ORIGINAL ARTICLE

# Immediate Effect of Shavasana on Cardiac Output and Systemic Peripheral Resistance in Untrained Young Adults

*Sharad Jain*

*Department of Physiology, Saraswathi Institute of Medical Sciences, Hapur-245304 (Uttar Pradesh) India*

**Abstract:**

*Background*: Shavasana is one of the most popular yogic exercises used for relaxation of body. *Aim and Objectives*: The present study was done to find out direct effect of Shavasana on cardiac output and peripheral resistance by using Impedance Cardiovasograph (Nivomon, Larsen & Toubro Medical's). *Material and Methods*: One hundred asymptomatic healthy male subjects, aged 17-23 years, participated voluntarily in the present study. Cardiac output, systemic peripheral resistance and other cardiovascular parameters were measured before and after Shavasana of 30 minutes. *Results*: Statistically significant decrement was observed in all cardiovascular parameters after shavasana but decrement was more pronounced in Diastolic Blood Pressure (DBP), Heart Rate (HR), Systemic Peripheral Resistance (SPR) and Systemic Vascular Resistance Index (SVRI) in comparison to decrement in Systolic Blood Pressure (SBP), Cardiac Output (CO), Stroke Volume (SV), Cardiac Index (CI), Stroke Volume Index (SI). *Conclusion*: The practice of Shavasana for short duration immediately improves cardiovascular parameters including cardiac output and systemic peripheral resistance which directly influence blood pressure and might be beneficial in normal subjects and hypertensive patients as well.

**Keywords:** Shavasana, Impedance Cardiovasograph, Cardiac output, Systemic Peripheral Resistance

**Introduction:**

Breathing is essential for life of human. Breathing is automatic process which is involuntary in nature. Rate and depth of breathing change according to the situations of a person, while the person may not be aware of it. Awareness and control over breathing is the key feature of yogic exercises. Yoga and meditation are legacy of ancient India. Yoga involves mental and physical training through various breathing exercises pranayama, various postures- asanas like shavasana, makar-asana and meditation [1].

Shavasana also known as corpse posture, is a very simple yogic asana. It is claimed to be very effective in relaxing the mind and body. It involves deep breathing and leads to systemic relaxation of body. It may alter cardio respiratory and autonomic parameters. Effects of Shavasana have been studied along with many other yogic exercises to find out combined effect of multiple yogic exercises on the body [2].

Several investigations have been conducted to determine the long-term effects of this technique on the cardiovascular and autonomic nervous systems in healthy and clinically affected populations and many of these studies have suggested that Shavasana leads to a shift in

sympathovagal balance towards parasympathetic dominance. Many researchers have found a significant reduction in Heart Rate (HR) and Blood Pressure (BP) both after brief period and 6 months of Shavasana exercise. It has been found to reduce life stress [3].

Shavasana has been advocated as adjunct therapy for hypertension and to reduce the dose of antihypertensive drug to control blood pressure in hypertensive patients [4].

It has been proven a useful therapeutic tool in treatment of tension headache. These beneficial effects might be brought by altering the autonomic status of the body [5].

Change in cardiac output and peripheral resistance are very good indicator of change in autonomic status. As they tend to increase with sympathetic stimulation and tend to decrease with increase in parasympathetic activity. Cardiac output is the product of stroke volume and heart rate. Peripheral resistance in the body in man is primarily controlled by the arterioles which are richly supplied with sympathetic fibers, but sparse parasympathetic innervations [6]. Cardiac output and peripheral resistance can be measured noninvasively by using Impedance Cardiovasograph (Nivomon, L&T Medical's). It is a non invasive vasography monitoring system [7, 8].

It measures the Cardiac Output (CO) and Blood Flow Index (BFI) of the patient non-invasively. It computes the Cardiac Output (CO), Stroke Volume (SV), Systemic Vascular Resistance (SVR), Cardiac Index (CI), Stroke volume Index (SI), Systemic Vascular Resistance Index (SVRI), Pulse Rate (PR) and various other cardiovascular parameters [8, 9]. Since arterial blood pressure is directly proportional to cardiac output and peripheral resistance. Any maneuver which may decrease cardiac out or peripheral resistance or both may be helpful for the patients suffering from hypertension and other cardiovascular diseases.

Various yoga techniques have been found useful for cardiovascular and respiratory system but compliance with the yogic practice is not very good. Even after realizing the beneficial effects of yoga, majority of people stop practicing after study period of the experiment or when they feel some relief which is similar to that of incomplete antibiotic course when they get some relief from illness.

In the present study, Shavasana was chosen because it is very easy to perform. The duration of Shavasana was kept short; to find out beneficial effect of Shavasana in brief period of time, so that people can be benefitted when they feel stressed with tachycardia and increased blood pressure. As blood pressure depends on cardiac output and peripheral resistance, therefore, the present study aims to study the effect of Shavasana on cardiac output and systemic peripheral resistance.

**Material and Methods:**

The present study was conducted in the department of physiology, Saraswathi Institute of Medical Sciences, Hapur, Uttar Pradesh, India. One hundred asymptomatic healthy male subjects, aged 17-23 years, participated voluntarily in the present study. The main

objective of the study was to assess the immediate effect of Shavasana on cardiac output and peripheral resistance and other cardiovascular parameters. Experimental procedures were in accordance with the ethics committee recommendations on human experimentation. Study was carried out at ambient temperature with minimal external or internal sound disturbances in the room. Subjects reported to laboratory 2 hours after light lunch. They were explained in detail about the experimental procedure. Informed consent was taken from all subjects. Subjects were asked to lie in supine position. The color coded 8 leads of NICO patient cables were connected at their respective locations as given below:

1. Red leads (I1 and I1') -Behind the ears (Top pair)
2. Yellow leads (V1 and V1') -Roof of the neck (Second pair)
3. Violet leads (V2 and V2') -Level of xiphisternum (Third pair)
4. Green leads (I2 and I2') End of ribcage or >5 cm from third pair (Bottom pair)

Systolic blood pressure (SBP), diastolic blood pressure (DBP) were recorded by using mercury sphygmomanometer. Cardiac output, peripheral resistance and other parameters were recorded using Impedance Cardiovasograph (Nivomon). Body surface area ($m^2$) of each subject was calculated from height (cms) and weight (kg).

Then they practiced Shavasana for 30min (acute exposure) as per instructions mentioned below.

1. Lie down in supine position. Put thin pillow below neck.
2. Close the eyes. Keep the legs slightly apart
3. Relax all parts of body completely
4. Place the arms alongside with palms open, facing upward.
5. Focus the mind on the body.
6. Keep breathing slowly and deeply without any jerky movements.
7. Feel the energy coming in the body with each inhalation while stress going out of the body with each exhalation.
8. Do not fall asleep.

After 30 minutes Shavasana exercise, again all parameters were recorded.

All data were collected and statistical analysis was done by paired t-test using the window SPSS Statistics 17.0 version.

**Results**

The mean age (±SD) of the subjects was 21.1±1.1. Body Surface Area (BSA) (Mean±SD) was 1.75±0.06; which was calculated using height (cms) 172.5±2.3 and Weight (Kg) 64.4±4.4 (Table 1).

**Table 1: Baseline Characteristics of All Subjects**

| S.N. | Baseline Parameters | Mean ± SD |
|---|---|---|
| 1 | Age (in years) | 21.1±1.1 |
| 2 | Height (cms) | 172.5±2.3 |
| 3 | Weight (Kg) | 64.4±4.4 |
| 4 | BSA ($m^2$) | 1.75±0.06 |

*BSA - Body Surface Area*

Table 2 shows comparison of parameters before and after Shavasana. There was significant decrease in all cardiovascular parameters after performing 30 minutes Shavasana. Decrease were highly significant at p<0.01 in diastolic blood pressure (p=0.006), heart rate (p=0.002), Systemic Peripheral Resistance (p=0.0016) and Systemic Vascular Resistance Index (p=0.008). While decrease was significant at p<0.05; in Systolic blood pressure (p=0.048), Cardiac Output (p=0.030), Stroke volume (p=0.041), Cardiac Index (p=0.036), Stroke volume Index (0.049). Data are expressed as Mean±SD.

**Table 2: Comparison of Cardiac Output and Peripheral Resistance and Other Cardiovascular Parameters before and after Shavasana**

| S.N. | Cardiovascular Parameters | Before Shavasana (control) | After Shavasana | t value | P value |
|---|---|---|---|---|---|
| 1 | Systolic blood pressure (SBP) (mm Hg) | 115.2±1.7 | 105.3±1.1 | 1.98 | 0.048* |
| 2 | Diastolic blood pressure (DBP) (mm Hg) | 73.82±1.5 | 66.12±1.6 | 2.8 | 0.006** |
| 3 | Heart rate (HR) (per minute) | 72.08±0.8 | 67.2±0.5 | 3.2 | 0.002** |
| 4 | Cardiac Output (CO) (L/min) | 5.26±0.18 | 4.84±0.06 | 2.2 | 0.030* |
| 5 | Stroke volume (SV) (ml/ beat) | 72.28±0.5 | 71.26±0.4 | 2.07 | 0.041* |
| 6 | Systemic Peripheral Resistance (SPR) (dyne.sec/$cm^5$) | 1357.1±8.3 | 1329.2±6.4 | 3.25 | 0.0016** |
| 7 | Cardiac Index (CI) (L/min/$m^2$) | 2.94±0.06 | 2.71±0.05 | 2.12 | 0.036* |
| 8 | Stroke volume Index (SI) (ml/ beat/$m^2$) | 41.36±0.03 | 40.56±0.02 | 1.99 | 0.049* |
| 9 | Systemic Vascular Resistance Index (SVRI) (dyne.sec/$cm^5$/$m^2$) | 771.2±4.1 | 753.45±3.9 | 2.7 | 0.008** |

**p<0.05 (significant), **p<0.01(highly significant)*

**Discussion:**

Cardiac output and peripheral resistance are the key determinants of blood pressure. Blood pressure and heart rate are important cardio-vascular parameters. Both are controlled by autonomic nervous system mediated via baroreceptor reflex mechanism. Cardiac output is product of stroke volume and heart rate. Stroke volume increases with increase in venous return and increased force of contraction of heart and vice-versa. Increase in sympathetic activity increases venous return by producing veno-constriction in splanchnic circulation and other parts of the body and also increased force of contraction of heart leading to more pumping of blood in each cardiac cycle leading to increased systolic blood pressure. Increased sympathetic activity also produces vasoconstriction of arterioles and increases total peripheral resistance leading to increase in diastolic blood pressure. Impulses of buffer nerves from arterial baroreceptors reach the medulla and affect the heart rate via vagal discharge to the heart. The neurons from which the vagal fibers arise are in the dorsal motor nucleus of the vagus and the nucleus ambiguous [10, 11].

So, increased sympathetic activity is responsible for increased cardiac output and heart rate and vice versa. Any maneuver which can decrease the sympathetic activity will decrease blood pressure, cardiac output, total peripheral resistance and heart rate. Shavasana results in decrease in sympathetic activity and also increase in para-sympathetic activity.

Shavasana has been suggested for short lifestyle modification and stress management educational programmes which leads to remarkable improvement in the subjective well being scores of the subjects and are suggested for primary prevention as well as management of lifestyle diseases [12]. Previous studies have shown that effects of stress were reversed in significantly shorter time in by practicing Shavasana in comparison to the resting posture in chair and a supine posture [13]. Previous studies also have shown that yoga reduces the age related deterioration in cardiovascular functions and in long duration it affects hypothalamus and influence on vasomotor centre which leads to reduction in sympathetic tone and peripheral resistance which brings about decrease in the systolic and diastolic blood pressure [14, 15]. Our results are in line of these studies with more precise analysis of cardiovascular parameters in the form of quantitative measurement of decrease in cardiac output and systemic peripheral resistance in addition to measurement of blood pressure and heart rate after Shavasana.

**Conclusion:**

As a result of this decrease in sympathetic activity there is vasodilatation which causes decrease in peripheral resistance. It also decreases heart rate and myocardial contractility leading to decreased cardiac output. Decrease in cardiac output and peripheral resistance both results in decrease in systolic as well as diastolic blood pressure. So Shavasana can be a useful exercise for the patients suffering from hypertension and other cardiac disease and other stress related problems.

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***Author for Correspondence**: Dr. Sharad Jain, Associate Professor, Department of Physiology, Saraswathi Institute of Medical Sciences, Hapur, (U.P.) India Email: drsharadjain@yahoo.co.in, Cell: 9758558729*