

Hemodynamic, Hematological and Biochemical Changes Induced by Sarvanga Swedana (Full-Body Sudation)

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ABSTRACT

Introduction *Sarvanga Swedana* (Full-Body Sudation) is one of the most widely practised therapy in Ayurveda for health, wellness and treatment of Kapha Vata disorders, yet comprehensive scientific validation of its systemic effects remains limited.

Methods A quasi-experimental pre-post study was conducted with 40 healthy volunteers (aged 20–50 years) subjected to *Sarvanga Swedana* (Full-Body Sudation). Daily one session for seven consecutive days was done and hemodynamic parameters (blood pressure, heart rate, SpO₂) were monitored and recorded before, immediately after, and 30 minutes post-session. Hematological and biochemical profiles were assessed before and post intervention 1st and 7th Day. Subjective wellness was measured using a structured questionnaire.

Results There are significant hemodynamic benefits of *Sarvanga Swedana* including reductions in systolic blood pressure, diastolic blood pressure, and resting heart rate. The hematological parameters remained stable, indicating safety of the procedure from the preliminary evidences. The significant reduction was observed in fasting glucose, triglycerides and inflammatory markers, CRP and ESR. There was improvement in subjective wellness scores for relaxation, body lightness, and stiffness. The study found strong correlations between objective physiological parameters and subjective well-being.

Conclusions *Sarvanga Swedana* (Full-Body Sudation) is a safe and effective procedure with a very strong correlation between objective physiological parameters and subjective well-being. These results are in line with the classical uses of Swedana and support its use in Ayurveda and integrative healthcare practices.

Key words: Ayurveda, Swedana, hemodynamic changes, integrative healthcare.

INTRODUCTION

Ayurveda is a traditional system of medicine, having its roots in vedic literature offering preventive, diagnostic and therapeutic health services^{1,2}. Globally, traditional medicines are considered easily accessible, acceptable, available and affordable³. Ayurveda is extensively practiced and recognized health care system in Nepal⁴. Increasing burden of lifestyle disease and chronic disease has brought a shift in number of people willing to take preventive healthcare. Panchakarma, an Ayurveda therapy, is renowned for its detoxifying and therapeutic benefits⁵. *Sarvanga Swedana* (full-body sudation) is a common procedure done in Ayurveda *Panchakarma* units⁶. The Public Health Service Regulation 2020 has mentioned Panchakarma *Purvakarma* (*Snehana Swedana*), as basic health services⁷. Ayurveda personalized holistic concepts give emphasis on health promotion, disease prevention and treatment⁸. *Sarvanga Swedana* is a type of *Sagni Sweda* (*Kuti Sweda*) in which heat is applied with steam⁹.

Several classical Ayurveda texts, including the Charaka Samhita (Charaka Samhita Sutrasthana 22) and Sushruta Samhita (Sushruta Samhita, Chikitsasthana 32), emphasize the therapeutic significance of Swedana in managing various diseases. Swedana as a primary means to pacify aggravated *Vata* and *Kapha Doshas*¹⁰. Swedana has historical significance in preventing diseases and treating ailments ranging from musculoskeletal disorders to stress-related conditions¹¹. Swedana therapy being one of the

shadavidhopakrama is utilized in Ayurveda for health promotion and cure of diseases. The increasing number of Swedana seeking patients are not only in healthcare but also in wellness spas, resort, health clubs. Some of the cases of adverse events in spas during *Sarvanga Swedana* have been reported¹². Tribhuvan University Ayurveda Teaching Hospital Kirtipur Kathmandu is providing outpatient department (OPD), inpatient department (IPD) service along with special Ayurveda services such as Panchakarma and Ksharsutra¹³. Swedana is one of the most predominantly used services in Panchakarma department of Ayurveda Teaching Hospital. Despite its widespread application, scientific investigations into its hemodynamic, hematological, biochemical and subjective wellbeing effects remain limited. This study aims to provide quantitative evidence of the effects of *Sarvanga Swedana*, offering insights into its safety and efficacy which helps in addressing the gap of integrating Ayurveda Swedana into evidence-based healthcare frameworks for preventing and managing lifestyle disorders and inflammatory conditions.

This study aimed to evaluate the immediate physiological effects of *Sarvanga Swedana* (full-body sudation) in healthy adults specifically hemodynamic, hematological and biochemical changes before and after the intervention. Additionally, the study examined the relationship between these physiological changes and participants' subjective wellness scores.

METHODS

A quasi-experimental pre- and post-intervention study with convenient sampling was conducted at Tribhuvan University Ayurveda Teaching Hospital, Panchakarma department Kirtipur Kathmandu, Nepal. Forty apparently healthy individuals willing to take Swedana services from Ayurveda Teaching Hospital were enrolled in the study. Apparently healthy individuals aged 20-50 years and willing to participate and provided informed consent were included in study. Individuals with pre-existing cardiovascular, hematological, hepatic and renal disorders, pregnancy, lactation, and during the menstrual period and recent history of *Panchakarma* therapy were excluded. Blood pressure (systolic and diastolic), heart rate, and oxygen saturation (SpO₂) were measured before, immediately after, and 30 minutes post-therapy for consecutive 7 days. For blood pressure measurement, aneroid sphygmomanometer was used, and for oxygen saturation (SpO₂) measurement, oximeter was used. Primary data were collected directly from participants through physiological measurements, blood tests and subjective wellness questionnaires. Blood samples of participants were collected pre- and post-intervention for hematological, biochemical parameters assessed on the first day before procedure and after 7 days consecutive procedure similar to regular hospital procedure and data were collected from participants. *Prakriti* assessment of participants was done before the session as a part of Ayurveda general examination. Participants were assessed with wellness questionnaire containing relaxation, body lightness, relief in stiffness and satisfaction with scores ranging from 1 to 5 before and after the session. All data were stored securely with confidentiality maintained. Ethical approval was obtained from the Ethical Review Board, TU (ERB-TU-2082-019) before starting the study. Procedures were conducted with constant monitoring and participant comfort was taken care. Written informed consent was obtained from every participant.

Sarvanga Swedana Procedure

Participants were given 7 sessions of *Sarvanga Swedana* in *Panchakarma sarvanga swedana* unit of Ayurveda Teaching Hospital Kirtipur Nepal on consecutive days till the Lakshanas (symptoms) of *Sarvanga Swedana* appear. The therapy involved application of medicated steam across the entire body till sweating occurs from forehead (for 15-20 minutes) in the steam box. Monitoring of comfort and temperature throughout the procedure was done on every session. *Sarvanga Swedana* apparatus constituted a wooden insulated chamber being used for *Swedana* (sudation) in sitting type arrangement in Ayurveda Teaching Hospital. The measurement dimension at head end was approximately

33 inches breadth, 18 inches back length. The measurement dimension at foot end was approximately 33 inches breadth, 36 inches back length – double the length of the head end. The total height was 50 inches where 5-inch gap was there between the foot end wooden plate and the surface. A sitting chair was kept inside the box chamber for sitting and taking the *Swedana* service. The chamber contained a retractable lid door type arrangement and the head outlet. The inner chamber was connected to a steam generator where steam of *Dashamula* decoction was produced and circulated inside the chamber. The inside temperature monitoring during the procedure was done by a portable temperature recorder a wire end which was kept inside the chamber and a small display outside. The same apparatus of *Sarvanga Swedana* was under use at *Panchakarma* unit for over 2 years and was in concordance to the conventional apparatuses used for the same purpose throughout the country. No *Snehana* was done prior to *Swedana* as usually done in regular *Purvakarma* services, since the study planned to study the role of *Swedana* only. During the process, the participants were covered with a small wet towel at their neck to prevent steam leak out. The participants who had undergone *Sarvanga Swedana* therapy were then allowed to change and rest in an enclosed area (without direct air exposure) for few minutes before they could leave after data recording. The participants were explained about the rules to be followed after the administration of *Swedana*.

Data Analysis: Paired t-tests were used to compare pre- and post-intervention values for continuous variables. Wilcoxon Signed-Rank test was used for subjective wellness scores. Correlation analysis explored relationships between physiological changes and subjective wellness scores. Descriptive statistics (frequencies, percentages) were calculated using Microsoft Excel. Data of the responses was stored on semi-structured questionnaire filled forms and transferred to Microsoft excel. The excel data sheet was further transferred to SPSS for data analysis.

RESULTS

A total of 40 healthy volunteers were registered to evaluate the effects of 7-day *Sarvanga Swedana* therapy. Among Participants 50% (20) were in the age group of 20-29 years, 25% (10) were in the age group of 30-39 years, and 25% (10) were in the age group of 40-49 years. Majority were females (60.0%). Married were 55.0% (22) and 45.0% (18) were unmarried. Majority of participants (50.0%) were bachelor's degree holders, followed by higher secondary (20.0%), secondary (17.5%), and master's (12.5%). The highest percentage (42.5%) were students, followed by housewives (25.0%), service (20.0%), and business (12.5%). Majority

Table 1: Hemodynamic Changes due to 7-Day Sarvanga Swedana therapy (n=40)

Parameter	Before Therapy (Day 1 Mean)	After Therapy (Day 7 Mean)	Mean Difference	% Change from day 1	Statistical Significance
Systolic BP (mmHg)	124.3 ± 4.6	117.6 ± 3.4	-6.7	-5.4%	p<0.001*
Diastolic BP (mmHg)	80.4 ± 3.2	74.0 ± 3.0	-6.4	-8.0%	p<0.001*
Heart Rate (bpm)	73.4 ± 6.3	71.3 ± 6.3	-2.1	-2.9%	p<0.05*
SpO ₂ (%)	97.6 ± 1.3	97.9 ± 1.1	+0.3	+0.3%	p>0.05*
Paired t-test; Significance level p<0.05					

Table 3: Changes in Biochemical and Inflammatory Parameters due to Swedana Therapy (N=40)

Parameter	Before Therapy (Day 1 Mean)	After Therapy (Day 7 Mean)	Mean Difference	% Change	P-value (paired t-test).
Fasting Glucose (mg/dL)	89.0 ± 6.5	83.9 ± 6.4	-5.1	-5.7%	<0.001*
Triglycerides (mg/dL)	134.4 ± 17.5	121.4 ± 15.8	-13.0	-9.7%	<0.001*
CRP (mg/L)	2.5 ± 1.0	1.8 ± 0.9	-0.7	-28.0%	<0.001*
ESR (mm/hr)	11.3 ± 4.6	7.4 ± 4.5	-3.9	-34.5%	<0.001*

Data presented as mean values. All other parameters (CBC, LFT, RFT, Total cholesterol, HDL, LDL) remained within normal ranges and showed no significant change (p>0.05).

Table 2: Changes in Hematological Parameters due to Swedana Therapy (N=40)

Parameter	Pre-Therapy Mean ± SD	Post-Therapy Mean ± SD	Mean Difference	p-value
Hemoglobin (g/dL)	14.2 ± 1.1	14.3 ± 1.3	+0.1	p>0.05*
RBC (million/μL)	4.9 ± 0.4	4.9 ± 0.4	0.0	p>0.05*
WBC (thousand/μL)	7.3 ± 0.6	7.4 ± 0.7	+0.1	p>0.05*
Neutrophils (%)	57.9 ± 4.2	59.7 ± 5.7	+1.8	p>0.05*
Lymphocytes (%)	32.3 ± 5.2	30.7 ± 3.9	-1.6	p>0.05*
Eosinophils (%)	2.0 ± 0.6	1.9 ± 0.7	-0.1	p>0.05*
Basophils (%)	1.0 ± 0.0	1.0 ± 0.0	0.0	-
Monocytes (%)	7.0 ± 0.2	7.0 ± 0.2	0.0	-
Platelets (thousand/μL)	234.7 ± 22.0	231.7 ± 24.8	-3.0	p>0.05*

Table 4: Changes in Subjective Wellness Assessment Score due to Swedana Therapy (Scale: 0-5#)

Parameter	Median (IQR)		Z-value	p-value*
	Pre-Therapy	Post-Therapy		
Relaxation	1 (1-2)	4 (3-4)	-5.72	<0.001
Body Lightness	1 (0-1)	3 (3-4)	-5.15	<0.001
Stiffness	2 (1-3)	1 (0-1)	-4.12	<0.001
Satisfaction	1 (1-2)	4 (3-4)	-5.64	<0.001

#Subjective Wellness Assessment Scale: 0-5 (0=worst, 5=best for Relaxation, Body Lightness, Satisfaction; reverse for Stiffness) *p-value was calculated from Wilcoxon Signed-Rank test

of participants (50.0%) belonged to Vata-Kapha Prakriti, followed by Vata-Pitta (20.0%), Pitta-Kapha (15.0%), Kapha (10.0%), and Vata (5.0%). The average session duration on 1st day was 12 minutes (10-15 range), and showed progressive increase from Day 1 to Day 7 where the average time was 17 minutes (range 15-20), indicating improved tolerance to the therapy. After seven days, there was a statistically significant reduction in resting systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR), as shown in Table 1 oxygen saturation (SpO₂) showed a slight change but not significant improvement (Table 1).

Analysis of blood parameters revealed significant improvements in key metabolic and inflammatory markers, while markers of liver and kidney function remained stable. As detailed in Table 2, a statistically significant reduction was observed in fasting blood glucose, triglycerides, and the inflammatory markers ESR and CRP (Table 3).

Participants reported a marked and highly significant improvement in all measured subjective wellness parameters following the 7-day therapy (Table 4).

Study demonstrated that 7 days of Sarvanga Swedana is safe with no obvious adverse effects on hematological, hepatic, or renal parameters. Significant hemodynamic benefits with blood pressure reduction was found. Subjective improvements in relaxation, body lightness, reduced stiffness, and satisfaction.

DISCUSSION

There are significant hemodynamic changes in body due to *Sarvanga Swedana*. Hemodynamic changes were observed both acutely (immediately after sessions) and cumulatively (over 7 days). Immediately after each session, a transient increase in heart rate and a slight rise in systolic BP were observed, consistent with thermoregulatory vasodilation and compensatory cardiac output. By 30 minutes' post-session, vitals mostly returned toward baseline. After day 7, consecutive Swedana session the resting systolic and diastolic BP were significantly reduced. Similar finding was published in Indian hospital patients with significant reductions in

systolic and diastolic blood pressure immediately after lying down type Swedana. Oxygen saturation showed a slight but non-significant improvement. Swedana liquefies (*Vilayana*) and mobilize (*Sravana*) toxins (*Ama*) and morbid Doshas lodged in the *Srotas* (micro-channels), facilitating their expulsion primarily through sweat. Sarvanga Swedana improves peripheral circulation promoting blood flow¹⁴. The significant reduction in blood pressure is consistent with the Ayurveda concept of *Vata Shamana*. *Vata* is the Dosha which governs circulation and nervous system activity. The observation of increasing heart rate post-session is a normal physiological response to heat stress, involving peripheral vasodilation and increased cardiac output to maintain core temperature. The reduction in resting heart rate after 7 days suggests improved cardiovascular efficiency and possibly reduced sympathetic tone, inline to the effects observed in repeated sauna therapy. To minimize the confounding factors, the procedure was done in same steam chamber in similar setup and the participants followed similar protocol before baseline and after procedure recordings.

There were no statistically significant changes in complete blood count (CBC) parameters which suggests a safety finding of Swedana. It indicates that the *Sarvanga Swedana* protocol did not induce hemoconcentration from fluid loss, nor did it trigger an inflammatory or stressful hematological response. The absence of change in RBC count and hemoglobin suggests that plasma volume was adequately maintained during the study period of 7 days with consecutive days' procedure. The minimal, non-significant fluctuations in WBC differentials may reflect normal daily biological variation in an individual, rather than an immune activation. The hematological stability reinforces that it is a safe procedure that does not affect blood composition. The reported cases of adverse event in sauna are unlike to happen in Ayurveda Swedana as the head is kept outside the chamber to prevent heat stress. The finding of this study is consistent with the known effects of mild hyperthermia, which stimulates leukocyte mobilization and enhances innate immune activity¹⁵. Similar hematological responses have been reported¹⁶ following Sarvanga Ruksha Swedana in healthy subjects.

Urea, creatinine, uric acid, and all liver function tests (SGOT/AST, SGPT/ALT, ALP, Bilirubin), total cholesterol, HDL, and LDL showed no significant changes. The significant reduction in fasting blood glucose and triglycerides points toward result of metabolic efficiency, aligning with the Ayurveda concept of improved *Agni* (digestive and metabolic fire) by treating *Dhatuagnimandhya* of *Medodhatu* (adipose tissue). The reduction in inflammatory markers (ESR and CRP) is particularly observed which correlates strongly with the traditional indication of Swedana for conditions involving stiffness (*Stambha*) and heaviness (*Gaurava*), which are often associated with *Ama* (metabolic toxins) and systemic inflammation. The stability of renal and hepatic parameters establishes the safety outcome, confirming that Swedana does not create stress on these organs. The detoxifying effect of sudation is attributed to the excretion of metabolic waste products, such as urea, uric acid, and electrolytes, through sweat¹⁷. Furthermore, studies suggest that heat therapies can provide benefit in circulating

lipid profiles¹⁸. Heat stress has been shown to activate the hypothalamic-pituitary-adrenal (HPA) axis, influencing various biochemical and physiological pathways¹⁹.

The sign and symptoms of proper Swedana is judged by the appearance of sweat on the forehead, perspiration, and a sense of lightness in the body. Studies show that acute heat stress induces peripheral vasodilation, leading to a drop in peripheral vascular resistance and subsequently increase in heart rate and cardiac output to maintain blood pressure²⁰. Repeated sauna use (similar to multiple Swedana sessions) has been found to have long-term improvements in endothelial function, reduction in arterial stiffness, and lower incidence of hypertension and cardiovascular diseases, suggesting a "cardiovascular workout" effect²¹. Researchers found that steam therapy can improve insulin sensitivity and glucose metabolism²². Sweating helps in excretion of trace elements and substances like urea, heavy metals, and Bisphenol-A²³ which provides a scientific validation of Ayurveda concept of detoxification (*Shodhana*). Previous study has shown that hyperthermia modulates the immune system, inducing a temporary increase in circulating white blood cells, and stimulating the release of heat shock proteins (HSPs) which have anti-inflammatory roles²⁴. Although a small sample size study the findings of this study in selected parameters are in line with the previous studies. Despite these promising findings, the literature reveals significant limitations. Many studies have small sample sizes, lack control groups, or focus on a single disease condition.

There were improvements in all subjective wellness parameters, which strongly correlated with the objective physiological improvements. Positive correlations were found between reduction in BP/HR and increased feelings of relaxation. There was reduction in ESR/CRP with the subjective improvement in stiffness. There was also reduction in triglycerides and increased sense of body lightness. Higher satisfaction scores were observed with longer session tolerance. The improvement in subjective well-being feeling more relaxed, lighter, less stiff, and highly satisfied is the most important validation of the patient reported benefits of *Sarvanga Swedana*. This demonstrates that Swedana's benefits are not merely perceptual but are rooted in systemic physiological change. The increase in session duration tolerance (from ~12 to ~17 minutes) further indicates an adaptive, positive response to the therapy, providing practical guidance for physician and therapist to gradually increase exposure based on individual tolerance. Although the study was not primarily focused to analyze Prakriti-based differences, variations in heat tolerance and physiological responses were observed. These findings are consistent with previous studies suggesting differential sweating and thermoregulatory patterns based on constitutional dominance²⁵ suggesting for further research. This strong correlation validates the holistic Ayurveda assessment model, where patient reported well-being is a key outcome measure, and grounds it in measurable physiology. The significant reduction in triglycerides supports the classical Ayurveda claim of Swedana in purifying fat tissue. The enhanced glucose metabolism indicates improved *Agni* function. Improved SpO₂ and

reduced respiratory rate suggest better functioning of the respiratory system channels. *Sarvanga Swedana* is an evidence supported preventive and health-promoting intervention, especially relevant in contexts of sedentary lifestyle and chronic diseases involving pain and stress. The observed safety profile supports its application in broader healthcare and wellness resort settings. The correlation between *Prakriti* and physiological response point out areas of consideration for personalized Swedana protocols for consecutive use of Swedana in promotive healthcare.

Limitations

This study was limited by its relatively small sample size ($n = 40$), which may reduce the statistical power and generalizability of the findings. In addition, only healthy adults aged 20–50 years were included, limiting the applicability of the results to other age groups and individuals with pre-existing medical conditions.

CONCLUSIONS

Sarvanga Swedana is an Ayurveda procedure that induces beneficial hemodynamic and metabolic changes in healthy individuals as observed by the preliminary evidences. The 7-day *Sarvanga Swedana* procedure produced significant beneficial effects on subjective wellness in healthy individuals. It validates classical Ayurveda claims related to *Vata-Kapha Shamana*, *Srotoshodhana*, *Ama Pachana*, and *Medodhatu Shuddhi*, while providing empirical evidence for its role in promoting cardiovascular health, metabolic balance, and overall well-being.

Recommendations and Future Directions

Future studies should include larger, more diverse populations using well-designed randomized controlled trials to enhance the generalizability of the findings. Longer follow-up periods (e.g., 60–90 days or beyond) are recommended to evaluate the durability of therapeutic.

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Author's Contributions NB conceptualized the study, designed the methodology, and drafted the initial manuscript. SA and AJ assisted to the acquisition of data. BR Ghimire contributed to review revisions and final proofreading. All authors read and agreed on the manuscript and responsible for all aspects of the preparation of this manuscript.

Ethics Approval and Consent to Participate

Ethical approval was obtained from the relevant Ethical

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