National Journal of Physiology, Pharmacy and Pharmacology

RESEARCH ARTICLE

Comparative study on the effect of yogic relaxing asanas and pranayamas on cardiovascular response in healthy young volunteers

Vasanthan S[1], Madanmohan T[1], Bhavanani A B[2], Hanifah M[3], Jaiganesh K[1]

[1]Department of Physiology, Mahatma Gandhi Medical College and Research Institute, Pillaiyarkuppam, Puducherry, India, [2]Deputy Director of Center for Yoga Therapy Education and Research, Sri Balaji Vidyapeeth, Puducherry, India, [3]Department of Medicine, Mahatma Gandhi Medical College and Research Institute, Pillaiyarkuppam, Puducherry, India

Correspondence to: Vasanthan S, E-mail: svasanthphysio@gmail.com

Received: August 06, 2016; **Accepted:** August 18, 2016

ABSTRACT

Background: Cardiovascular morbidity is increasing recently in India. Stress and autonomic dysfunction are associated with cardiovascular morbidity. Yoga is the best lifestyle ever designed. Based on limited scientific research, yoga (meditation, asanas, and pranayamas including relaxation) therapy is known to improve cardiovascular autonomic functions. **Aims and Objective:** To study and compare the effect of 6 months of training in relaxing asanas and pranayamas on blood pressure (BP), pulse pressure (PP), heart rate (HR), and rate-pressure product (RPP) in young healthy volunteers. **Materials and Methods:** A total of 109 healthy volunteers aged 20-25 years were divided into 3 groups consisting of asan (n = 38), pranayam (n = 38), and control group (n = 33). The Yoga training was given 25 min/day for 6 days/week for 6 months. Pranayam group received relaxing pranayam (pranav, savitri, nadi shuddhi and chandra nadi), asan group received relaxing asan (pawanmuktasana, balasan, dharnicasan, and shavasan) and waiting list were kept as a control group. The results were statistically compared between groups by analysis of variance and intra-group pre-post comparisons by paired t-test. **Results:** Post training analysis showed significant decreases in systolic BP and diastolic BP as well as PP, mean arterial pressure and RPP in both asan and pranayam group as compared with control. There was, however, no significant difference between asan and pranayam group. **Conclusion:** Practising either relaxing asan or pranayam enhances parasympathetic activity and decreases sympathetic activity.

KEY WORDS: Pranayam; Asan; Blood Pressure

INTRODUCTION

Yoga is the best lifestyle ever designed by our ancient India culture, an eternal gift to the world, achieves the union of our mind, body and soul. The term “yoga” derived from the Sanskrit root “Yuj” which means union. Modern lifestyle is a challenge of stress and stress related disorders such as hypertension and diabetic mellitus. Yoga practitioners are physically and mentally healthier and have better capability to cope up the stress than the normal population. Among the eight-fold path of Astanga Yoga, asan (firm and comfortable postures) and pranayam (slow, deep, conscious, rhythmic breathing) are mainly practiced by many people and also it is given as yoga therapy. Stress and autonomic dysfunction associated with cardiovascular morbidity are seen as upward trend in India in recent years. Based on scientific research, yoga (meditation, asanas, and pranayamas including relaxation), therapy is known to improve cardiovascular autonomic functions and reduces stress. Yoga has a role in prevention, management, and rehabilitation in stress-induced lifestyle disorder like hypertension.[1-3]

Access this article online	
Website: www.njppp.com	Quick Response code
DOI: 10.5455/njppp.2017.7.0824018082016	

Pranayam and asan reduce basal sympathetic tone and enhance basal parasympathetic tone while reducing rate-pressure product (RPP).[4] A combined protocol of pranayam and asan improves cardiovagal activity[5,6] and decreases systolic blood pressure (SBP), diastolic BP (DBP), and pulse pressure (PP).[7-10] Minimum of 3 months practice of pranayam improves autonomic functions.[11] Practicing uijayi pranayama and shavasan for 6 weeks decrease heart rate (HR), SBP, DBP, PP, mean arterial pressure (MAP), and RPP.[12] 5 min of bhramari pranayam has been shown to decrease SBP, DBP, MAP, and HR.[13] Alternate nostril breathing (naadishudhi) improves parasympathetic activity.[14,15] Adhomukhasvanasana decreases BP, body mass index, and HR.[16] Suchitra et al. found that a set of asan decreases BP and improves exercise tolerance.[17] However comparative study on asan and pranayam has not been reported in world literature, thereby this study seems to be the first of its kind to be reported in literature. Moreover in our busy lifestyle, practicing asan requires time, space, and comfortable clothes. It is practically difficult to practice asan by old aged people, physically challenged, and bed-ridden patients. Thus, to overcome these practical difficulties, this study was planned to compare the effect of 6 months training in asan and pranayam on cardiovascular parameters.

MATERIALS AND METHODS

Before commencement of the study, approval from Institute Research Committee and Institute Human Ethical Committee approval was obtained.

A total number of 120 subjects aged between 20 and 25 years were selected through Centre for Yoga Therapy Education and Research in Sri Balaji Vidyapeeth, Puducherry, and an informed consent obtained from them. They were randomly divided into three Groups: Group 1 received pranayam (pranav, savitri, nadi shuddhi and chandra nadi), Group 2 received asan (pawanmuktasana, balasan, dharmikasan and shavasan), and Group 3 was wait listed as a control. Two subjects dropped out from Group 1, two from Group 2, and seven from Group 3. Pranayam and asan techniques were taught to the respective groups for 3 days, and they were familiarized with the techniques and made comfortable to the yoga training hall atmosphere. Yoga training protocol for each group is given in Tables 1 and 2. A total of 25 min training program was given to each group for 6 days a week for 6 months under our supervision. During this period, waiting list control group was given study time for group discussion on academic activities.

Subjects were explained about the method of recording and were familiarized with the laboratory environment. Recordings were obtained between 8 AM and 10 AM without any stimulants in pre-recording period. The laboratory temperature was maintained at comfortable level for the subject. After 15 min of rest in supine, SBP and DBP were obtained from the subjects using sphygmomanometer.

Table 1: Group 1-pranayam training protocol

Name of pranayams	Repetition	Duration (min)
Prayer	5	5
Pranav	5	5
Savitri	5	5
Nadi shuddhi	5	5
Chandra nadi	5	5
Total		25

Table 2: Group 2 - Asan training protocol

Name of asanas	Repetition	Duration (min)
Prayer	5	5
Pawanmuktasana	5	5
Balasan	5	5
Dharmikasan	5	5
Shavasan	5	5
Total		25

The average of 3 trials with 5 min interval were taken for our calculation. PP was determined by PP = SBP-DBP. MAP and RPP were determined using respective formulae, MAP = DBP + (PP/3); RRP = (HR x SBP)/100. All the above-mentioned parameters were recorded before and after 6 months of yoga training program.

Statistical Analysis

After obtaining the study data, it was statistically analyzed using SPSS version 16.0. All data passed normality testing by Kolmogorov-Smirnov test and hence further analysis was done between groups using one-way analysis of variance (ANOVA) and using Students paired *t*-test for intra-group pre-post comparisons.

RESULTS

The results are given in Table 3. Relaxing pranayam and asan resulted in significant decreases in resting HR and PP ($P < 0.05$), SBP and MAP ($P < 0.01$), and DBP and RPP ($P < 0.001$) after training. The means of pre and post training values of all groups were compared by one-way ANOVA. There were no significant differences between groups at pre training. Post training comparison showed significant differences in HR ($P < 0.05$), SBP and MAP ($P < 0.01$), DBP, PP and RPP ($P < 0.001$) for the means of both pranayam and asan to control group after training. However, there were no significant differences between pranayam and asan group after yoga training.

DISCUSSION

In this study, it was found that 6 months of either pranayam or asan training decreases HR, SBP, DBP, PP, MAP, and

Table 3: Effect of 6 months of pranayamas and asanas training on HR, SBP, DBP, PP, MAP and RPP

Parameters	Pranayam		Asan		Control	
	Pre	Post	Pre	Post	Pre	Post
HR (bpm)	77.88±5.8	74.13±3.6*$^{\#}$	78.62±5.9	73.71±6.3*$^{\#}$	79.54±10.7	77.84±11.5
SBP (mmHg)	118.9±4.8	112.79±5.9**$^{\#\#}$	115.34±4.2	112.79±5.4**$^{\#\#}$	116.3±6.8	116.67±5.9
DBP (mmHg)	72.59±2.0	69.68±3.4***$^{\#\#\#}$	73.14±2.6	69.51±2.4***$^{\#\#\#}$	72.63±3.0	72.31±3.0
PP (mmHg)	43.37±5.2	40.66±5.1*$^{\#\#\#}$	42.24±5.7	39.84±5.2*$^{\#\#\#}$	43.76±4.91	44.48±5.1
MAP (mmHg)	85.99±2.74	82.59±2.8**$^{\#\#}$	87.18±2.9	82.70±2.7**$^{\#\#}$	87.13±2.9	87.01±3.1
RRP (units)	90.24±7.5	83.63±6.4***$^{\#\#\#}$	90.69±7.6	83.02±6.99***$^{\#\#\#}$	92.52±6.5	90.83±6.5

Data are expressed as Mean±SD. *P<0.05, **P<0.01 and ***P<0.001, difference between pre and post training. $^{\#}P$<0.05, $^{\#\#}P$<0.01 and $^{\#\#\#}P$<0.001, difference between pranayam, asan and control by using one-way ANOVA. HR: Heart rate, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, PP: Pulse pressure, MAP: Mean arterial pressure, RPP: Rate-pressure product

RPP. Findings of this study are collaborated by reports from Streeter et al. who proposed that yoga may help to reduce allostatic load in stress response systems thus restoring optimal homeostasis.[18] They hypothesized that stress produces an imbalance of autonomic nervous system with decreased parasympathetic and increased sympathetic activity. They also suggested that yoga may help correct such parasympathetic under activity through stimulation of vagus nerves as well as a reduction in allostatic load. Innes et al. have also postulated two interconnected pathways through which yoga may reduce cardiovascular and metabolic risk. They suggested that this was through parasympathetic activation coupled with decreased reactivity of sympathoadrenal system and hypothalomo-pituitary-adrenal axis.[19,20]

The de-stressing effect of pranayam may be reducing sympathetic arousal, resulting in lesser release of adrenaline, thus bringing about a fall in HR and SBP as reported in the previous study.[21] Slow deep breathing stimulates stretch receptors in the lungs that stimulate Hering-breuer inflation reflex. This causes a withdrawal of sympathetic tone that in turn leads to vasodilation and reduced DBP.[12] One of the more useful non-invasive methods of determining load on the heart is the RPP that is an indicator of myocardial oxygen consumption.[22,23] This was significantly reduced in both the asan and pranayam groups. The slow and conscious performance of the relaxing asanas in our subjects may be contributing to the cardiovascular changes evidenced this study. The benefits of asan may be attributed to intra-thoracic and intra-abdominal pressure changes that occur while performing these practices. The mechanisms for positive changes may also be an improvement of baroreflex sensitivity and attenuation of sympathetic and renin-angiotensin activity following Yoga training.[8] It has been reported that yoga improves "heart friendly" status of lipid profile in peri and post-menopausal DM[24] and Damodaran et al.[9] suggested that yoga can play an important role in risk modification for cardiovascular diseases.

A series of studies at Puducherry, India,[24,25-31] have documented immediate effects of various pranayam in hypertension where yoga has been shown to be an effective adjunct therapy. These changes were attributed to a normalization of autonomic cardiovascular rhythms as a result of increased vagal modulation and/or decreased sympathetic activity and improved baroreflex sensitivity along with an augmentation of endogenous nitric oxide production. The prolonged exhalation phase of pranava pranayam was hypothesized to mimic Valsalva maneuver resulting in decreased venous return, cardiac output and SBP. Pranayam has been shown to decrease oxygen consumption as well as the basal metabolic rate. Hence, the set of pranayam techniques used in this study may be a useful adjuvant to medical therapy in patients of hypertension and aid in cardiac rehabilitation post-myocardial infarction. Pranayam is relatively easier to perform than asan and requires less space than asan that involves different body postures requiring greater space for performance.

The strength of this study is the strict adherence to the practice schedule and near perfect attendance by all subjects. The duration of the study as well as the regularity of the practice make it stand out when compared to most yoga studies where compliance is much lower. The study is limited to non invasive measurements of HR and BP and doesn't allow for ambulatory measurements that would be more accurate. As other more exhaustive autonomic tests were not done exact mechanisms of action of yoga training is more hypothetical and cannot be substantiated fully.

CONCLUSION

This study offers further evidence of the cardiovascular relaxation afforded by yoga. It also has studied the differential effects of asan and pranayam training and found that both have similar beneficial effects as compared to a wait-listed control group. This may be attributed to the enhancement of parasympathetic tone and reduction in sympathetic activity in the autonomic nervous system. Pranayam is relatively easier to perform and hence the findings of this study give us scope for further research in clinical and geriatric population as well as those who are physically challenged.

REFERENCES

1. Goyal A, Yusuf S. The burden of cardiovascular disease in the Indian subcontinent. Indian J Med Res. 2006;124(3):235-44.
2. Gupta R. Trends in hypertension epidemiology in India. J Hum Hypertens. 2004;18(2):73-8.
3. Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: Analysis of worldwide data. Lancet. 2005;365(9455):217-23.
4. Madanmohan, Udupa K, Bhavanani AB, Shatapathy CC, Sahai A. Modulation of cardiovascular response to exercise by yoga training. Indian J Physiol Pharmacol. 2004;48(4):461-5.
5. Krishna BH, Pal P, Pal GK, Balachander J, Jayasettiaseelon E, Sreekanth Y, et al. Effect of yoga therapy on heart rate, blood pressure and cardiac autonomic function in heart failure. J Clin Diagn Res. 2014;8(1):14-6.
6. Punita P, Madanmohan T, Palamalai SR, Subramanian SK, Bhavanani AB, Madhavan C. Randomized controlled trial of 12-week yoga therapy as lifestyle intervention in patients of essential hypertension and cardiac autonomic function tests. Natl J Physiol Pharm Pharmacol. 2016;6(1):19-26.
7. Sharma M, Meena M, Sharma R, Meena CB, Meena PD, Chauhan N. Study on the effect of yoga training on hypertension. Indian J Sci Res Technol. 2013;1(2):89-95.
8. Selvamurthy W, Sridharan K, Ray US, Tiwary RS, Hegde KS, Radhakrishan U, et al. A new physiological approach to control essential hypertension. Indian J Physiol Pharmacol. 1998;42(2):205-13.
9. Damodaran A, Malathi A, Patil N, Shah N, Suryavansihi, Marathe S. Therapeutic potential of yoga practices in modifying cardiovascular risk profile in middle aged men and women. J Assoc Physicians India. 2002;50(5):633-40.
10. McCaffrey R, Ruknui P, Hatthakit U, Kasetsomboon P. The effects of yoga on hypertensive persons in Thailand. Holist Nurs Pract. 2005;19(4):173-80.
11. Pal GK, Velkumary S, Madanmohan T. Effect of short-term practice of breathing exercises on autonomic functions in normal human volunteers. Indian J Med Res. 2004;120(2):115-21.
12. Lathadevi GV, Uma Maheshwari T, Nagashree R. Modulation of cardiovascular response after Ujjayi pranayama and Shavasana training in normal human volunteers. J Clin Diagn Res. 2012;6(4):571-3.
13. Pramanik T, Pudasaini B, Prajapati R. Immediate effect of a slow pace breathing exercise Bhramari pranayama on blood pressure and heart rate. Nepal Med Coll J. 2010;12(3):154-7.
14. Dhanvijay AD, Bagede AH, Chaoudhary AK, Kishanrao SS, Dhokne N. Alternate nostril breathing and autonomic function in healthy young adults. IOSR J Dent Med Sci. 2015;14(3):62-5.
15. Srivastava RD, Jain N, Singhal A. Influence of alternate nostril breathing on cardiorespiratory and autonomic functions in healthy young adults. Indian J Physiol Pharmacol. 2005;49(4):475-83.
16. Satyanarayana P, Benerji GV, Dulala RK, Meka FB, Kummari NR. Effect of yoga on heart rate blood pressure, body mass index. IOSR J Dent Med Sci. 2013;8(2):36-9.
17. Prakhad SB, Palve SB, Chandrashekar M. Effect of yoga on indices of cardiovascular system in Maharashtrian adolescent girls. Natl J Physiol Pharm Pharmacol. 2015;5(2):120-33.
18. Streeter CC, Gerbarg PL, Saper RB, Ciraulo DA, Brown RP. Effects of yoga on the autonomic nervous system, gamma-aminobutyric-acid, and allostasis in epilepsy, depression, and post-traumatic stress disorder. Med Hypotheses. 2012;78(5):571-9.
19. Innes KE, Bourguignon C, Taylor AG. Risk indices associated with the insulin resistance syndrome, cardiovascular disease, and possible protection with yoga: A systematic review. J Am Board Fam Pract. 2005;18(6):491-519.
20. Innes KE, Vincent HK. The influence of yoga-based programs on risk profiles in adults with Type 2 diabetes mellitus: A systematic review. Evid Based Complement Alternat Med. 2007;4(4):469-86.
21. Gobel FL, Norstrom LA, Nelson RR, Jorgensen CR, Wang Y. The rate-pressure product as an index of myocardial oxygen consumption during exercise in patients with angina pectoris. Circulation. 1978;57(3):549-56.
22. Vijayalakshmi P, Madanmohan, Bhavanani AB, Patil A, Babu K. Modulation of stress induced by isometric handgrip test in hypertensive patients following yogic relaxation training. Indian J Physiol Pharmacol. 2004;48(1):59-64.
23. White WB. Heart rate and the rate-pressure product as determinants of cardiovascular risk in patients with hypertension. Am J Hypertens. 1999;12:50S-5.
24. Madanmohan, Bhavanani AB, Dayanidy G, Sanjay Z, Basavaraddi IV. Effect of yoga therapy on reaction time, biochemical parameters and wellness score of peri and post-menopausal diabetic patients. Int J Yoga. 2012;5(1):10-5.
25. Bhavanani AB, Sanjay Z, Madanmohan. Immediate effect of sukha pranayama on cardiovascular variables in patients of hypertension. Int J Yoga Therap. 2011;21:73-6.
26. Bhavanani AB, Madanmohan, Sanjay Z. Immediate effect of chandra nadi pranayama (left unilateral forced nostril breathing) on cardiovascular parameters in hypertensive patients. Int J Yoga. 2012;5(2):108-11.
27. 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.
28. Bhavanani AB, Madanmohan T, Sanjay Z, Vithiyalakshmi L. Immediate cardiovascular effects of pranava relaxation in patients of hypertension and diabetes. Biomed Hum Kinet. 2012;4:66-9.
29. Bhavanani AB, Madanmohan T, Sanjay Z. Suryanadi pranayama (right unilateral nostril breathing) may be safe for hypertensives. J Yoga and Phys Ther. 2012;2:118.
30. Bhavanani AB, Ramanathan M. Immediate cardiovascular effects of Savitri pranayama in sitting and supine positions in female volunteers. Yoga Mimamsa. 2012;44(2):101-12.
31. Madanmohan T, Bhavanani AB, Sanjay Z, Vithiyalakshmi L, Dayanidy G. Effects of a comprehensive eight week yoga therapy programme on cardiovascular health in patients of essential hypertension. Indian J Tradit Knowl. 2013;12:535-41.

How to cite this article: Vasanthan S, Madanmohan, Bhavanani AB, Hanifah M, Jaiganesh K. Comparative study on the effect of yogic relaxing asanas and pranayamas on cardiovascular response in healthy young volunteers. Natl J Physiol Pharm Pharmacol 2017;7(1):127-130.

Source of Support: Nil, **Conflict of Interest:** None declared.