IJPPAZ 56 (3) 193-292 (2012) ISSN 0019-5499

Volume 56 – Number 3 – July - September 2012

# Indian Journal of Physiology and Pharmacology

The official Journal of the Association of Physiologists and Pharmacologists of India

Indian J Physiol Pharmacol 2012; 56(3) : 273–278

*SHORT COMMUNICATION*

# IMMEDIATE CARDIOVASCULAR EFFECTS OF PRANAVA PRANAYAMA IN HYPERTENSIVE PATIENTS

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**( Received on August 18, 2011 )**

**Abstract :** Slow, deep, pranayama - based breathing training has been shown to be effective in reducing blood pressure (BP). The present study was undertaken to determine immediate effects of performing pranava pranayama on cardiovascular parameters in hypertensive patients. 29 hypertensive patients who were on medical treatment and also attending yoga sessions were recruited for the present study. Supine heart rate (HR) and BP were recorded before and after performance of pranava pranayama for five minutes. Post intervention statistical analysis revealed a significant ($P<0.05$) reduction in systolic pressure (SP) and a more significant ($P<0.01$) reduction in HR, pulse pressure and double product (Do P). The reduction in rate-pressure product (RPP) was highly significant ($P<0.001$). Pranava pranayama is effective in reducing HR and SP in hypertensive patients within five minutes of the practice. This may be due 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. Our findings have potential therapeutic applications in day-to-day as well as clinical situations where blood pressure needs to be brought down at the earliest. The significant fall in RPP and Do P signifies a reduction in oxygen consumption and work done by the heart. It is concluded that pranava pranayama, a simple and cost effective technique can be used in the management of hypertensive patients in addition to the regular medical management. Further studies are required to enable a deeper understanding of the mechanisms involved and its usefulness in the long- term management of hypertension.

**Key words :** yoga therapy hypertension pranava pranayama

## INTRODUCTION

Hypertension is one of the most common health disorders prevalent worldwide and is a major risk factor for stroke, coronary artery disease and organ failure. Yoga has

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been shown to be an effective adjunct therapy in hypertension and many studies have demonstrated the scientific basis of using it as a therapy and also as an effective lifestyle modification measure (1, 2).

Yoga as a therapy is simple and inexpensive and can be easily adopted in most patients without any complications (3). Yoga therapy encompasses the use of asana, pranayama and relaxation techniques along with dietary advice and yogic counselling that attempts to address the root cause of the problem rather than merely providing a symptomatic relief (4).

Pranayama is an integral component of holistic yoga therapy schedule and involves slowing down of the normal breathing rate along with an awareness based, conscious inner focus on respiration. Slow, deep, pranayama based breathing training has been shown to be effective in reducing blood pressure (BP) after 3 weeks and 3 months (5, 6).

Jerath et al have reported that slow deep breathing in pranayama results in decreased oxygen consumption, heart rate (HR) and BP (7). They postulated that the performance of voluntary slow breathing functionally resets the autonomic nervous system via stretch - induced inhibitory signals coupled with synchronization of neural elements in limbic system and cortex.

Pranava pranayama is an important technique of the Gitananda Yoga tradition and Vibrational Breath Therapy (VBT) modules propounded by Sri Bala Rathnam of Melbourne, Australia (www.vbt.com.au). It involves slow and deep inhalation with conscious use of complete yogic breathing (mahat yoga pranayama) followed by the audible vibratory resonance of a prolonged AUM chant. This technique is one of the practices taught in the comprehensive yoga therapy schedule used for hypertensive patients at ACYTER, JIPMER, Puducherry, India. Keeping this in mind, the present study was undertaken to determine immediate effects of performing pranava pranayama on cardiovascular parameters in hypertensive patients.

## MATERIALS AND METHODS

This study was conducted as part of a larger study on the effects of yoga therapy on hypertensive patients that had been accorded permission by the research and ethics councils of the institute. 29 subjects (16 male and 13 female, 49.34±2.36 y) attending yoga therapy sessions at ACYTER and able to perform pranava pranayama in a competent manner were recruited and informed consent obtained from them. All of them were receiving medical treatment for their hypertension at the Medicine OPD. Sub classification of the subjects according to JNC VII revealed that based on systolic pressure (SP) values, 11 of them were in the normal range, 14 in the prehypertensive range, two in stage I hypertension and two in stage II hypertension. Based on diastolic pressure (DP) values, 24 were in normal range, four in prehypertensive range and one in stage II hypertension. Patients of secondary hypertension and those with history, signs and symptoms or laboratory reports suggestive of nephrologic, neurologic and ophthalmologic complications were excluded from the study.

HR and BP were recorded in the supine position using a digital BP monitor, (CH – 432, Citizen Systems, Tokyo, Japan). The pre-intervention recording was done after 5 minutes of supine rest. Post-intervention recording was also done in the supine position immediately after the performance of 3 rounds of pranava pranayama in sitting position that took approximately 5 minutes. Rate-pressure product (RPP) was calculated as HR × SP/100 and double product (Do P) as HR × mean arterial pressure (MAP)/100.

The technique of pranava pranayama is as follows. The subject sits in a comfortable sitting position such as sukhasana, ardha padmasana or vajarasana. He/she then performs three rounds of slow and deep yogic breathing into low chest, mid chest and upper chest followed by the prolonged audible rendition of the akara, ukara and makara nada (Aaa, Uuu and Mmm sounds) respectively during exhalation phase. Following this, he/she performs three rounds of the complete yogic breathing (mahat yoga pranayama) technique with an audible rendition of omkara nada (AUM sound) during exhalation phase. Appropriate hasta mudras (hand gestures) are used during each part of the four-part practice. The time taken for the exhalation with nada is approximately three times the time taken for each inhalation, thus maintaining a ratio of 1:3. After completing the performance of pranava pranayama that took approximately 5 minutes, the subject lay down in the supine position and post intervention HR and BP were recorded.

Data was assessed for normality using GraphPad InStat and passed normality testing by Kolmogorov-Smirnov Test. Statistical analysis was done using Students t (paired) test and p values less than 0.05 were accepted as indicating significant differences between pre and post intervention data.

## RESULTS

The values are given as mean±SEM. Post intervention statistical analysis revealed a significant ($P<0.05$) reduction in SP from 126.86±3.03 to 124.07±3.09 mmHg and a more significant ($P<0.01$) reduction in HR from 75.24±2.34 to 72.96±2.22 beats/min, pulse pressure (PP) from 52.79±2.24 to 50.06±2.23 mm Hg, and Do P from 69.07±2.75 to 66.26±2.65 units. The reduction in RPP from 95.31±3.66 to 90.43±3.49 units was statistically highly significant ($P<0.001$).

Upon analysis of subgroups based on JNC VII (12) criteria, the maximum % decrease in HR (5.1%) and Do P (6%) was in patients who were in the normotensive range while maximum % decrease in SP (3.4%), PP (10.2%) and RPP (7.21%) was in those who were in the range of stage I and II hypertension. The least % fall in HR (1.31%), SP (1.85%), PP (3.6%), RPP (3.3%) and Do P (2.6%) was in patients in the prehypertensive range.

## DISCUSSION

Our finding that pranava pranayama produces an immediate decrease in HR and SP is similar to earlier studies that have reported on the immediate effects of slow and deep breathing (8, 9). In a recent study, we have reported that sukha pranayama involving equal periods of inhalation and exhalation at the rate of 6 breaths/min can

reduce HR and BP in hypertensive patients within five minutes. We have postulated that this could be attributed to normalization of autonomic cardiovascular rhythms due to either improved vagal modulation, and/or decreased sympathetic activity and improved baroreflex sensitivity (10).

In one of our pilot studies on 19 hypertensive patients, we have found that 15 minutes of shavasana with pranava pranayama reduces SP, DP, PP and MAP in hypertensive patients. There was also a significant fall in RPP and Do P signifying a reduction in $O_2$ consumption and work done by the heart. However, as that study was done in shavasana, the cardiovascular effects of pranava pranayama may have been influenced by the supine position. There are two major differences between these two studies. The first is that the decrease in HR was not statistically significant when pranava pranayama was performed in the supine position in our earlier study whereas in the present study it is highly significant. The second major difference is that the decrease in DP was significant in our earlier pilot study whereas there is no change in DP in the present study. This may be attributed to a reduction in perceived stress, peripheral vasodilatation as a result of decrease in sympathetic tone and the normalization of cardiac autonomic regulatory processes. These may be more apparent in the supine position as compared to the sitting postures that may be preventing a fall in peripheral resistance.

Conscious deep breathing with prolonged exhalation and audible chanting during pranava pranayama may be contributing towards the normalization of autonomic cardiovascular rhythms. These rhythms first described by Mayer more than a century ago occur as a 10 second cycle in BP and are co-related to both vagal and sympathetic activity. Bernardi et al have reported the beneficial effects of rosary prayer and yoga mantras in restoring these autonomic cardiovascular rhythms (11). They reported an increase in baroreflex sensitivity following such chanting and concluded that rhythm formulas involving breathing at 6 breaths/min induce favourable psychological and possibly physiological effects. The audible chanting of the pranava in the present study may be having a similar effect on baroreflex sensitivity as Joseph et al reported a fall in BP and normalisation of baroreflex sensitivity in hypertensive patients following just 2 minutes of slow breathing at 6 breaths/min (12).

Pramanik et al studied the immediate effect of 5 minutes of bhramari pranayama using 1:3 ratio, similar to the time cycle used in our present study (13). They reported a decrease in SP, DP, MP and HR that was significant with respect to DP and MP and concluded that bhramari pranayama induced parasympathetic dominance. Pranava pranayama like bhramari, is also a nada pranayama employing audible sounds during exhalation, hence these findings are comparable with our findings.

It has been postulated that pranayama increases frequency and duration of inhibitory neural impulses by activating pulmonary stretch receptors as in Hering Bruer reflex (8). Withdrawal of sympathetic tone to skeletal muscle blood vessels leads to widespread vasodilatation decreasing peripheral resistance, hence reducing DP.

This could be a mechanism by which DP decreased in our earlier pilot study when pranava was done in shavasana and that the sitting position adopted by the subjects in the present study was a confounding factor in this regard.

Valsalva manoeuvre produces an increased intrathoracic pressure and decreased pre-load to the heart. Humming shares many physiological similarities to Valsalva and is equally effective for distending the jugular and common femoral veins (14). The prolonged exhalation phase of pranava pranayama mimicked Valsalva manoeuvre resulting in a decrease in venous return, cardiac output and SP. The absence of reflex tachycardia may be due to a simultaneous blunting of the sympathetic component by pranava -induced relaxation.

It has been reported that the stimulation of endogenous Nitric Oxide (NO) pathways might enhance parasympathetic protection against adverse influences of cardiac sympathetic over activity (15). NO appears to play a tonic facilitatory role in baroreflex control of cardiac parasympathetic activity and acts at a postsynaptic level to facilitate cardiac responses to muscarinic stimulation when background levels of adrenergic activity are high. As low pitch humming increases tissue nasal NO production, it is possible that pranava pranayama is stimulating endogenous production of NO and thus producing a cardio protective benefit (16).

The effects in our study were more pronounced with regard to RPP and Do P due to cumulative benefits occurring as result of reduction in HR, SP and MAP. RPP and Do P are especially significant as they are indicators of myocardial oxygen consumption and load on the heart and therefore imply a lowering of strain on the heart (5).

**Conclusion**

It is concluded that the practice of pranava pranayama is effective in reducing HR and SP in hypertensive patients. This may be due 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 NO production. Our findings have potential therapeutic applications in day-to-day as well as clinical situations where BP needs to be brought down at the earliest. This simple and cost effective technique may be added to the management protocol of hypertension in addition to regular medical management. Further studies are required to enable a deeper understanding of the mechanisms involved. We plan to further investigate how long such a BP lowering effect persists as this will provide more information about its usefulness in the long-term management of hypertension.

ACKNOWLEDGEMENTS

We thank L Vithiyalakshmi and G Dayanidy, yoga instructors at ACYTER for their assistance during the study. We are also grateful to the Department of AYUSH, Ministry of Health and Family Welfare, Government of India for establishing ACYTER as a collaborative venture between the MDNIY, New Delhi and JIPMER, Puducherry.

## REFERENCES


1. Sharma R, Gupta N, Bijlani R. Effect of yoga based lifestyle intervention on subjective well being. *Indian J Physiol Pharmacol* 2008; 52: 123–131.
2. Sundar S, Agrawal SK, Singh VP et al. Role of yoga in management of essential hypertension. *Acta Cardiol* 1984; 39: 203–208.
3. Vijayalakshmi P, Madanmohan, Bhavanani AB et al. Modulation of stress induced by isometric handgrip test in hypertensive patients following yogic relaxation training. *Indian J Physiol Pharmacol* 2004; 48: 59–64.
4. Bhavanani AB. Are we practicing yoga therapy or yogopathy ? *Yoga Therapy Today* 2011; 7: 26–28.
5. Madanmohan, Udupa K, Bhavanani AB et al. Effect of slow and fast pranayams on reaction time and cardio respiratory variables. *Indian J Physiol Pharmacol* 2005; 49: 313–318.
6. Pal GK, Velkumary S, Madanmohan. Effect of short-term practice of breathing exercises on autonomic functions in normal human volunteers. *Indian J Med Res* 2004; 120: 115–121.
7. Jerath R, Edry JW, Barnes VA et al. Physiology of long pranayamic breathing: neural respiratory elements may provide a mechanism that explains how slow deep breathing shifts the autonomic nervous system. *Med Hypotheses* 2006; 67: 566–571.
8. Pramanik T, Sharma HO, Mishra S et al. Immediate effect of slow pace bhastrika pranayama on blood pressure and heart rate. *J Altern Complement Med* 2009; 15: 293–295.
9. 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.
10. Bhavanani AB, Madanmohan, Zeena Sanjay. Immediate effect of sukha pranayama on cardiovascular variables in patients of hypertension. *Int J Yoga Therap* 2011; 21: 73–76.
11. Bernardi L, Sleight P, Bandinelli G et al. Effect of rosary prayer and yoga mantras on autonomic cardiovascular rhythms: comparative study. *BMJ* 2001; 323: 1446–1449.
12. Joseph CN, Porta C, Casucci G, et al. Slow breathing improves arterial baroreflex sensitivity and decreases blood pressure in essential hypertension. *Hypertension* 2005; 46: 714–718.
13. Pramanik T, Pudasaini B, Prajapati R. Immediate effect of slow pace breathing exercise Bhramari pranayama on blood pressure and heart rate. *Nepal Med Coll J* 2010; 12: 154–157.
14. Lewin MR, Stein J, Wang R et al. Humming is as effective as Valsalva's maneuver and Trendelenburg's position for ultrasonographic visualization of the jugular venous system and common femoral veins. *Ann Emerg Med* 2007; 50: 73–77.
15. Chowdhary S, Marsh AM, John H et al. Nitric oxide and cardiac Muscarinic control in humans. *Hypertension* 2004; 43: 1023–1028.
16. Eby GA. Strong humming for one hour daily to terminate chronic rhinosinusitis in four days: A case report and hypothesis for action by stimulation of endogenous nasal nitric oxide production. *Med Hypotheses* 2006; 66: 851–854.