

Effect of Pranava Yoga on Cardiac Output and Systemic Peripheral Resistance

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Abstract

Pranava yoga is one of the most popular pranayama yogic exercises. The present study was done to find out direct effect of Pranava yoga on cardiac output and peripheral resistance by using Impedance Cardiovasograph (Nivomon, L&T Medical's). 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 Pranava yoga of 15 minutes. Statistically significant decrement was observed in all cardiovascular parameters after Pranava yoga but decrement was more pronounced in systolic blood pressure (SBP), heart rate (HR), cardiac output (CO), stroke volume (SV), cardiac index (CI), stroke volume Index (SI) in comparison to decrement in diastolic blood pressure (DBP), Systemic Peripheral Resistance (SPR) and Systemic Vascular Resistance Index (SVRI).

Keywords: Pranava Yoga; Impedance Cardiovasograph; Cardiac Output; Systemic Peripheral Resistance.

Introduction

Human life is full of stress and tension. In the present scenario people have to face challenges at every step of life, which create a stressful life to a person. Failure to cope with stress leads to depression, anxiety and related disorders. Some studies have shown that people having spiritual life style are able to face the day to day stress more efficiently. Yoga and meditation are practiced from Vedic period in ancient India. Various methods of yoga and meditation are described in Upnishads and Yoga Sutras of Patanjali. These also consist of chanting of various mantras and performing Hawan etc. These meditation and yoga practices were performed daily as part of religious act in ancient India, but not common in present days in majority of population [1]. However now again practice of yoga and meditation is becoming popular throughout the world including India for improving the quality of life [2,3]. Many researches have proven multiple beneficial effects of yoga and meditation. Awareness and control over breathing is the key feature of yogic exercises. Yoga is claimed to be very effective in

relaxing the mind and body. It has been found to reduce life stress [4,5]. It may alter cardio respiratory and autonomic parameters. Several investigations have been conducted to determine the long-term effects of pranayama and meditation techniques on the cardiovascular and autonomic nervous systems in healthy and clinical populations like hypothyroidism and rheumatoid arthritis[6-8]. Many of these studies have suggested that yoga leads to a shift in sympathovagal balance towards parasympathetic dominance [9,10]. Yoga has been advocated as adjunct therapy in hypertension and to reduce the dose of antihypertensive drug to control blood pressure in hypertensive patients[11,12]. These beneficial effects might be brought by altering the autonomic status of the body. Pranava yoga is a very simple exercise among various yogic exercises. According to Hindu philosophy, Aum is sound of power and whole universe is formed by this power of Aum. Pranava yoga (Aum yoga) is simple chanting of word Aum and focus the mind on the sound and vibrations produced during Aum Chanting.

Studies have shown that Pranava pranayama produces an immediate decrease in heart rate and systolic blood pressure in hypertensive patients and

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advocated for management of hypertensive patients in addition to the regular medical management and suggested the need of further studies to enable a deeper understanding of the mechanisms involved and its usefulness in the long term management of hypertension [13].

Therefore, the present study aims to study the effect of Pranava yoga on cardiac output and systemic peripheral resistance. Since any maneuver which may decrease cardiac output or peripheral resistance or both may be helpful for the patients suffering from hypertension and other cardiovascular diseases.

Cardiac output and peripheral resistance can be measured non invasively by using Impedance Cardiovasograph (Nivomon, L&T Medical's). It is a Non Invasive vasography monitoring system. 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 [14].

Material and Methods

The present study was conducted in the department of physiology, Saraswathi Institute of Medical Sciences, Hapur. One hundred asymptomatic healthy male subjects, aged 17-23 years, participated voluntarily in the present study, undertaken, to assess the effect of Pranava yoga on cardiac output and peripheral resistance and other cardiovascular parameters. Experiment procedures were in accordance with the ethical committee on human experimentation. Study was carried out at ambient temperature with minimal external or internal sound disturbances and little light 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 cable 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) and diastolic blood pressure (DBP) were recorded by using mercury sphygmomanometer. Cardiac output, peripheral resistance and other parameters were recorded using Impedance Cardiovasograph (Nivomon). Subjects were asked to sit in comfortable position with back support.

Then they practiced Pranava yoga for 15 minutes as per instructions mentioned below.

1. Sit up with back rest in comfortable position taking care of the cables remain attached.
2. Close the eyes and relax all parts of body completely.
3. Keep breathing slowly and deeply without any jerky movements.
4. After slow deep inspiration, start chanting Aum during slow expiration phase.
5. At the end of expiration, repeat the procedure of slow deep inspiration followed by Aum chanting in expiration phase.
6. Focus the mind on the vibrations produced by Aum chanting.
7. After 15 minutes of Aum chanting subjects were asked lie down slowly in supine position.

After 15 minutes Pranava yoga, again all parameters were recorded.

All data were collected and statistical analysis was done by paired t-test using the window SPSS Statistics 20.0 version.

Result

Table 2 shows comparison of parameters before and after Pranava yoga. There was significant decrease in all cardiovascular parameters after performing 15 minutes Pranava yoga.

Table 1: Baseline characteristics of all subjects

S.N.		
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

Table 2: Comparison of cardiac output and peripheral resistance and other cardiovascular parameters before and after Pranava yoga

S.N.		Before Pranava yoga	After Pranava yoga
1	Systolic blood pressure (SBP) (mm Hg)	116.4±1.5	104.4±1.1**
2	Diastolic blood pressure (DBP) (mm Hg)	74.12±1.6	65.32±1.4*
3	Heart rate (HR) (per minute)	73.08±0.9	66.2±0.4**
4	Cardiac Output (CO) (L/min)	5.16±0.12	4.74±0.16**
5	Stroke volume (SV) (ml/ beat)	72.26±0.6	70.22±0.4**
6	Systemic Peripheral Resistance (SPR) (dyne.sec/cm ⁵)	1358.1±7.3	1328.2±5.4*
7	Cardiac Index (CI) (L/min/m ²)	2.94±0.06	2.61±0.04**
8	Stroke volume Index (SI) (ml/ beat/m ²)	41.31±0.13	40.53±0.03**
9	Systemic Vascular Resistance Index (SVRI) (dyne.sec/cm ⁵ /m ²)	770.1±4.2	753.25±3.8*

* $p < 0.05$ (significant), ** $p < 0.001$ (highly significant)

Decrease in Systolic blood pressure (SBP), heart rate (HR), Cardiac Output (CO), Stroke volume (SV), Cardiac Index (CI), Stroke volume Index (SI) were highly significant ($p < 0.001$). while decrease in Diastolic blood pressure (DBP), Systemic Peripheral Resistance (SPR) and Systemic Vascular Resistance Index (SVRI) were less significant ($p < 0.05$).

Discussion

It is a proven fact that regular yoga exercises improve the life and give sense of subjective well being in normal people as well as in patients suffering from diseases. It can be used as powerful tool to combat stress. Aum chanting is very easy exercise and can be done any time in sitting posture. Previous studies have shown a significant decrease in heart rate during Aum chanting, insignificant reduction in oxygen consumption and significant decrease in finger plethysmogram amplitude (i.e. increased peripheral vascular resistance) indicating that chanting "Aum" mentally causes increased alertness (reduced finger plethysmogram amplitude), along with simultaneous relaxation of body (reduced heart rate) [15]. In contrast to this, present study showed significant decrease both in heart rate and systemic vascular resistance; however decrease in heart rate was more pronounced. Aum chanting shifted the symapatho vagal balance towards vagal side and resulted in a decrease in sympathetic activity.

Change in cardiac output and peripheral resistance is 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 and peripheral resistance are the key determinant of

blood pressure. Blood pressure and heart rate are important cardiovascular 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 decreases with decrease in venous return & decrease force of contraction of heart and vice-versa. Increase in parasympathetic activity decreases venous return by producing venodilation in splanchnic circulation and other parts of body and also decrease force of contraction of heart leading to less pumping of blood in each cardiac cycle leading to decreased systolic blood pressure. Decreased sympathetic activity also produces vasodilatation of arterioles and decreases total peripheral resistance leading to decrease 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 ambiguus[16]. So, decreased sympathetic activity is responsible for decreased cardiac output and heart rate and vice versa. Any maneuver which can decrease the sympathetic activity or increase parasympathetic activity will decrease blood pressure, cardiac output, total peripheral resistance and heart rate.

Pranava yoga results in decrease in sympathetic activity and increase in parasympathetic activity. 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 result in decrease in systolic as well as diastolic blood pressure. So Pranava yoga can be a useful exercise for the patients suffering from hypertension

and other cardiac disease and other stress related problems.

References

1. Bhavanani AB. Are we practicing yoga therapy or yogopathy? *Yoga Therapy Today* 2011; 7: 26–28.
2. Malathi A, Damodaran A, Shah N, Patil N, Maratha S. Effect Of Yogic Practices On Subjective Well Being. *Indian J Physiol Pharmacol*. 2000; 44(2):202-6.
3. Madanmohan, Udupa K, Bhavanani AB, Shatapathy CS, Sahai A. Modulation of cardiovascular response to exercise by yoga training. *Indian J Physiol Pharmacol* 2004; 48: 461–465.
4. Sharma R, Gupta N, Bijlani R. Effect of yoga based lifestyle intervention on subjective well being. *Indian J Physiol Pharmacol* 2008; 52: 123– 131.
5. Kim SD. Effects of yogic exercises on life stress and blood glucose levels in nursing students. *J Phys Ther Sci*. 2014; 26(12):2003-2006.
6. Swami G, Singh S, Singh KP, Gupta M. Effect of yoga on pulmonary function tests of hypothyroid patients. *Indian J Physiol Pharmacol* 2009; 54 (1): 51–56.
7. Singh VK, Bhandari RB, Rana BB. Effect of yogic package on rheumatoid arthritis. *Indian J Physiol Pharmacol* 2011; 55 (4): 329–335.
8. Haslock I, Monro R, Nagarathna R, Nagendra HR, Raghuram NV. Measuring the effects of yoga in rheumatoid arthritis. *Br J Rheumatol* 1994; 33: 787–788.
9. Bhavnani AB, Ramanathan M, Balaji R, Pushpa D. Comparative immediate effect of different yoga asanas on heart rate and blood pressure in healthy young volunteers. *Int J Yoga*. 2014; 7(2): 89–95.
10. Raghuraj P, Telles S. Immediate effect of specific nostril manipulating yoga breathing practices on autonomic and respiratory variables. *Appl Psychophysiol Biofeedback* 2008; 33: 65–75.
11. Kaushika RM, Kaushika R, Mahajana SK et al. Effects of mental relaxation and slow breathing in essential hypertension. *Complement Ther Med* 2006; 14: 120–126.
12. Sundar S, Agrawal SK, Singh VP, Bhattacharya SK, Udupa KN, Vaish SK. Role of yoga in management of essential hypertension. *Acta Cardiol*. 1984;39(3): 203-208.
13. Bhavanani AB, Madanmohan, Sanjay Z, Basavaraddi IV. Immediate cardiovascular effects of pranava pranayama in hypertensive patients. *Indian J Physiol Pharmacol*. 2012; 56(3):273-8.
14. Parashar R, Bajpai M, Goyal M, Singh S, Tiwari S, Narayan VS. Impedance cardiography for monitoring changes in cardiac output. *Indian J Physiol Pharmacol* 2012; 56(2): 117–124.
15. Telles S, Nagarathnaand R, Nagendra R. Autonomic changes during “om” meditation. *Indian J Physiol Pharmacol* 1995; 39(4): 418-420.
16. Ganong WF. The heart as a pump. In: Ganong WF, ed. *Review of Medical Physiology* 22nd ed. India. Appleton & Lange, 2009; 565-576.