Missing	4.03 (.85) 1	3.88 (.91)-	0.02
Energy <sup>b</sup> mean (SD) -Missing	71.32 (18.40) 8	65.64 (20.89) 6	<0.001
Stress <sup>b</sup> mean (SD) -Missing	38.96 (25.98) 17	39.14 (27.19) 5	0.96
Happiness <sup>b</sup> mean (SD) -Missing	73.83 (17.12) 15	69.24 (19.56) 9	<0.001

<sup>a</sup>Scale ranges from 1 (very dissatisfied) to 5 (very satisfied). <sup>b</sup>Scale ranges from 0 (energy level, stress, and happiness) to 100 (highest energy level, stress and happiness). Statistical analysis = Student's *t*-test, Chi-square test and Mann-Whitney U Test for independence. Statistical significance at *p* ≤ .05.

**Table 2.** Sauna bathing frequency and satisfaction with sleep, health, energy, and happiness.

Variable	Group A < 1/month ( <i>n</i> = 330)	Group B 1–4/month ( <i>n</i> = 198)	Group C 2–7/week ( <i>n</i> = 73)	<i>p</i> -value
Satisfaction sleep pattern <sup>a</sup> mean (SD) -Missing	3.4 (1.1) 9	3.5 (1.0) 6	3.5 (1.1) 6	0.70
General health <sup>a</sup> mean (SD) -Missing	3.7 (0.9) 8	3.8 (0.9) 6	3.9 (0.9) 6	0.32
Mental health <sup>a</sup> mean (SD) -Missing	3.9 (0.9)-	4.2 (0.8) 1	4.2 (0.7) 6	<0.001 A vs. B and C
Energy <sup>b</sup> mean (SD) -Missing	69.3 (18.9) 4	73.8 (17.1) 3	74.9 (18.4) 1	0.004 A vs. B and C
Happiness <sup>b</sup> mean (SD) -Missing	72.8 (18.1) 9	76.3 (15.4) 5	72.3 (16.2) 7	0.05 B vs A and C

<sup>a</sup>Scale ranges from 1 (very dissatisfied) to 5 (very satisfied). <sup>b</sup> Scale ranges from 0 (energy level, stress, and happiness) to 100 (highest energy level, stress and happiness).

Statistical analysis = Mann-Whitney U Test and Chi-square test for independence. Statistical significance at *p* ≤ 0.05.

ankylosing spondylitis [34]. Pain shares an inverse relationship with quality of life and less reported pain often leads to better quality of life [35,36].

In the present study, sauna bathers also reported lower levels of anxiety. A study explored the effects of sauna bathing utilising residual heat from charcoal kiln saunas on psychological states and showed that sauna bathing was an effective complementary and alternative medicine practice for the improvement of mood and reduction of anxiety [37]. Patients' perceived fatigue and negative mood also improved after infrared sauna, in a pilot study of chronic fatigue syndrome [38].

The sauna bathers were more satisfied with their sleep patterns than the non-sauna bathers. In a study of sleep patterns following sauna use, the amount of deep sleep showed significant increase [39]. Other forms of passive heat therapy have also been shown to promote sleep and improve sleep quality in the elderly [40,41]. A global sauna survey [28] found that 83.5% of respondents reported improvements in sleep after sauna use. The top three motivations for sauna-bathing in the above-mentioned study included relaxation and stress reduction, enjoyment and invigoration, and pain relief. However, in our study stress reduction was not seen in sauna bathers.

The sauna bathers scored higher levels of both general and mental health, as well as reduced self-reported pain, higher levels of energy and happiness and sauna bathing once a month or more associated with greater perceived mental health levels and higher levels of energy compared to those who sauna bathed less. Interestingly, the reported mental health levels increased with increased frequency of sauna bathing, although this was not seen in the levels of general health. Furthermore, mental health levels and levels of energy did not increase by sauna bathing more frequently than 1–4 times a month.

We also found greater levels of happiness reported by participants who sauna bathed 1–4 times a month compared to less or more frequent sauna bathing.

Most of the sauna bathers in the present study spent 15 to 20 min in the sauna, split between one or two bouts with a temperature between 60 and 80°C. This is in line with what Hussain et al. [28] found from most respondents in their global sauna study reported using traditional Finnish-style saunas, with temperature settings in the range of 60–90°C (or ~140–195 °F). The sauna bathers in this survey reported that they preferred sauna bathing together with others, with sauna bathing in combination with cold water (or ice) swimming being reported by a minority. In Hussain

**Table 3.** Description of sauna bathing frequency and sauna habits among sauna bathers.

Variable <i>n</i> (%)	Group B 1-4/month ( <i>n</i> = 198)	Group C 2-7/week ( <i>n</i> = 73)	<i>p</i> -value
Minutes in sauna			0.02
-< 15	39 (19.7)	14 (19.4)	
-15-20	88 (44.4)	44 (61.1)	
->20	71 (35.9)	14 (19.4)	
-Missing		1	
Bouts			0.01
-1-2	136 (69.0)	61 (84.7)	
-≥3	61 (22.0)	11 (5.3)	
-Missing	1	1	
Temperature Celsius			0.45
-<60	24 (12.2)	13 (18.1)	
-60-80	136 (69.0)	47 (65.3)	
->80	20 (10.2)	6 (8.3)	
-Do not know	17 (8.6)	6 (8.3)	
-Missing	1	1	
Type of Sauna			0.03
-Electrical sauna	117 (59.1)	50 (69.4)	
-Infrared sauna	1 (0.5)	5 (6.9)	
-Steam sauna/steam bath	3 (1.5)	17 (23.6)	
-Wood heated sauna	74 (37.4)	3 (1.5)	
-Smoke sauna			
-Do not know			
-Missing			
Together with others			0.08
-Yes	165 (83.3)	54 (74.0)	
-No	33 (16.7)	19 (26.0)	
-Missing			
Sauna and cold-water swimming			0.95
-Yes	25 (12.6)	9 (12.3)	
-No	173 (87.4)	64 (87.7)	
-Missing			

Statistical analysis = Chi-square test for independence. Statistical significance at  $p \leq 0.05$ .

et al. [28] one main motivation for sauna bath was “social – to meet and talk with friends”. It would therefore be of interest to further study the impact of social relationship and health effects of sauna bathing.

This study has limitations. The sauna bathing group was younger than the non-sauna bathing group which may explain the lower prevalence of hypertension diagnosis, less reported pain, anxiety, sleep problems and higher general and mental health. On the other hand, a higher proportion of retirees in the non-sauna bathing group may have played a role in the lack of difference between the groups in terms of stress relief. The high prevalence of pain (57%/68%) and anxiety or mildly depressed scores (40%/47%) in the studied population might have influenced the results and is something that ought to be investigated further.

A higher proportion of men were sauna bathers, compared to women, and some of the examined factors may differ between sexes. Many of the associations present in the current study are supported by data from previous research, but it is vital to adjust for age, sex and other possible confounding

factors such as education or income levels in future studies examining health effects of sauna bathing. Higher affluency may have a bearing on lifestyle choices and decisions [42].

The participation rate in the northern Sweden MONICA study 2022 was lower than in previous screenings (47% as to compared to 81% in 1986 and 62% in 2014 [24,25]. Although 47% participation rate is still a relatively favourable response rate considering the typically modest response rates in population studies [43], generalisability may be challenging. The cross-sectional design means we are unable to infer cause–effect relationships. To elucidate possible cause–effect relationships between sauna bathing and health randomised controlled trials are warranted.

## Conclusion

In conclusion, this study describes and compares sauna bathers with non-sauna bathers using data from the



MONICA study 2022. Sauna bathers were associated with a healthier life-profile than non-sauna bathers, because they reported less hypertension, less self-reported pain, more satisfying sleep patterns, greater mental and general health as well as higher levels of happiness and energy. Moreover, the association between sauna bathing 1–4 times a month and increased mental health and levels of energy was similar to sauna bathing more frequently. This suggests that these benefits can still be reaped from less frequent use of the sauna, and that more is not always better. Nevertheless, sauna bathing appears to be a promising means for improving health and well-being.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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