Sauna Use: Implications for Aging and the Brain

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Living longer and healthier is inherently linked with preventing or delaying the onset of aging, a complex, multifactorial process that involves biological, physiological, and behavioral changes. Aging has far-reaching effects on multiple systems within your body, even at the cellular and molecular levels. But aging is a dynamic process, too, meaning that it can be forestalled – or even **reversed**.

Sauna use, sometimes referred to as "sauna bathing," is an ancient practice with profound implications for slowing aging. Sauna bathing exposes the body to extreme heat, a form of stress. The effects of heat stress on longevity have been shown in both flies and worms, increasing their lifespans by as much as 15 percent. Large, observational studies in humans have identified strong links between sauna use and lower risk for age-related conditions, such as cardiovascular disease, cognitive decline, and premature death.

For example, studies of participants in the Kuopio Ischemic Heart Disease Risk Factor (KIHD) Study, an ongoing prospective population-based cohort study of health outcomes in more than 2,300 middle-aged men from eastern Finland, found that men who used the sauna two to three times per week were 27 percent less likely to die from aging-related disorders such as cardiovascular disease than men who didn't use the sauna. Furthermore, the benefits they experienced were found to be dose-dependent: Men who used the sauna roughly *twice* as often, about four to seven times per week, experienced roughly twice the benefits – and were 50 percent less likely to die from cardiovascular-related causes.

In addition, the KIHD studies also revealed that frequent sauna use reduced the risk of developing two disorders associated with age-related cognitive decline – dementia and Alzheimer's disease – in a dose-dependent manner. Men who used the sauna two to three times per week had a 66 percent lower risk of developing dementia and a 65 percent lower risk of developing Alzheimer's disease, compared to men who used the sauna only one time per week.

The KIHD findings also showed that frequent sauna users were 40 percent less likely to die from all causes of premature death. These findings held true even when considering age, activity levels, and lifestyle factors that might have influenced the men's health.

Here's how it works. Sauna bathing exposes your body to extreme heat, eliciting a rapid, robust response:

- Skin and core body temperatures increase markedly, and you begin to sweat.
- Cardiac output, a measure of the amount of work the heart performs in response to your body's need for oxygen, increases by 60 to 70 percent, and your heart rate (the number of beats per minute) increases.
- Blood flow – roughly 50 to 70 percent – is redirected from your core to your skin to facilitate sweating. The average person loses approximately 0.5 kilogram – about one pound – of sweat while sauna bathing.
- Plasma volume (the liquid component of your blood) increases to compensate for the decrease in your core blood volume, provide a reserve source of fluid for sweating, and prevent rapid increases in your core body temperature, promoting hyperthermic conditioning, a form of heat tolerance.

- If you exercise regularly, you've probably recognized that the physiological responses to sauna use are remarkably similar to those experienced during moderate- to vigorous-intensity exercise. For example, during moderate-temperature sauna bathing sessions, your heart rate may increase up to 100 beats per minute. Turn the heat up, and your heart rate may increase up to 150 beats per minute, similar to the increases observed during moderate- to vigorous-intensity physical exercise.

- But those are just some of the visible signs of heat stress. "Invisible" responses to heat stress occur at the cellular and molecular level, likely through a physiological phenomenon known as hormesis. Hormesis is a defensive response that occurs following exposure to a mild stressor. Interestingly, hormetic responses to stress are typically disproportionate to the magnitude of the stressor. The end result is the triggering of a vast array of protective responses in your body that elicit long-term adaptations, repair cell damage, and provide protection from subsequent exposures to more devastating stressors.

Sauna and your aging heart

The World Health Organization estimates that nearly 18 million people die each year from cardiovascular diseases, roughly one-third of all deaths worldwide. Cardiovascular disease is largely preventable with lifestyle behaviors such as sauna use. People who engage in long-term sauna use typically experience improvements in several aspects of cardiovascular health, including:

- Reduced blood pressure
- Improved endothelial function
- Improved left ventricular function
- Reduced markers of inflammation

In fact, sauna use and other forms of heat therapy have been proposed as alternatives to exercise for people who are unable to engage in physical activity due to chronic disease or physical limitations.

Learn more about the role of sauna use in the prevention of cardiovascular disease in this podcast featuring Dr. Jari Laukkanen.

Sauna and your aging brain

Your brain is particularly vulnerable to the deleterious effects of aging. The cumulative effects of oxidative stress, unhealthy dietary patterns, and everyday energy metabolism work against long-term cognitive function. Heat-induced responses, however, protect the brain and include:

- Increased expression of brain-derived neurotrophic factor, or BDNF, a protein that acts on neurons in your central and peripheral nervous systems, to promote the growth of new neurons.
- Improved blood flow to your brain, facilitating clearance of amyloid-beta, a protein associated with Alzheimer's disease.
- Prevention or reduction of symptoms of depression.

- Robust increases in your body's production of beta-endorphins, endogenous opioids that are part of your body's natural pain-killing system.
- Increased production of norepinephrine, which improves focus and attention, and prolactin, which supports myelin growth, a critical feature in repairing nerve cell damage.

Sauna and molecular mechanisms

Research has identified a variety of heat stress-induced molecular mechanisms that modulate aging and cognitive decline, such as those that mitigate protein damage and aggregation or activate endogenous antioxidant, repair, and degradation processes. Some of these mechanisms include increased expression of the following protective factors:

- Heat-shock proteins, a large, highly conserved family of proteins that prominent roles in many cellular processes, including immune function, cell signaling, and cell-cycle regulation. Genetic variants of some heat shock proteins are associated with a longer lifespan.
- Nrf2, a transcription factor that regulates a vast network of genes with cytoprotective, antioxidant, and anti-inflammatory functions. Nrf2 activation provides protection against oxidative stress, electrophilic stress, and chronic inflammation – the underlying causes of most chronic diseases.
- FOXO3, a transcriptional regulator that plays important roles in human lifespan and healthy aging. FOXO3s participate in autophagy, but when autophagic mechanisms are disturbed, FOXO3s confer cellular sensitization to apoptosis, a type of programmed cell death.
  Read more about FOXO proteins in this topic article from FMF
- Interleukin-6 (IL-6), a pro-inflammatory cytokine, and interleukin-10 (IL-10), an anti-inflammatory cytokine – two proteins that modulate your body's inflammatory response. Heat stress induces a large increase in circulating IL-6 and, potentially, a reciprocal release of IL-10.

Bottom line and how to's:

A growing body of evidence from observational, clinical, and mechanistic studies suggests that sauna use is associated with many health benefits and may offer a means to forestall the effects of aging. The KIHD studies, in particular, describe relevant human doses that help us establish protocols for incorporating sauna use into our own lives.

For maximum benefit, healthy adults should practice sauna bathing along these guidelines:

- Frequency: 4 to 7 sessions per week
- Duration: Approximately 20 minutes per session
- Temperature: At least 78.9°C (174°F), optimally 80°C to 90°C (176°F to 194°F)

And get ready to sweat!
Read more about the health benefits of sauna use in this topic article from FMF.

The information provided herein is not intended or implied to be a substitute for professional medical advice, diagnosis, or treatment. If you are pregnant or have a chronic illness or medical condition, please consult a physician before engaging in sauna use.