Sauna as a Valuable Clinical Tool for Cardiovascular, Autoimmune, Toxicant-induced and other Chronic Health Problems

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Abstract

Sauna therapy has been used for hundreds of years in the Scandinavian region as a standard health activity. Studies document the effectiveness of sauna therapy for persons with hypertension, congestive heart failure, and for post-myocardial infarction care. Some individuals with chronic obstructive pulmonary disease (COPD), chronic fatigue, chronic pain, or addictions also find benefit. Existing evidence supports the use of saunas as a component of depuration (purification or cleansing) protocols for environmentally-induced illness. While far-infrared saunas have been used in many cardiovascular studies, all studies applying sauna for depuration have utilized saunas with radiant heating units. Overall, regular sauna therapy (either radiant heat or far-infrared units) appears to be safe and offers multiple health benefits to regular users. One potential area of concern is sauna use in early pregnancy because of evidence suggesting that hyperthermia might be teratogenic.

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Introduction

Saunas have been utilized for hundreds or years, especially in the Scandinavian countries. Finland, with a population of five million, has close to one million saunas. Most Finns take a sauna bath weekly and grew up hearing the adage: "If the sauna, schnapps, and birch tar don't help, then death is near."[1]

There are several distinct types of saunas: Finnish steam sauna (Finnish steam bath), dry-heat sauna, infrared saunas, and far-infrared (FIR) saunas.

Radiant-heat Saunas (Finnish Steam Saunas and Dry-heat Saunas)

When the term "sauna" is used in the medical literature without any modifiers (e.g., infrared), it generally refers to the Finnish steam sauna. This sauna uses a wood-paneled room with wooden benches and a radiant heater that keeps the temperature between 70 and 100°C (158-212°F) with a face level temperature of 80-90°C (176-194°F). Steam is produced by pouring water over heated rocks. Generally enough steam is produced to create a humidity of 50-60 g H_2O vapor/M^3. Standard length of a Finnish sauna is 5-20 minutes in the sauna, followed by cold immersion (swim or shower) and a period of room temperature recovery before repeating. In a single sauna session, this pattern is repeated 2-3 times.

Dry-heat saunas are essentially the same as Finnish steam saunas; however, the room used is dry so steam is not produced. The procedure for these saunas is also roughly the same as that described for Finnish steam saunas.

Infrared Saunas (Infrared and Far-infrared Saunas)

Infrared saunas utilize a different heating element and typically do not achieve the same temperatures as the radiant heat saunas. There are also no hot rocks on which to splash water for humidity. There are two main types of infrared saunas – infrared and far-infrared (FIR).

Infrared saunas use incandescent infrared heat lamps to produce heat. They emit primarily near-infrared wavelengths, with lesser amounts of

middle-infrared, and perhaps a small amount of far-infrared energy. They also emit a small amount of red, orange, and yellow visible light. FIR saunas use ceramic or metallic heat elements that mainly emit energy in the far-infrared range.

Infrared wavelengths, acting primarily on the cutaneous blood vessels and nerve receptors, do not penetrate deeply into tissues. There is less scientific research on infrared saunas than on radiant-heat saunas, and the existing evidence focuses primarily on cardiovascular benefits. There are no standard temperature and duration ranges used generically for infrared saunas.

The infrared portion of the electromagnetic spectrum is usually divided into three regions or bands: near-, mid-, and far-infrared. According to research published in the 1930s, near-infrared (IR-A) has the greatest tissue penetration of the three, while far-infrared (IR-C) has practically no penetration.[2] IR-A (700 nm - 1400 nm) has a tissue penetration up to 5 mm. This wavelength penetrates to the subcutaneous layer and provides the best dissipation of heat from the skin surface. Mid-infrared (IR-B; 1400 nm - 3000 nm) has the next deepest tissue penetration (about 0.5 mm). IR-C (3,000 nm - 1 mm) has a tissue penetration of about 0.1 mm.[2] Near-infrared wavelengths not only provide the deepest penetration, but also result in changes in mitochondrial signaling in skin cells.[3] Near-infrared wavelengths are also being used for non-invasive blood glucose and hemoglobin testing.[4] Although FIR units do not provide any significant tissue penetration, they may still provide clinical benefits.

Physiological Response to Sauna Therapy

Saunas produce thermal stress. The cardiovascular system responds to thermal stress by increasing heart rate; the resting heart rate can double with a 70-percent increase in cardiac output.[5,6] There is also an approximate 40-percent decrease in peripheral resistance, which allows for increased peripheral circulation.[7] The increased peripheral blood flow allows for greater heat exchange through the skin (with diaphoresis), and consequently decreases circulation to muscles, kidneys, and viscera. With the reduction in peripheral resistance, diastolic and arterial blood pressures decrease, while the systolic blood pressure typically remains unchanged for the duration of the sauna session. There is a corresponding acute increase in metabolic rate and O_2 consumption, the overall effect being similar to moderate exercise.[7] This might be a cardiovascular benefit for those living in climates with limited exercise options during the winter months.

The sympathetic nervous system and the hypothalamic-pituitary-adrenal axis also respond to help compensate for thermal stress. Norepinephrine output increases in persons undergoing sauna baths, while levels of epinephrine and cortisol typically do not, unless cold water immersion is included in the protocol.[6,8] Plasma levels of growth hormone, beta-endorphins, and prolactin also increase during a sauna session.[6,8,9] The increase in beta-endorphins presumably accounts for some of the pleasure and analgesic affects attributed to sauna use. Muscle relaxation also occurs, along with increased elastic properties of the tendons and joint capsule and reduced viscosity of synovial joint fluid.[10] There is a loss of water and electrolytes (sodium, potassium, and chlorine) through the skin during a sauna session; however, this loss is compensated by hormonal regulation via adrenal secretion of aldosterone.[6] Individuals with proper aldosterone secretion, therefore, do not experience excessive electrolyte loss.

Health Benefits of Sauna Therapy

Respiratory

Finnish saunas decrease pulmonary congestion and increase forced vital capacity (FVC), peak expiratory flow rate (PEF), and forced expiratory volume in one second (FEV1).[11,12] Research indicates sauna therapy can help respiration in patients with asthma and bronchitis; however, saunas should not be used during the acute phase of a respiratory infection.[12] Regular Finnish sauna therapy improved lung function in a group of 12 men from the Netherlands with chronic obstructive pulmonary disease (COPD). These men did not experience adverse effects from the sauna, had significant improvements in FEV1 and FVC, and reported that they did not have to expend as much effort to breathe.[13] Having a Finnish sauna session twice weekly for six months reduced the incidence of the common cold by 50 percent during months 4-6 of the protocol.[14]

Cardiovascular

Saunas appear to be an effective form of treatment for various forms of heart disease. Despite concerns to the contrary, saunas are not associated with increased mortality from sudden cardiac death or myocardial infarction (MI) in countries that routinely use saunas. Only 1.7 percent of the

Key words: sauna, thermal chamber, thermal stress, hyperthermia, infrared, far-infrared, congestive heart failure, CHF, myocardial infarction, MI, chronic heart failure, hypertension, weight loss, anorexia nervosa, depression, autoimmunity, fatigue, multiple chemical sensitivities, MCS, pesticides, polychlorinated biphenyls, PCBs, solvents, sweating, pregnancy, congenital defects, depuration, cleansing, detox, detoxification, purification

6,175 sudden deaths in Finland occurred within 24 hours of taking a sauna.[15] A total of 77 deaths occurred in saunas in Sweden during an 11-year period (1992-2003). Of those deaths, 71 percent were directly related to elevated blood alcohol levels rather than cardiovascular factors.[16]

Post-Myocardial Infarction

A Finnish study investigated the cardiovascular response to sauna in 69 men who had experienced an MI in the previous 4-6 weeks and compared the response to that of 32 healthy controls (non-MI). All persons in the sauna group had increased cardiac output without trouble, and the post-MI group showed no adverse effects from sitting in the sauna. Although the sauna increased cardiac workload similar to brisk walking, only eight percent of the men experienced cardiac dysrhythmias during a sauna, compared to 18 percent who experienced dysrhythmia during a submaximal exercise test.[17]

A 10-year follow-up study included 102 men who had experienced an MI, 80 of whom began regular saunas 2-24 weeks post MI. As would be expected from men with established cardiac insufficiency, 60 percent reported angina during normal daily life. Only two percent, however, reported chest pains while in the sauna,[18] a remarkable result considering the increased cardiac output during a sauna. Although studies have demonstrated symptom improvement, a scintigraphic study showed a reduction in cardiac perfusion during sauna that was only slightly less than that found during exercise in individuals with coronary artery disease.[19]

Hypertension

Several German studies have examined the effect of radiant-heat sauna therapy on persons with hypertension. Taking saunas just once every two weeks (bi-weekly) resulted in increased ventricular ejection fraction (7-8% improvement) in 19 men.[20] A group of 114 hypertensive men who began bi-weekly saunas after receiving coronary bypass surgery experienced a non-significant reduction in blood pressure.[15] A group of 46 hypertensive males having bi-weekly saunas for three months demonstrated a decrease in blood pressure from an average of 166/101 mmHg to 143/92 mmHg.[21] This decrease is equivalent to what some persons get with anti-hypertensive medication.

FIR saunas also appear to positively influence blood pressure. Individuals with at least one coronary risk factor sat in a FIR sauna at 60°C (140°F) for 15 minutes (followed by 30 minutes of bed rest) daily for two weeks. Participants who underwent FIR sauna had significantly lower systolic blood pressure than those who did not (average of 110 versus 122 mmHg). Participants who had daily FIR sauna therapy also had lower urinary levels of 8-epi-PGF2-alpha, suggesting lower oxidative stress.[22] One mechanism for blood pressure reduction may be increased production of nitric oxide in response to FIR sauna therapy.[23]

FIR sauna has also been studied for obesity and hypertension. Persons in this study participated in either cardiovascular exercise for 15 minutes with 30 minutes of FIR sauna (55-60°C) or 15 minutes of exercise only (the control group) three times weekly for eight weeks. Subjects in the sauna group lost 1.8 times as much weight and 4.6 times as much body fat as controls. The diastolic blood pressure drop was 1.8-times greater than in the exercise-only group and the systolic drop was 3.3-times greater. The sauna group went from an average systolic pressure of 142.8 mmHg to 121.3 mmHg, while the non-sauna group started with a lower average of 140.2 mmHg and ended with an average of 133.7 mmHg. Diastolic averages began at 89.4 mmHg for the sauna group and ended up at 79.5 mmHg, while the non-sauna group went from 90.2 mmHg to 84.6 mmHg.[24]

Congestive Heart Failure

Three intervention studies on the effect of FIR saunas for patients with congestive heart failure (CHF) have been published by a group of Japanese researchers.[25-27] They first looked at the ability of FIR sauna sessions to improve endothelial function by enlisting 25 men with cardiovascular risk and 10 healthy controls to take 10 FIR sauna sessions over 14 days (15 minutes at 60°C [140°F] followed by 30 minutes of bed rest covered with a blanket). The at-risk group enjoyed a significant improvement in brachial artery dilation (untreated with nitroglycerin) that was almost as good as the dilation seen in the group of healthy men.[25]

These same researchers then enrolled 20 patients with diagnosed CHF (New York Heart Association functional class II or III) to undergo the same FIR sauna protocol used in the above study and an additional 10 CHF patients who were treated only with bed rest. The FIR sauna group experienced improvement in endothelial-dependent dilation of the brachial artery after only 10 sauna sessions, while the control group had no change. In addition, 17/20 in the sauna group reported an improvement with clinical symptoms.[26]

In a third study, these researchers investigated the effects of FIR sauna therapy in a group of persons diagnosed with class II and III CHF who were experiencing at least 200 premature ventricular contractions (PVCs) in a 24-hour period. Twenty subjects followed the researchers' standard protocol of two weeks of daily (5 days/week) FIR at 60°C for 15 minutes followed by 30 minutes of bed rest. Ten other CHF patients reclined on a bed in a 24°C (75.2°F) room for 45 minutes daily for two weeks. After 10 sauna sessions the treatment group experienced a dramatically lower number of PVCs than the control group (avg. 848/24 hour vs. 3,097/24 hour). In the treatment group the average number of PVCs decreased from 3,161 per 24 hours to an average of 848.[27]

In a pilot, crossover study, nine individuals with class III and IV CHF were randomized into two groups: one group participated in 15-minute FIR sauna (60°C) sessions three times weekly for four weeks, while the other group did nothing during these first four weeks. Participants were crossed over to the other protocol for the second four weeks. All participants filled out the Minnesota Living with Heart Failure Questionnaire (MLWHFQ) and underwent treadmill and blood testing. While there was a trend toward improvement in the New York Heart Association classification and in the MLWHFQ in those who participated in the sauna sessions, neither reached statistical significance (note: the small sample size in this study made statistical significance difficult to achieve). There was a slight improvement in treadmill function after the sauna phase, which also failed to reach statistical significance ($p<0.035$).[28]

Another group of 15 individuals with class II-III CHF participated in 15 minutes of sauna bathing five days per week for four weeks. In this group, 20 sessions of sauna therapy resulted in statistically significant reductions in systolic blood pressures, as well as statistically significant improvements in left ventricular ejection fraction, exercise tolerance, peak respiratory flow, and anaerobic threshold. There was also a statistically significant reduction in plasma epinephrine levels and less hospitalization for CHF during the following year than those in the non-sauna group.[29]

Anorexia nervosa

A single case study reports that FIR sauna therapy helped improve anorexia nervosa in a teenage girl. The individual did regular FIR sauna sessions in a home sauna unit. According to the report, she gained weight, experienced a reduction in "hyper" activity, and regained emotional balance.[30]

Depression

Twenty-eight patients with mild depression, general fatigue, and appetite loss were divided into treatment and control groups. Fourteen subjects participated in 20 FIR sauna sessions over a four-week period. Each session lasted 15 minutes in a 60°C unit followed by 30 minutes of bed rest with a blanket. When compared with the control group, FIR sauna treatment produced statistically significant improvements in somatic complaints, hunger, and ability to relax.[31]

Pain Relief

Forty-six patients who were hospitalized for chronic pain (of at least six-month duration) were divided into two groups. Twenty-four subjects participated in a multidisciplinary protocol (cognitive behavioral therapy, rehabilitation, and exercise therapy) without additional saunas, while 22 subjects were enrolled in the same program but also had 15 minutes of 60°C FIR sauna therapy five days weekly for four weeks. At the end of the treatment program on discharge, the sauna group exhibited diminished pain behaviors and had statistically lower anger scores. A two-year follow-up revealed that 77 percent of the sauna group had been able to return to work, compared to only 50 percent of the non-sauna group.[32]

Autoimmunity

An individual with class II-III CHF, who also had Sjogren's syndrome, underwent 20 sessions of FIR sauna therapy over a course of four weeks at a hospital in Japan. She followed the same FIR protocol mentioned in the section on CHF. After 20 sessions of FIR sauna, the patient reported "dramatic" improvements in symptoms of xerostomia and arthritis. Levels of human leukocyte antigen (HLA)-A, -B, and -C, which had been 3.4-times higher than mean normal values, dropped to the high end of normal after the sessions.[33]

Seventeen patients with rheumatoid arthritis (RA) and another 17 patients with ankylosing spondylitis (AS) participated in four weeks of twice weekly FIR saunas. Sauna sessions were 30 minutes in duration at 55°C (131°F). During the time period while in the sauna, all participants enjoyed a statistically significant temporary reduction in pain and stiffness. Overall, those with

RA showed non-significant improvements in pain, stiffness, and fatigue, although the improvement in stiffness came close to reaching statistical significance (p=0.06). In the patients with AS, there was a non-statistically significant improvement in stiffness.[34]

Chronic Fatigue

A single case report describes the response to FIR saunas of two women with severe chronic fatigue. Both had been treated with prednisolone, which only seemed to maintain the *status quo*. Both participated in 30 FIR sauna sessions lasting for 15 minutes at 60°C followed by 30-minute sessions of resting under a blanket. This protocol was followed five days per week for the first six weeks; subsequent once or twice weekly sessions continued over the next 11 months. Both women reported "dramatic improvements" in fatigue, pain, sleep disturbances, and low-grade fevers.[35]

Depuration Programs

Depuration and the Elimination of Impurities in Sweat

Sauna therapy has been used as a component of several multi-component depuration protocols. Depuration is a term used to describe the removal of impurities from the body, especially from bodily fluids like sweat and urine. Synonyms for depuration include purification and cleansing.

Saunas are used as a component of depuration protocols because they increase sweating, which in theory might increase the excretion of impurities, such as heavy metals, found in sweat. While evidence is clear that some heavy metals, for example, are excreted in sweat, there is currently no definitive evidence for increased elimination of heavy metals or other impurities in sweat during a sauna.

Only three published studies on mercury in sweat were found in the literature, none offering any evidence that saunas play a significant role in increasing mercury elimination via sweat. One study reported that the concentration of mercury released in sweat was comparable to that in urine. Levels in the sweat of persons employed in industry who work with mercury as part of their daily job varied from about 75 percent of that in urine (mcg/L) to over twice the amount in the urine. The highest levels of mercury in sweat were observed in persons who sweated the most.[36] In another study, the average concentration of urinary mercury was 0.65 mcg/L, while that of sweat was 0.86 mcg/L.[37] A case report of a mercury-poisoned person noted that using saunas following chelation therapy resulted in a continued drop in blood mercury levels, although the report did not provide measurements of mercury in the sweat.[38]

Other heavy metals, including cadmium, nickel,[39] and antimony,[40] are found in sweat. Elimination of antimony in sweat appears to increase as exposure increases,[40] suggesting that increasing sweating might be a method for reducing antimony levels in persons with high exposure.

Lead is found in sweat; however, concentrations are less than those found in urine. In persons whose blood lead levels averaged 8.62 mcg/dL, the level in sweat only averaged 5.2 mcg/L and was only about 25 percent the concentration found in urine.[41] Lead found in sweat (and saliva) appears to be primarily from lead absorbed through the skin (rather than the lungs or GI system).[42] A study on the toxicokinetics of lead states that soft tissue, not blood, is the source for lead in sweat.[43] This evidence suggests that sweating is not likely to be a significant excretion method for reducing blood lead from current exposure.

Specific Depuration Protocols

L. Ron Hubbard, founder of the Church of Scientology, developed and promoted the use of the Hubbard Purification Rundown (also called the Hubbard Method) to reduce environmental chemicals in an individual. The components of the 3-6 week protocol are as follows:[44]

- Physical exercise for 20-30 minutes daily
- Radiant heat saunas, 140-180°F, done in 30-minute sessions for a total of 2.5-5 hours daily
- A multiple vitamin/mineral that contains high doses of niacin
- Water, sodium, and potassium replacement to replace fluids and electrolytes lost during sauna therapy
- 1-8 tablespoons of vegetable oil daily
- Balanced meals and adequate sleep

A group of 10 electrical workers with polychlorinated biphenyl (PCB) exposure completed three weeks of the Hubbard Purification Rundown. PCB adipose levels were measured in blood and with needle biopsies from the gluteal region. Two groups of patients (A and B) underwent the Hubbard Purification Rundown and another 10 workers served as controls.

The abstract states that the PCBs were reduced in serum by 42 percent and in adipose by 30

percent.[45] The information provided in the body of the article does not seem to confirm these percentage reductions, however (Table 1). The six persons in group A appeared to have a reduction in both adipose and serum levels of PCBs, while the four persons in group B had no appreciable changes. Unfortunately, the individual values for each person were not made available in the paper. Despite this omission, the available information suggests that for persons with lower tissue levels of PCBs sauna therapy as a component of a fuller depuration protocol may be beneficial.

A second study using this same program was conducted on 14 firemen exposed to PCBs while fighting a fire at a power station where a PCB-containing transformer exploded. The firemen had begun to experience symptoms, including extreme fatigue, headaches, muscle weakness, arthralgias, memory loss, and reduced concentration. They completed 2-3 weeks of the program. Neurological and toxicological testing was conducted before and six weeks after treatment. A second group of 14 firemen, who had not been at the powerhouse fire, served as controls. They were also given neurological testing. The researchers found no correlation between PCB levels in the firemen and their symptomatic presentations, and no mention was made of PCB reductions after treatment. However, the firemen who participated in the program did have significant improvements in memory, vision, cognition, and motor function.[46] The evidence suggests that Hubbard Purification Rundown, as a depuration protocol, may help persons with toxicant-related symptoms; however, it is not possible to determine what affect it has, if any, on the half-life of PCBs in the human body.

William Rea, MD, Director of Environmental Health Center, Dallas (EHC-D) has documented the use of thermal chambers as a component of a more comprehensive protocol in his practice. Rea's protocol includes:

- Living in chemically-free facilities
- Two hours daily of radiant-heat sauna therapy (set between 140-160°F)
- 15-30 minutes of exercise daily
- 20-30 minutes of massage daily
- Niacin – up to 3 g daily
- Vitamins, minerals, amino acids given orally and IV: IV vitamin C (15 g daily) with another 2-8 g orally; other vitamins and minerals per physician recommendation

Table 1. Mean Total PCB Levels in Adipose and Serum[45]

Group	Pre-Purification Average PCB Levels (mg/kg)	Post-Purification Average PCB Levels (mg/kg)	12-Month Follow-up Average PCB Levels (mg/kg)
Group A (Adipose)	20.9	14.5	16.7
Group A (Serum)	139.4	80.3	168.8
Group B (Adipose)	40.9	37.0	38.2
Group B (Serum)	284.8	292.6	287.1
Control (Adipose)	22.4	23.1	27.4
Control (Serum)	139.8	179.4	183.8

Rea's first study population consisted of chemically sensitive individuals; 156 females and 54 males completed the above protocol. Rea reported that 86 percent of the participants noted a reduction in chemical reactivity. In addition, 57 percent of subjects with abnormal balance and 31 percent of subjects with autonomic nervous system functional disorders (assessed and measured with an iriscorder) improved. Serum levels of aromatic and aliphatic solvents were reduced in 63 percent

of individuals. Of those without any noted reduction, 18 percent showed an increase in circulating levels, while 19 percent remained the same.[47]

A second Rea study illustrated the differences in blood solvent level reductions with different forms of treatment for 69 chemically sensitive individuals. Thirteen subjects stayed in a chemical-free, "non-toxic unit" in a hospital, where all the air, food, and water was intended to be non-polluted. The other 56 individuals were outpatients and only 15 completed the protocol described above. The outpatients were asked to follow protocols designed to reduce daily air and food-borne toxicant exposures. Blood tests for circulating solvents were conducted on all participants before and after treatment. All participants of the inpatient program showed improvement in signs and symptoms by the time of discharge (average stay 3.8 months), while 70 percent of the outpatients noted improvement with avoidance techniques after an average of 8.8 months. For outpatient subjects who included the sauna program, 80 percent experienced improvement after an average duration of only seven weeks. The amount of solvent clearance from the blood of these persons undergoing sauna therapy was similar to that of individuals in the inpatient environmental unit, but occurred in less than half the time.[48]

The author of this review utilized thermal chambers as part of a comprehensive protocol for close to 20 years in the Seattle area. Participants underwent depuration five days weekly for a minimum of three weeks. The protocol used was as follows:

- Physical exercise on rebounder or exercycle for 15-20 minutes daily
- Thermal chambers at 120-130°F, with radiant heating units for three 60-minute sessions daily, with cool-down time in between
- Glass-bottled spring water and electrolyte replacement were made available for use in each sauna session
- Ginger/yarrow tea was made available as an optional diaphoretic in the first sauna session of the day
- Constitutional hydrotherapy (alternating hot and cold towels covering first the ventral surface and then the dorsal surface of the body as described by Boyle and Seine)[49] was done for five minutes with hot- and 10 minutes with cold-water applications after the sauna and before colonic irrigations
- 1 capsule daily of an herbal supplement for liver support (consisting of *Chelidonium majus*, *Chionanthus virginicus*, *Arctium lappa*, *Taraxacum officinale*, *Urtica dioica*, *Arctostaphylos uva-ursi*, *Silybum marianum*)
- Colonic irrigations daily for 50 minutes with purified water
- Dietary avoidance of adverse food reactors
- Dietary avoidance of fruits and vegetables with high amounts of pesticide residues (from www.foodnews.org)
- Dietary avoidance of sugar
- Note: Unlike the Hubbard Purification Rundown and the Dr. Rea protocols previously described, no niacin was given

By the second week of the program, it was not uncommon for the smell of chemicals to exude from a patient after sauna therapy. After the first 10 years of participating in the cleansing program, participants were contacted and asked to rate their results. Table 2 lists the primary health complaint of the 112 participants on study entry and their self-rated degree of improvement. All participants had serious enough health problems to motivate them to take a minimum of three weeks out of their lives for this full-time depuration program

Table 2. Results of 15 or More Sessions of the Crinnion Cleansing Program Listed by Complaint and Degree of Improvement

Complaint	Worse	No Change	Slight	Good	Great	Total
MCS	0	2	1	8	13	25
Autoimmune	0	0	0	4	12	16
Neurologic	0	3	2	4	6	15
Fatigue	0	1	0	6	7	14
Cancer	0	2	0	2	4	8
Allergies	0	0	1	5	1	7
General Cleansing	0	0	2	5	0	7
Musculoskeletal	0	0	2	2	1	5
Dermatological	0	0	0	3	1	4
Respiratory	0	0	0	0	3	3
GI/Liver	0	0	0	1	2	3
General Debility	0	1	1	0	1	3
HIV/AIDS	0	0	1	1	0	2
Addictions	0	0	0	0	1	1
Totals	0	9	10	41	52	112
Percent	0	8	9	36.6	46.4	100

(eight hours in-office daily, five days weekly for a minimum of three weeks). The largest group of patients (25 persons) presented with a chief complaint of multiple chemical sensitivities (MCS). Over 84 percent of them reported "good" to "great" improvement after following the protocol. In persons with autoimmune disorders – the second largest group with 16 persons – a self-reported "good" or "great" improvement occurred in 100 percent of participants.[50]

All three of these depuration protocols used radiant heat (Finnish) saunas to help individuals recover from toxicant-induced health problems. Different temperatures, session times, and duration of protocols were used with each of these three programs, but all resulted in health improvements for the participants. These health improvements occurred with multiple chronic health conditions that had been resistant to standard allopathic and naturopathic therapies. Because only individuals with severe and heretofore untreatable morbidity are generally willing to take several weeks out of their lives for such a treatment protocol, it is not possible to determine how more limited versions of these protocols, in terms of frequency and duration, might work in clinical settings. Since radiant heat Finnish sauna sessions were only one aspect of multi-component depuration protocols, it also is not possible to determine what, if any, benefits Finnish sauna therapy as a sole intervention or other types of saunas might have.

Contraindications for Sauna Therapy

Several contraindications for sauna therapy are generally found when reviewing information on saunas.

Published recommendations suggest that persons with aortic stenosis, unstable angina, severe orthostatic hypotension, or any history of recent MI avoid sauna therapy.[18,51] Cardiovascular safety of saunas was discussed in more detail in the section under "cardiovascular benefits;" however, evidence suggests Finnish saunas are not associated with increased incidence of cardiovascular events and have been used safely in individuals who have had a recent MI. These safety studies were conducted in populations who frequently used Finnish (radiant heat) saunas, so it is not possible to determine cardiovascular safety of saunas for those who are not habitual sauna users or for non-radiant heat (e.g., infrared) saunas.

It is recommended that persons with fevers and certain skin conditions (cholinergic urticaria, abrasions, and oozing rashes) avoid saunas.[52]

Safety of saunas during early pregnancy is an area of uncertainty. The primary concerns are that hyperthermia might be teratogenic and/or increase risk for spontaneous abortion. Increases in core body temperature (hyperthermia) in the range of 1.5-2.5°C (~2.7-4.5°F) cause increased incidence of embryonic resorption, abortion, and malformations in many different experimental animals. The severity, incidence, and type of congenital defect depend on various factors, including the species and strain of the animal, the amount of temperature elevation, the duration of time exposed to high temperature, and stage of embryonic development of the exposure.[53,54] In general, an exposure that causes lower core temperature elevations requires longer exposure duration to cause defects, while a higher core temperature spike requires a much shorter time of exposure.[53-55] The timing of the hyperthermic insult is critical. Exposure when cells are rapidly dividing (early pregnancy) is considered the critical time period. During this time the central nervous system appears to be particularly vulnerable to hyperthermia, with central nervous system defects being the most common congenital defects produced. Increases in body temperature during critical developmental stages can also result in congenital defects in a variety of other tissues, including the heart, kidneys, limbs, and teeth.[53]

Hyperthermia is a suspected human teratogen, with some,[56-63] but not all,[64-66] retrospective and prospective epidemiological studies suggesting that hyperthermia might increase incidence of congenital defects. In these human studies, the source of hyperthermia was primarily febrile illnesses; however, hot tubs and saunas have also been sources of thermal stress. In these reports, similar to animal studies, adverse effects on pregnancy outcomes were observed when hyperthermia occurred during early gestation.

Of the three epidemiological studies that did not find an association with hyperthermia and congenital defects, two were in Finnish women.[64,65] As noted in the introduction, most Finns regularly use saunas. Evidence indicates that Finnish women also routinely visit saunas during pregnancy,[64,66] although some appear to reduce the amount of time spent in saunas during a visit, the sauna temperature, or both.[67] Despite this frequency of sauna use during early pregnancy, Finland has one of the lowest rates of anencephaly in the world.[68] One possible explanation for the observations of

apparent safety in Finnish women is that saunas might not be teratogenic in humans adapted to their use, like the Finnish population. Animal experiments are suggestive of this possibility.[53] Acute thermal stress studies conducted in Finnish pregnant and non-pregnant women suggest that these women adapt well to the heat of saunas and that there are minimal differences in response to thermal stress in pregnant and non-pregnant Finnish women.[69-73]

It is also possible that the sauna method used by Finnish women during pregnancy is safe. In general, Finnish women have a number of short sauna exposures – 10-20 minutes in duration – with intervening cooling periods. This short duration might not be sufficient to increase core body temperature above a threshold needed to be teratogenic. In one acute study, a 20-minute stay in a sauna (70°C, 15% relative humidity) only increased rectal temperature 0.3-0.4°C in pregnant and non-pregnant Finnish women.[73] In animals, the lowest temperature observed to have teratogenic effects was a 1.5°C increase above core temperature. Therefore, the increase seen in the acute Finnish study suggests that, in these women, 20 minutes in a Finnish steam sauna does not produce increases sufficient to be a concern.

This might not be the case for other populations or other types of sauna use. A study in Canadian women indicated that 10 minutes in a sauna bath with a dry bulb temperature of 93.3-98.9°C increased mean oral temperature by 1°C. The mean oral temperature after 20 minutes was increased by 1.9°C and, in half of the women exposed, the oral temperature was at least 2.0°C above core temperature after 20 minutes.[74] The increase observed after 20 minutes in this study was above the threshold for teratogenicity in animals.

Current evidence suggests that Finnish steam saunas used for short durations appear to be safe for pregnant Finnish women accustomed to sauna use. The epidemiological research in support of sauna safety in non-Finnish pregnant women is sparse compared to the research that suggests potential for increased risk. While it is possible that sauna use during pregnancy might also be safe for non-Finnish women who routinely used saunas prior to pregnancy, evidence to support this is lacking. For women who have not routinely used saunas prior to pregnancy, it is recommended that saunas be avoided until more definitive safety data is available. Ideally, use of saunas during pregnancy would include monitoring of oral temperature to ensure that core temperature increases are kept to a minimum. In lieu of this, since a combination of either higher sauna temperatures, longer stays, or both can increase core body temperature to a greater degree than shorter visits at lower temperatures, it is recommended that any pregnant women who does decide to use a sauna during early pregnancy keep sauna temperatures lower (less than 70°C) and limit durations inside the sauna to 10 minutes or less.

Summary

Sauna therapy has a long history of safe use in several populations. With rare exceptions, possibly including pregnant women and persons with existing cardiovascular disease, saunas are considered to be quite safe when used correctly. Most adverse events linked to saunas appear to involve the consumption of alcohol prior to entering the sauna. The cardiac stress from a sauna does not appear to increase risk of death.

There is a growing body of evidence on the clinical use of saunas for therapeutic purposes. Evidence suggests that sauna therapy is an effective and underutilized treatment for a variety of cardiovascular problems. Mechanistically, sauna therapy increases vasodilation, possibly through increased production of nitric oxide, and enhances left ventricular ejection fraction. Persons with class II, III, or IV CHF can experience improvements in CHF-related symptoms from just 15 minutes in low temperature FIR sauna sessions, 3-5 times weekly. Sauna therapy appears to promote improved blood pressure in persons with hypertension. Dramatic reductions in systolic blood pressure from regular sessions of 15-30 minutes in radiant-heat and FIR saunas have been reported. There is more limited evidence in other clinical areas; however, studies suggest that sauna use improves lung function and might offer pain relief.

Sauna therapy is a component of the three depuration protocols reviewed. All three used multiple sessions of Finnish saunas for a daily total duration of 2-5 hours. Heat settings varied. The Crinnion protocol used lower temperatures (120-130°F), Rea protocol used moderate temperatures (140-160°F), and the Hubbard Purification Rundown used the highest temperature range (140-180°F). There is currently insufficient evidence to determine an optimal temperature for depuration. Despite the differences in temperature settings, as well as the other components of these depuration protocols, the published studies report health benefits. It is not known whether infrared saunas would offer benefits as part of a multi-component depuration protocol.

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