

Immediate Effects of *Bhramari Pranayama* on Resting Cardiovascular Parameters in Healthy Adolescents

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ABSTRACT

Introduction: In yoga, Pranayama has a very important role in maintaining sound health. There is some strong scientific basis on constant physiological changes produced when pranayama is practiced for long duration. Still, there exists a dearth of literature on the effect of *Bhramari pranayama* (Bhr.p) on physiological systems.

Aim: To assess the immediate effect of *Bhramari pranayama* (Bhr.P) practice on the resting cardiovascular parameters in healthy adolescents.

Materials and Methods: Sixty apparently healthy adolescents of both sex participated in the study. They were randomly divided into Bhr.P (n-30) and control (n-30) group. Informed consent was obtained after explaining the detailed procedure of the study. Bhr.P group practiced *Bhramari pranayama* for 45 min

(5 cycles) and control group was allowed to do normal breathing (12-16 breath /min). Heart rate (HR) was assessed by radial artery palpation method and blood pressure was recorded in supine position after 5 minutes of rest by sphygmomanometer.

Results: The HR reduced significantly (p-0.001) in Bhr.P group. BP indices, Pulse Pressure (PP), Mean Arterial Pressure (MAP), Rate Pressure Product (RPP) and Double Product (DoP) significantly decreased after Bhr.p practice compared with control. Pre and Post inter group analysis also showed that significant reduction in HR and BP indices in Bhr.P group.

Conclusion: Present study showed that Bhr.P practice produces relaxed state and in this state parasympathetic activity overrides the sympathetic activity. It suggests that *Bhramari pranayama* improves the resting cardiovascular parameters in healthy adolescents.

Keywords: Breathing, Blood pressure, Heart rate, Vagal tone

INTRODUCTION

Pranayama is defined as a manipulation of one's own breathing movement. In yoga "*Prana*" means life force/energy and "*Ayama*" means to control. So Pranayama Practice will help us control the life force or energy and make our system more healthy and energetic. Pranyamas such as *Savitri*, *Kapalabhati*, *Bhasrika*, *Nadisuddhi*, *Bhramari* cause pronounced physiological responses among normal healthy people [1]. Further, it is known that yoga and pranayama are helpful in managing the cardiopulmonary diseases, autonomic nervous system imbalances and psychosomatic disorders [2-4]. Most of the studies previously done have reported the effect of different pranayama individually as well as collectively with different duration of these practices (e.g., immediately, 1 month, 3 months, etc.) [5-8].

In this growing era of scientific advances on yoga where scientific evidences about pranayama are increasing, *Bhramari pranayama* (Bhr.P) is one among the pranayama that could be practiced by everyone which lack in evidence on various physiological effects. *Bhramari* is derived from the Sanskrit word '*Bhramar*' meaning Wasp. It is because of the humming sound that is produced during the expiration mimicking the flying wasp, it is named as *Bhramari pranayama*. Immediately after 5 min of practice of Bhr.P, the heart rate and blood pressure is influenced in healthy subjects because of the parasympathetic dominance [9]. High frequency paroxysmal gamma wave pattern is observed in the participants immediately after practicing the Bhr.P [10,11]. These gamma brain waves are related with the performance of high mental activities and perceptual task. Apart from these, there are no further studies on the effects of Bhr.P.

Adolescent population is one vulnerable group who are in the transformation period between the childhood and adulthood [12]. They face lot of stress in this period in multi

dimensionary perspective; physical stress due to their changing physiology, mental and emotional stress and the social stress in accommodating the changes that approach them in their social environment. They face high level of anxiety during this period [13]. They need support to cope up in a better way that could be beneficial both in their adolescent period as well as in their later lives [14]. The association of stress to the cardiovascular complications is very well known. Further, there is evidence that yoga and pranayama practice help in reducing and managing the stress of day to day life event [15].

AIM

The present pilot study aimed to record the immediate effect of single session of Bhr.P practice on resting cardiovascular parameters.

MATERIALS AND METHODS

This study was carried out during July-September 2014 at the Physiology department of Sri Ramachandra Medical College and Research Institute. Ethical approval {IEC-NI/14/JAN/38/07} was obtained from the institutional human ethical committee in Sri Ramachandra University (SRU). Before recruiting the school children, permission from the head/ principal of the school was exercised through proper channel. Written informed consent was obtained from the parents or guardians after explaining the detailed procedure in the intervention and separate assent also has been exercised from the students since it was a voluntary participation.

Sixty healthy adolescents of both sex (38 males and 22 females) with mean age of 14.56±2.01 years participated. Students with any history of metabolic or systemic diseases, under any medication, recent surgery within three months, active athletes, or previous yoga training were excluded and only apparently healthy students

after general as well as systemic examination were included in the study. They were randomly grouped into two; Bhr.P (n=30) and control (n=30) group.

All their assessments were done in the evening between 3 pm and 4 pm. Height (cm) and weight (kg) was measured and their BMI was calculated. Heart rate was recorded in radial artery after ten minutes of the supine rest and blood pressure was obtained in standard manner by sphygmomanometer. All the reading noted three times with five minutes interval and lowest of all the three values was included for the study.

Bhramari Pranayama

Bhr.P training was given by qualified yoga doctors as per standard procedure. Accordingly, the subjects were made to sit in any comfortable posture with erect spine with their eyes closed. At this position, they were asked to take slow and deep inhalation through both the nostrils (5 secs approx), followed by deep and slow exhalation in the same way (15 secs approx.) with their thumbs on two external auditory canal. While exhaling, they are instructed to chant the "A U Mmm" mantra along with a humming nasal sound similar to that of a wasp. It causes mild vibration on the laryngeal walls and the inner walls of the nostrils. This complete procedure at the respiratory rate 3-4/min followed with one min rest form one cycle of Bhr.P [16]. They were allowed to practice up to 5 cycles (45 min) in the same manner. Control group subjects were made to do normal breathing (12-16 breath/min) with eyes open in a comfortable sitting posture. After this, the blood pressure and heart rate were again recorded using the same instrument mentioned earlier for both the groups.

RESULTS

[Table/Fig-1] depicts the demography of both the study group and control group. They were not significantly different in age, height, weight and BMI so both groups were ideal for comparison. [Table/Fig-2] shows the cardiovascular parameters taken immediately after practice of Bhr.P for 45 min and found significant reduction of the resting cardiovascular parameters in the Pranayama group. The HR reduced from 77.35±5.6 to 72.7±2.84 (p=0.006), SBP from 116.8±4.9 to 112.3±4.4 (p=0.009), DBP from 74.1±4.12 to 71.85±3.4 (p=0.039), MAP from 88.3±3.4 to 85.33±2.4 (p=0.0241), RPP from 90.32±7.38 to 81.64±4.56 (p=0.006) and DoP from 6834.3±583 to 6204.3±331 (p=0.0003). Though there was a decrease in PP from 42.7±5.92 to 40.45±5.49 it was not statistically significant (p=0.0592).

Demographic Variable	Bhr. P Group	Control Group
Age (y)	15.24±1.23	14.23±1.93
Height (cm)	143.12±10.12	142.00±7.92
Weight (kg)	54.28±9.53	47.11±7.95
BMI (kg/m ²)	19.44±4.07	20.89±3.18

[Table/Fig-1]: Demographic characteristics of Bhr.P and Control group. Data expressed Mean ± SD.

BP Variable	Bhr. P Group		Control Group	
	Before	After	Before	After
SBP(mmHg)	116.8±4.9	112.3±4.4** #	114.9±5.9	116.1±4.3
DBP(mmHg)	74.1±4.12	71.85±3.4** #	74.9±3.4	75.9±2.19
HR(beat/min)	77.35±5.6	72.7±2.84** #	75.30±4.95	76.3±3.57
MAP (mmHg)	88.3±3.4	85.33±2.4* #	88.23±2.2	89.3±1.7
PP(mmHg)	42.7±5.92	40.45±5.49	40.0±7.07	40.20±5.34
RPP(bpm-mmHg)	90.32±7.38	81.64±4.56** #	86.62±8.11	88.62±6.09
DoP(bpm mmHg)	6834.3±583	6204.3±331**** #	6645.86±500	6813.6±348

[Table/Fig-2]: Resting cardiovascular Parameters before and immediately after Bhr.P practice.

Data expressed Mean ± SD. Paired t.test and unpaired t.test was used to compare the intra and inter group differences. * compared within the group, # compared between the group.

*p<0.05, **p<0.01, ***p<0.001. # p<0.05, ##p<0.01, ###p<0.001.

DISCUSSION

In this study, it was found that following a single session of 5 cycles of (45 min) Bhr.P practice, has significant effects on resting cardiovascular parameters in the healthy adolescents. We observed that DBP, SBP, HR, MAP, RPP, and Do P decreased significantly in Bhr.P group. A similar result was observed in a study done by Pramanik et al., in that study, immediately after 5 minutes of Bhr.P practice, they found a decrease in SBP, DBP, MAP and HR. From this, they derived a conclusion that Bhr.P induced parasympathetic dominance however their study design was different from our study because they have given the intervention of Bhr.P practice for only 5 min [9]. In another study, it was found that BP and HR decreased significantly when measured immediately after the practice of Savitri Pranayama which is similar to Bhr.P supports our results as well [17]. Sympathetic Nervous System (SNS) and Parasympathetic Nervous System (PNS) determines the HR and DBP. Parasympathetic is associated with the HR and the SNS with the DBP by altering the peripheral vascular resistance. The Mean Arterial Pressure (MAP) of the cardiac cycle is determined by both the SNS and PNS. Hence, parasympathetic activity increases and sympathetic decreases in the Bhr.P group causing a decrease in HR, DBP and MAP. RPP and Do P are the index of the Oxygen consumption and workload of the heart and they denote the status of sympathetic activity [18-20]. Decrease in RPP and Do P represent decreased workload on the heart in the Bhr.P group which is a favourable outcome. In deep breathing pulmonary stretch receptors are stimulated which lead to withdrawal of sympathetic tone on the skeletal muscle causing pervasive vasodilatation with decrease of peripheral resistance [21].

During extended voluntary expiration, there is raise of intra-thoracic pressure causing more blood flow to the heart from lung and thus increasing the stroke volume. This in turn increases the blood pressure stimulating the baroreceptors in carotid sinus [22]. Further, this increased baroreceptor discharge inhibits the vasoconstrictor nerves and excites the vagus innervations of the heart. These are the possible reasons for a drop in blood pressure and heart rate in our study. Jerath et al., have reported that slow deep breathing in pranayama results in decreased oxygen consumption, heart rate (HR) and BP [23], thus adding more strength to our study. Neural activity in heart, lung, limbic system and cortex is synchronized by the signals of two main sources; one is the slow adapting stretch receptors which produces inhibitory signal by deep inspiration above tidal volume and the other is the hyperpolarized current produced when the connective tissues like fibroblast around lungs are stretched [24-26]. This in turn causes the cells of cardiopulmonary and central nervous system to act rhythmically within them and regulating the excitability of nervous tissues. All these create a state of relaxation. In todays modern industrial societies most of the children and adolescents are not having proper physical activity and this lead to an increased risk of cardiovascular and other lifestyle-related diseases later in their adulthood [27].

Yoga is currently being accepted as a part of academic curriculum in some school programs and is gaining more awareness not only in teachers but also among the parents. Obesity among the adolescents is increasing because of their sedentary nature, yoga remains as the only ideal option and alternative form of physical therapy that is beneficial both for their body and mind. It has strong effects on physiological system in improving the physical fitness along with their performance by enhancing the cognitive function. As for our study is concerned, Bhr.P as a pranayama was well accepted by the students because of its simplicity, the humming sound produced during the practice and the mimicking group chanting that induced deep state of relaxation like meditation. 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 the respiration.

CONCLUSION

The findings of this study concludes that Bhr.P (3bpm) practice improves the cardiovascular parameters through parasympathetic dominance in adolescents and it can be practiced routinely for the reduction of stress induced cardiovascular risk in their future.

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