Contents

Editorial
Models and mechanisms in yoga research

Original Articles
Yoga in Australia: Results of a national survey
Yoga breathing through a particular nostril is associated with contralateral event-related potential changes
Immediate effect of chandra nadi pranayama (left unilateral forced nostril breathing) on cardiovascular parameters in hypertensive patients
Effect of holistic yoga program on anxiety symptoms in adolescent girls with polycystic ovarian syndrome: A randomized control trial
Comparative study of conventional therapy and additional yogasanas for knee rehabilitation after total knee arthroplasty
Study of the effect of yoga training on diffusion capacity in chronic obstructive pulmonary disease patients: A controlled trial
A comparative study of the effects of yoga and swimming on pulmonary functions in sedentary subjects

ISSN 0973-6131

Online full text at http://www.ijoy.org.in
Immediate effect of chandra nadi pranayama (left unilateral forced nostril breathing) on cardiovascular parameters in hypertensive patients

Ananda Balayogi Bhavanani, Madanmohan1, Zeena Sanjay2
Program Co-ordinator, 1Professor and Head, Department of Physiology and Program Director, 2Senior Research Fellow, ACYTER, JIPMER, Puducherry, India

Address for correspondence: Dr. Ananda Balayogi Bhavanani,
Programme Co-ordinator, Advanced Centre for Yoga Therapy,
Education and Research (ACYTER), JIPMER, Pondicherry - 605 006, India.
E-mail: ananda@icyer.com

ABSTRACT

Introduction: Recent studies have reported differential physiological and psychological effects produced by exclusive right and left nostril breathing and clinical research is required to prove immediate and sustained efficacy of these techniques in various psychosomatic conditions such as hypertension (HT). The present study was designed to determine immediate effects of 27 rounds of exclusive left nostril breathing, a yogic pranayama technique known as chandra nadi pranayama (CNP) on cardiovascular parameters in patients of essential HT.

Materials and Methods: Twenty two patients of essential HT under regular standard medical management were individually taught to perform CNP by a qualified yoga instructor with a regularity of 6 breaths/min throughout a performance of 27 rounds of CNP. Pre and post intervention heart rate (HR) and blood pressure (BP) measurements were recorded using non-invasive semi-automatic BP monitor and Students t test for paired data used to determine significant differences.

Results: Twenty seven rounds of CNP produced an immediate decrease in all the measured cardiovascular parameters with the decrease in HR, systolic pressure (SP), pulse pressure, rate-pressure product and double product being statistically significant. Further, gender-based sub-analysis of our data revealed that our male participants evidenced significant reductions in HR and SP with an insignificant decrease in diastolic pressure, while in female participants only HR decreased significantly with an insignificant decrease in SP.

Discussion and Conclusion: It is concluded that CNP is effective in reducing HR and SP in hypertensive patients on regular standard medical management. To the best of our knowledge, there are no previously published reports on immediate effects of left UFNB in patients of HT and ours is the first to report on this beneficial clinical effect. This may be due to a normalization of autonomic cardiovascular rhythms with increased vagal modulation and/or decreased sympathetic activity along with improvement in baroreflex sensitivity. Further studies are required to enable a deeper understanding of the mechanisms involved as well as determine how long such a BP lowering effect persists. We recommend that this simple and cost effective technique be added to the regular management protocol of HT and utilized when immediate reduction of BP is required in day-to-day as well as clinical situations.

Key words: Blood pressure; chandra nadi pranayama; hypertension; yoga therapy.

INTRODUCTION

The science of swara (nasal cycle) that has recently caught interest of scientists all over the world, had been analyzed extensively by Indian yogis of lore. Though they lacked the equipment available to modern science, these yogis through their dedicated practice (abhyasa), inner vision (antar drishti) and self-analysis (swadhyaya) had made extensive observations on this concept. The Vedic science of understanding the function of the nasal cycle is known as Swarodaya Vigjnan (swara = sonorous sound produced by the airflow through the nostrils in the nasal cycle, udaya = functioning state, and vigjnan = knowledge). The Shivaswarodaya, an ancient treatise advises quieter, passive activities (soumya karya) when left nostril (ida/chandra
that based on either systolic pressure (SP) or diastolic pressure (DP) values, 16 were in the prehypertensive range, 4 in stage I HT and 2 in stage II HT even with regular medication. None of them had any previous experience of yoga training. Informed consent was obtained by one of the investigators. Pre intervention heart rate (HR) and blood pressure (BP) were recorded after 5 min of rest in sitting posture using non-invasive semi-automatic BP monitor (CH – 432, Citizen Systems, Tokyo, Japan).

The subjects were individually taught to perform CNP by a qualified yoga instructor. An overview of the practice was given to the patients and then they were instructed to take up an erect sitting position with palms on their thighs. They were asked to keep their eyes closed to facilitate the development of inner awareness. The subjects were instructed to perform nasika mudra with their right hand, by touching the tip of their index finger to the base of their thumb. The right thumb was then used to close their right nostril with gentle pressure. The pranayama was then performed through the unblocked left nostril in a calm and regular manner with a conscious effort to use low, mid and upper parts of the lungs in a sequential manner for both inspiration and expiration. Subjects were instructed to breathe in and out for an equal count of 5 that was given by the instructor throughout the period in tune with a stop watch. A regularity of counts at the rate of 6 breaths/min (BPM) was maintained by the instructor for the entire duration of nearly 5min taken to complete 27 rounds of CNP.

Post intervention HR and BP measurements were recorded again at the end of the 27 rounds of CNP. Pulse pressure (PP) was calculated as SP-DP, mean pressure (MP) as DP + 1/3 PP, rate-pressure product (RPP) as HR × SP/100 and double product (Do P) as HR × MP/100.

Statistical analysis of pre and post intervention data was done using GraphPad InStat version 3.06 for Windows 95, GraphPad Software, San Diego California USA, www.graphpad.com. All data passed normality testing by Kolmogorov-Smirnov test and hence was analyzed using Students t test for paired data. P values less than 0.05 were accepted as indicating significant differences between pre and post intervention data.

RESULTS

Results of the pre and post intervention comparisons are given in Table 1. All values are given as mean ± SEM. 27 rounds of CNP produced an immediate decrease in all the measured cardiovascular parameters with the decrease in HR, SP, PP, MP, RPP and Do P being statistically significant while the fall in DP missed statistical significance. Students paired t test showed significant reductions in HR, t (21) = 4.23, P <0.001, SP,
**Table 1**: Immediate effect of chandra nadi pranayama on heart rate (HR), systolic pressure (SP), diastolic pressure (DP), pulse pressure (PP), mean pressure (MP), rate-pressure product (RPP) and double product (Do P) in patients of essential hypertension. B: before and A: after the intervention.

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>A</th>
<th>% change</th>
<th>t value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR (beats/min)</td>
<td>75.77 ± 3.15</td>
<td>73.45 ± 3.12</td>
<td>-3.06</td>
<td>4.23 (21)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>SP (mmHg)</td>
<td>134.68 ± 3.17</td>
<td>130.27 ± 3.16</td>
<td>-3.27</td>
<td>3.61 (21)</td>
<td>0.0016</td>
</tr>
<tr>
<td>DP (mmHg)</td>
<td>78.77 ± 1.74</td>
<td>78.05 ± 1.89</td>
<td>-0.91</td>
<td>0.74 (21)</td>
<td>0.467</td>
</tr>
<tr>
<td>PP (mmHg)</td>
<td>55.91 ± 2.99</td>
<td>52.23 ± 2.56</td>
<td>-6.58</td>
<td>2.95 (21)</td>
<td>0.0076</td>
</tr>
<tr>
<td>MP (mmHg)</td>
<td>97.41 ± 1.84</td>
<td>95.45 ± 2.06</td>
<td>-2.01</td>
<td>2.20 (21)</td>
<td>0.0395</td>
</tr>
<tr>
<td>RPP (units)</td>
<td>101.87 ± 4.66</td>
<td>95.58 ± 4.59</td>
<td>-6.17</td>
<td>5.07 (21)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>DoP (units)</td>
<td>73.94 ± 3.56</td>
<td>70.35 ± 3.69</td>
<td>-4.85</td>
<td>4.55 (21)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Values are mean ± SEM for 22 subjects. t and P values as obtained from Students t test for paired data.

Further, gender based sub-analysis of our data revealed that the male participants evidenced significant reductions in HR, t (11) = 2.48, P = 0.03 and SP, t (11) = 2.97, P=0.013 from 73.17 ± 3.78 to 71.25 ± 3.70 beats/min and 132.75 ± 4.55 to 128.08 ± 4.71 mm HG respectively. The decrease in DP from 77.91 ± 1.89 to 81.00 ± 2.06 mm HG just missed significance t (11) = 2.09, P = 0.06. On the other hand in female participants, only HR decreased significantly from 78.90 ± 5.28 to 76.10 ± 5.31 beats/min, t (9) = 3.56, P = 0.006 while the decrease in SP from 137.00 ± 4.46 to 132.90 ± 4.14 mm HG just missed significance, t(9) = 2.05, P = 0.07. There was a statistically insignificant rise in DP in female participants 79.80 ± 1.33 to 81.00 ± 1.87 mm HG.

**DISCUSSION**

The immediate decrease in all cardiovascular parameters in our patients can be explained by changes in the autonomic balance as it has been previously reported that sympathetic activity is lower during left nostril breathing.[6] It has also been reported that exclusive left nostril breathing, repeated 4 times a day for a month reduced sympathetic activity.[7]

We have earlier reported that the practice of sukhaprana yama for 5 min at a rate of 6 BPM reduces HR and BP in patients of hypertension.[8] In both that study as well as the present study we have found significant reduction in SP values that were on the higher side despite regular medication. However we have found in both studies that DP didn’t change much and this may be attributed to the fact it was already stabilized within the normal range with medication.

The cardiovascular effects in the present study as well as our previous one are more pronounced with regard to the RPP and Do P due to the cumulative benefits occurring as a result of reduction in HR as well as BP RPP and Do P are especially important in patient care as they are indirect indicators of myocardial oxygen consumption and load on the heart, thereby signifying a lowering of strain on the heart.[9] The RPP also provides a simple measure of overall heart rate variability (HRV) in hypertensive patients and is a surrogate marker In situations where HRV analysis is not available.[10] Hence, the reduction in RPP in our study implies better autonomic regulation of the heart in hypertensive patients. A previous study from our laboratories reported that pranayama training of three months duration modulates ventricular performance by increasing parasympathetic activity and simultaneously decreasing sympathetic activity.[11] This may explain significant decreases in HR and BP observed in the present study with pronounced effects on the heart.

Our findings are in agreement with those of a previous report that left UFNB at the rate of 6 BPM lowers HR with compensatory increase in stroke volume and end diastolic volume.[4] Another study done on normal volunteers reported a significant decrease in SP and MP following 30 min of exclusive left nostril breathing while the small reduction in DP in that study also missed significance as in ours.[5] This shows that similar beneficial effects can be obtained in hypertensive patients even after less than 5 min of pranayama practice. Interestingly Raghuraj and Telles reported a significant increase in HR whereas we have found a significant decrease in HR in the present study. They suggested that the fall in SP may have been influenced by changes in cardiac output (CO), peripheral vascular resistance and humoral factors.[6] However the rise in HR in their study doesn’t support the contention of changes in CO and if there was change in peripheral vascular resistance, it should have been reflected in the DP changes. As the HR reduced significantly in our study, it is more plausible that the fall is SP is related to CO. They had not used timed breathing rates in their study whereas our subjects were breathing at the rate of 6 BPM and this may have harmonized respiratory and cardiovascular Meyer rhythms, resulting in changes in HR as well as BP. Breathing at the rate of 6 BPM increases vgal modulation of sinoatrial (SA) and atrioventricular (AV) nodes[13] and enhances baroreceptor sensitivity[14] by entraining all RR interval fluctuations, thereby causing them to merge at the rate of respiration and to increase greatly in amplitude. This
increase in RR interval fluctuations enhances baroreflex efficiency and may have contributed towards lowering the BP.[16] Increase vagal modulation of SA and AV nodes along with enhancement of baroreceptor sensitivity may be responsible for reduction in HR and subsequent fall in SP evidenced in our study.

Interestingly the gender based sub-analysis of our data reveals that our male participants evidenced significant reductions in HR and SP with an insignificant decrease in DP while in female participants only the HR decreased significantly with an insignificant decrease in SP. The statistically insignificant increase in DP in our female participants as opposed to its decrease in our male participants seems to have influenced the overall result with regard to DP. Similar differences between genders following UFNB have been reported suggesting that there may be a nostril laterality affecting the autonomous nervous system differentially in males and females.[16] The differential effect on BP between genders as evidenced by our study is in agreement with another previous study in normal healthy volunteers that reported significant reduction in HR, SP and DP after 15min of left nostril breathing in males while the reduction in females was significant only with regard to HR.[17] The different response of our female participants may also be due to the fact that most of them were peri and postmenopausal and this may have influenced their autonomic status.

It is concluded that CNP is effective in reducing HR and SP in hypertensive patients on regular standard medical management. To the best of our knowledge, there is no previous published report on immediate effects of left UFNB in patients of HT and ours is the first to report on this beneficial clinical effect. This may be due to a normalization of autonomic cardiovascular rhythms with increased vagal modulation and/or decreased sympathetic activity along with improvement in baroreflex sensitivity. Further studies are required to enable a deeper understanding of the mechanisms involved as well as determine how long such a BP lowering effect persists. We recommend that this simple and cost effective technique be added to the regular management protocol of HT and utilized when immediate reduction of BP is required in day-to-day as well as clinical situations.

ACKNOWLEDGMENTS

The authors thank Selvi L Vithiyalakshmi, yoga instructor ACYTER for her assistance during the study. We also thank the Director, MDNIY and Director, JIPMER for their support as this study was possible because ACYTER has been established as a collaborative venture between the Morarji Desai National Institute of Yoga, New Delhi and JIPMER, Puducherry with funding from Department of AYUSH, Ministry of Health and Family Welfare, Government of India.

REFERENCES