

Effect of Steam Sauna Bath on Fasting Blood Glucose Level in Healthy Adults

¹Vandana V Shiralkar, ²Pratap E Jagtap, ³Gajanan J Belwalkar, ⁴Nitin S Nagane, ⁵Sushama P Dhonde

ABSTRACT

The aim of the study was to know the effects of steam sauna bath on fasting blood glucose levels (FBGLs). A total of 80 subjects, 40 males and 40 females, in the age group of 30 to 50 years were subjected to seven steam baths on alternate days. The temperature of the steam sauna was maintained at 50°C and each bath was taken for 15 minutes.

Blood for FBGL was taken before the first steam bath and blood was taken again after seven steam sauna baths and the FBGL was estimated. The FBGLs after seven steam sauna baths were significantly decreased as compared with presteam sauna FBGLs. Steam saunas may help in preventing hyperglycemia and hence diabetes mellitus. It is also beneficial for healthy, asymptomatic subjects.

Keywords: Diabetes mellitus, Fasting blood glucose level, Hyperthermia, Insulin sensitivity, Steam sauna bath.

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INTRODUCTION

Steam baths were known to ancient Greeks and are a traditional place for experiencing heat sessions. According to the Oxford dictionary, "Steam bath is a room filled with hot steam for the purpose of cleaning and refreshing the body and for relaxation."^{1,2} Steam sauna operates effectively at temperature of 50°C and humidity of 100%.

It is an important time-tested treatment which induces perspiration naturally. The temperature of the body rises and goes into a state of hyperthermia. The physiological changes that occur are due in part to hyperthermia and in part to the influence of the hormonal and nervous systems which attempt to increase the heat loss.^{3,4} The

amount of blood glucose rise is one of the risk markers for developing type II diabetes, so keeping it down is important for good health.

Steam sauna increases insulin sensitivity. Insulin is an endocrine hormone that primarily regulates glucose homeostasis by promoting the uptake of glucose into muscle and adipose tissue. In humans, there is more evidence indicating that the major anabolic effects of insulin on skeletal muscle are due to its inhibitory action on protein degradation.

Intermittent hyperthermia (by steam sauna) has been known to reduce insulin resistance in obese, diabetic mouse model. There was a 31% decrease in insulin levels and a notable reduction in blood glucose levels, suggesting resensitization to insulin.⁵ Nowadays, because of speedily changing lifestyles, lack of exercise, sedentary life systems, and stress, early onset of diabetes is common, with overweight and obesity.

For such people, steam bath is a boon. Steam bath appears to be useful as it increases the rate of metabolism. Most people are unaware of the health benefits of sweating and use of steam bath for improving their health. Heating of the body in steam bath creates "sensible perspiration." Producing 1 gm of sweat requires 0.585 Kcal.

A person can sweat off up to 500 gm in steam sauna consuming nearly 300 Kcal, which is equal to running 2 to 3 miles. It gives the benefits of exercise without exertion.⁶ Thus, "artificially induced fever leads to therapeutic sweating." Moreover, when the body temperature rises, blood vessels start to dilate. This encourages blood flow and circulation within the body.

The function of the vascular endothelium is impaired in subjects with lifestyle-related diseases, such as hypertension, hyperlipidemia, diabetes mellitus, obesity, and smoking. Vascular endothelium is a monolayer covering the intimal surface and plays a pivotal role in maintaining vasomotor tone, coagulation, fibrinolysis and vascular structure, modulating inflammatory response, and oxidative stress.

Endothelial cells secrete many substances, including nitric oxide, prostacyclin, endothelial-derived hyperpolarizing factors, endothelin, thromboxane, growth factors cytokines, and others. Endothelial function is determined by the balance among these substances.⁷ Thermal therapies, such as taking a warm water bath or steam sauna, induces systemic vasodilatation.

¹Assistant Professor, ²Professor and Head, ³Associate Professor, ^{4,5}Professor

¹⁻⁵Department of Biochemistry, Bharati Vidyapeeth Deemed University Medical College and Hospital, Sangli, Maharashtra India

Corresponding Author: Vandana V Shiralkar, Assistant Professor, Department of Biochemistry, Bharati Vidyapeeth Deemed University Medical College and Hospital, Sangli Maharashtra, India, Phone: +912332374502, e-mail: vandanashiralkar@gmail.com

Repeated sauna therapy (50°C for 15 minutes) improves hemodynamic parameters, clinical symptoms, cardiac function, and vascular endothelial function in patients with congestive heart failure. One of the molecular mechanisms by which steam sauna improves endothelial dysfunction in these subjects is increase in messenger ribonucleic acid and protein levels of endothelial nitric oxide synthase.⁷

There are very few studies on the effects of steam sauna bath on blood glucose levels and particularly there is very much scarcity in the study of effect of sauna on blood glucose levels in healthy adults. Hence, the aim of the present study was to determine the effect of steam sauna bath on FBGLs in healthy adults.

OBJECTIVE

The objective of the study was to assess the effects of steam sauna bath on FBGL in healthy adults.

MATERIALS AND METHODS

The present study was carried out in the Department of Biochemistry, Bharati Vidyapeeth Deemed University Medical College and Hospital (BVDUMC&H), Sangli. The study protocol was approved by the Institutional Ethical Committee of BVDUMC&H, Sangli.

A total of 80 volunteers, apparently healthy 40 men and 40 women, between the age group 30 and 50 years, were selected randomly. They did not practice any sport and had not used steam bath before. The female subjects did not report any menstrual irregularities. None of the female subjects used any hormonal contraception.

After informed consent, blood samples were collected before first steam sauna bath and second blood samples were collected after seven steam sauna baths given on alternate days. The temperature of sauna was maintained at 50°C. The time duration of each steam sauna bath was 15 minutes. The subjects were asked to drink plenty of water before and after the bath to prevent dehydration due to excessive perspiration.

Steam sauna bath was well tolerated by all subjects without any complaints during and after the procedure. Fasting blood glucose levels were assayed in both pre- and postsauna bath blood samples on fully automatic biochemistry analyzer.^{8,9} All values were expressed as mean + standard deviation (SD). Comparison of FBGLs before and after sauna was done in total 80 subjects as well as in males and females.

METHOD EMPLOYED

The glucose oxidase–peroxidase method was used. SteamLife Portable Steam Bath was used for the project.

SteamLife is an easy-to-use portable steam bath unit that helps you detoxify, rejuvenate, and burn extra calories. It is easy, convenient, and safe to use. We can take steam bath on our own convenience, in our personal room, while watching TV, reading newspaper, talking on phone, etc.

It is compact and portable so that you can carry it with you anywhere.

RESULTS

The mean FBGL before steam sauna in all the subjects was 115.94 mg/dL + 26.434 SD and the mean FBGL after seven steam baths in all the subjects was 97.19 mg/dL + 19.553 SD. There is decrease in mean FBGL in all subjects before and after the steam bath. This difference is statistically significant (Table 1).

The mean FBGL before steam sauna bath in male subjects was 116.9 mg/dL + 22.676 SD and after seven steam baths, it was 95.98 mg/dL + 15.662 SD (Table 2).

There is statistically significant difference (decrease in mean FBGL) in mean FBSL of male subjects before and after the steam bath.

The mean FBGL before steam bath in female subjects was 114.98 mg/dL + 29.989 SD and after seven steam saunas, it was 98.4 mg/dL + 22.938 SD (Table 3).

Table 1: Fasting blood glucose level (mg/dL) before and after steam bath in all the 80 subjects

Paired samples statistics	Mean		Standard deviation	Standard error		t-value	p-value
	Mean	n		mean	mean		
Before FBSL	115.94	80	26.434	2.955	14.107	<0.001	
After FBSL	97.19	80	19.553	2.186			

Table 2: Fasting blood glucose level (mg/dL) before and after steam sauna in male subjects

Paired samples statistics	Mean		Standard deviation	Standard error		t-value	p-value
	Mean	n		mean	mean		
Before FBSL (male)	116.9	40	22.676	3.585	12.749	<0.001	
After FBSL (male)	95.98	40	15.662	2.476			

Table 3: Fasting blood glucose level (mg/dL) before and after steam sauna in female subjects

Paired samples statistics	Mean		Standard deviation	Standard error		t-value	p-value
	Mean	n		mean	mean		
Before FBSL (female)	114.98	40	29.989	4.742	8.068	<0.001	
After FBSL (female)	98.4	40	22.938	3.627			

Table 4: Comparison of FBGL (mg/dL) in male and female subjects before and after steam sauna

B	Gender	n	Mean	Standard deviation	Standard error mean	Z	p-value
Before FBSL	Male	40	116.9	22.676	3.585	0.324	0.747
	Female	40	114.98	29.989	4.742		
After FBSL	Male	40	95.98	15.662	2.476	-0.552	0.583
	Female	40	98.4	22.938	3.627		

Thus, there is statistically significant difference (decrease in mean FBGL) in mean FBGL of female subjects before and after the steam bath.

Statistically significant difference is not found in mean FBGL of males and females before and after steam bath (Table 4).

DISCUSSION

The regulation of the rate of metabolic changes in the human body depends mainly on the functioning of the nervous and endocrine system and the activity of key enzymes in peripheral tissues. Insulin is an endocrine hormone that primarily regulates glucose homeostasis, particularly by promoting the uptake of glucose into muscle and adipose tissue.

Insulin regulates protein metabolism in skeletal muscle by two mechanisms: (1) By stimulating the uptake of amino acids into skeletal muscle and (2) there is more evidence indicating that the major anabolic effects of insulin on skeletal muscle are due to the inhibitory action on protein degradation. Thus, hyperthermic conditioning may promote muscle growth by improving insulin sensitivity and decreasing muscle protein catabolism.^{10,11} Steam sauna increases blood flow to the skeletal muscles, keeping them fueled with glucose and oxygen, while removing by-products of metabolic process, such as lactic acid.

This may be due to increase in metabolic rate resulting from excitation of the sympathoadrenal system and an increase in the internal temperature of the body by steam sauna bath.¹² One small pilot study from 1999 had eight type II diabetics use steam sauna for 30 minutes a day, 6 days a week for 3 weeks. The volunteers' average blood glucose level went down significantly, dropping more than 10%.

Overall, research indicates that passive heating, such as a steam bath can increase the rate calories are burnt by the people and may help reduce blood glucose spikes. In the long term, these may assist with weight control and improve control of blood glucose which would help persons with type II diabetes mellitus.¹³

Steve Faulkner of Loughborough University tested the men's blood for heat shock proteins (HSPs) before and after steam bath and exercise, as they are released in

response to heat stress and exercise. In Faulkner's study, the volunteers were healthy individuals without a history of diabetes. According to Faulkner, peak glucose was actually quite a bit lower after the bath, compared with exercise. He also concluded that HSPs are released when body temperature rises.

These proteins are part of the defense system and help shunt glucose from blood stream into skeletal muscles, thus reducing blood glucose levels. They are released when the body is under stress, such as inflammation, infection, and exercise. From Faulkner's perspective, increasing the core temperature of the body through hot baths and saunas would be most beneficial if one struggles with insulin resistance and controlling blood sugar, or is physically unable to exercise.^{14,15} Faulkner did his study to find out whether there are any alternatives to exercise which could assist people in maintaining health.

He conducted a study on 10 sedentary males, bathed for an hour at 40°C with continuous glucose monitoring in subsequent 24 hours. The same participants were asked to do cycling on separate days. He compared an hour-long hot bath with same period of cycling and found that less strenuous activity produced surprising results.

Overall, the research suggested that passive heating, such as steam bath, can increase the rate of calorie burning by people and may help to reduce blood sugar spikes. He also commented that, these findings may help weight control and possibly improve control of blood sugar, which would help people with type II diabetes.¹⁴ The anti-inflammatory response to exercise is important as it helps to protect us against infection and illness, but chronic inflammation is associated with a reduced ability to fight off diseases.

Thus, repeated passive heating may contribute to reducing chronic inflammation, which is often present with long-term diseases, such as type II diabetes.^{14,16} It was seen that people with obesity and diabetes tend to have a lower response to HSPs, which suggests that they may be important in helping to control our blood glucose levels.¹⁴ Recent research by Dr Mercola confirms that more calories are burned when the body temperature rises in a hot bath, and it also has a beneficial effect on blood glucose.¹⁷ Dr Richard Beever did his study on the effect of far-infrared saunas on cardiovascular benefits in people with type II diabetes mellitus. This was done

on 15 people with thrice-weekly infrared sessions over a period of 3 months. The results were: mean systolic blood pressure decreased by 6.4 mm Hg, waist circumference decreased by 5.1 cm. But there was no decrease in FBGL.

In our study, seven steam sauna baths were given to 80 subjects on alternate days. The duration of each bath was 15 minutes and there was a significant decrease in FBGL after the seven steam baths. Thus, steam sauna may be a nonpharmacological therapeutic intervention in lifestyle modification. It could prevent the current epidemic of lifestyle-induced chronic disease.¹⁸⁻²¹

Limitations of the Study

The present study and also most of the previous studies looked at the short-term effects of taking steam bath.

So, more detailed long-term study on a larger group of subjects (control as well as cases of diabetes mellitus) is required to help subjects with diabetes mellitus.

CONCLUSION

Steam sauna activates many biological systems in the body including the endocrine system. Majority of research on the influence of steam bath on volunteers using steam sauna showed that hyperthermia causes a shift of metabolism toward carbohydrate changes. Steam sauna is an important modality in biological regeneration and is used by athletes and people who do not practice any exercise.

Thus, the aim of the present study was to know the effects of steam sauna bath on FBGLs in healthy adults. It can be concluded that there is a significant decrease in the FBGLs after seven steam saunas.

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