Immediate effect of a slow pace breathing exercise *Bhramari pranayama* on blood pressure and heart rate

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ABSTRACT

The study was carried out to evaluate the immediate effect *Bhramari pranayama,* a slow breathing exercise for 5 minutes on heart rate and blood pressure. Heart rate and blood pressure of volunteers were recorded. The subject was directed to inhale slowly up to the maximum for about 5 seconds and then to exhale slowly up to the maximum for about 15 sec keeping two thumbs on two external auditory canal, index and middle finger together on two closed eyes and ring finger on the two sides of the nose. During exhalation the subject must chant the word "*O-U-Mmmma*" with a humming nasal sound mimicking the sound of a humming wasp, so that the laryngeal walls and the inner walls of the nostril mildly vibrate (*Bhramari pranayama,* respiratory rate 3/ min). After 5 minutes of this exercise, the blood pressure and heart rate were recorded again. Both the systolic and diastolic blood pressure were found to be decreased with a slight fall in heart rate. Fall of diastolic pressure and mean pressure were significant. The result indicated that slow pace *Bhramari pranayama* for 5 minutes, induced parasympathetic dominance on cardiovascular system.

Keywords: *Bhramari pranayama*, parasympathetic dominance.

INTRODUCTION

The cases of stress-related disease are increasing day by day throughout the world and the World Health Organization (WHO) Global Burden of Disease Survey estimates that mental disease, including stress-related disorders, will be the second leading cause of disability by the year 2020.[1] Stress, is inevitable, but can be combated by many ways (e.g., adopting regular physical exercise, change of lifestyle, change of food habit, etc.).[2] According to many, yoga and *pranayama* (breathing exercises) can be practiced to combat stress.[3,4] It has been reported earlier that yoga and *pranayama* are beneficial for the treatment of cardiopulmonary diseases, autonomic nervous system imbalances, and psychologic or stress-related disorders.[3,5] Slow *pranayamic* breathing is reported as one of the most practical relaxation techniques. *Pranayama* (breathing exercise) is known as a part of yogic techniques followed in ancient India. *Pranayama* is defined as a manipulation of breath movement. Different types of *pranayamas* produce different physiologic responses in normal young volunteers. *Savitri pranayama*, *Kapalbhati, Bhasrika, Nadisnddhi pranayama*, and so on are well known among them. [6] Most of the studies report the effect of different *pranayamas*, yogic postures, meditation, and so on collectively and the effect of regular practices of all these for a period of time, (e.g., 1 month, 3 months, etc.). In the present study, the immediate effect of a simple breathing exercise (*Bhramari pranayama*) for 5 minutes' duration on blood pressure and heart rate has been represented.

SUBJECTS AND METHODS

Healthy, nonsmoker, sedentary volunteers (n = 50; male 25, females 25; age 25–35 years) took part in this study. They were either medical students or staff of our medical college. The aims and objectives were explained and verbal consent was taken. Heart rate was noted. Blood pressure was recorded by using a mercury sphygmomanometer following 5 minutes rest.[7,8] The breathing technique was demonstrated to them. First, one has to sit comfortably in an easy and steady posture (*Sukhasana*) on a fairly soft seat placed on the floor and keeping the head, neck, and trunk erect and in a straight line, with eyes closed. One should keep the body still during the breathing practice. The back muscles should not remain very stiff and he/she should try to keep the other muscles also loose. Then the subject was directed to inhale through both the nostrils slowly up to the maximum for about 5 sec. The breathing must not be abdominal. Then subject was instructed to exhale slowly up to the maximum through both the nostrils for about 15 sec keeping two thumbs on two external auditory canal, index and middle finger together on two closed eyes and ring finger on the two sides of the nose. During exhalation the subject must chant the word "*O-U-Mmmma*" with a humming nasal sound mimicking the sound of a humming wasp, so that the laryngeal walls

and the inner walls of the nostril mildly vibrate. These steps complete one cycle of *Bhramari* (slow pace) *pranayama* (respiratory rate 3/min).[9] The *pranayama* was conducted in a cool, well-ventilated room (18–20°C). After 5 minutes of this breathing practice, the blood pressure and heart rate were recorded again in the aforesaid manner using the same instrument. Data was statistically analyzed by using Student's t test. After the breathing exercise they were asked about their feeling.

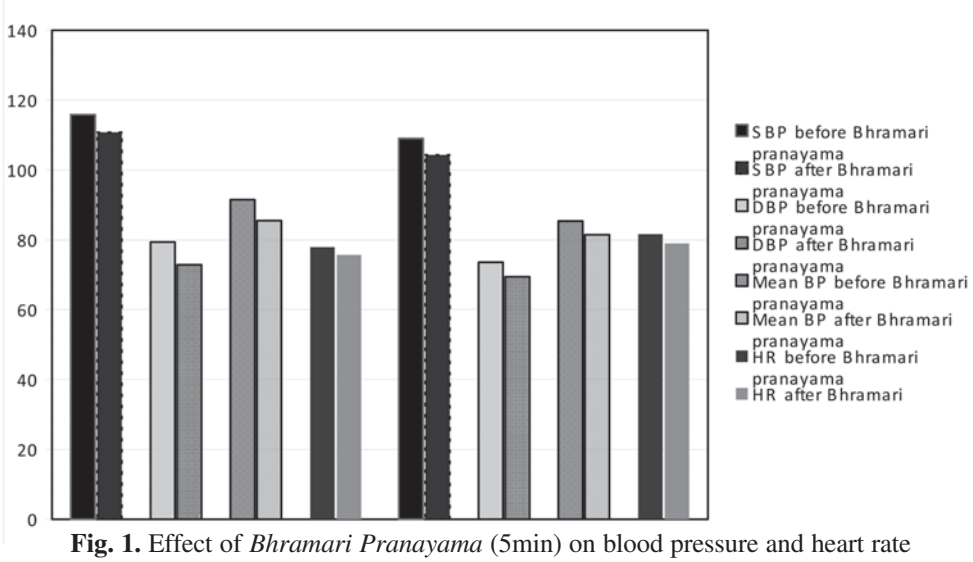

Fig. 1. Effect of *Bhramari Pranayama* (5min) on blood pressure and heart rate

RESULTS

In both the sexes slow *Bhramari pranayamic* breathing (respiratory rate 3/min) for 5 minutes caused a slight fall in heart rate. In male subjects heart rate was decreased from 78 beats/min to 76 beats/min and in female volunteers the same was decreased from 82 beats/min to 79 beats/min. The systolic blood pressure also decreased. In male volunteers systolic blood pressure decreased from 116 mm Hg to 111 mm Hg and in female counterpart systolic blood pressure decreased from 109 mm Hg to 104 mm Hg following *Bhramari pranayama*. Whereas, the diastolic blood pressure and the mean pressure decreased significantly. In male subjects diastolic pressure decreased from 79.36 mm Hg to 72.88 mmHg; in female volunteers the same decreased from 73.60 mm Hg to 69.44 mm Hg. Mean pressure in male and female volunteers decreased from 91.51 mmHg to 85.51mmHg and 85.40 mmHg to 81.46 mmHg respectively (Table-1 and Fig. 1). After the breathing exercise some felt calm; some felt sleepy; some felt very light and calm.

DISCUSSION

The *Sanskrit* word *Bhramar* means wasp. As in this Pranayama the humming sound of a flying wasp is mimicked, it is named as *Bhramari pranayama.* That slow pace pranayama influence the heart rate and blood pressure through the parasympathetic dominance had been reported in our previous study.[10] As *Bhramari pranayama* is a type of slow pace breathing exercise, it stimulates the parasympathetic system. Earlier studies also reported that *Bhramari pranayama* produced gamma wave indicating parasympathetic dominance.[11]

Pranayama increases frequency and duration of inhibitory neural impulses by activating stretch receptors of the lungs during above tidal volume inhalation as in Hering-Breuer reflex.[12] Inhibitory impulses, produced by slowly adapting receptors in the lungs during inflation[13] play a role in controlling typically autonomic functions such as systemic vascular resistance and heart rate.[14]

Inhibitory current synchronizes rhythmic cellular activity between the cardiopulmonary center[15] and the central nervous system.[16] Inhibitory current regulates excitability of nervous tissue[17] and is known to elicit synchronization of neural elements, which typically is indicative of a state of relaxation.[18] Synchronization within the hypothalamus and the brainstem[19] is likely responsible for inducing the parasympathetic response[20] during breathing exercises.

Diastolic blood pressure depends upon peripheral resistance, and lung inflation has been known to decrease

Table-1: Effect of *Bhramari Pranayama* (5min) on blood pressure and heart rate

Volunteers	Systolic Blood pressure (mm Hg) (Mean ± SD)		Diastolic Blood pressure (mm Hg)(Mean ± SD)		Mean pressure(mm Hg) (Mean ± SD)		Heart rate(cycles/min.) (Mean ± SD)	
	Before *Bhramari*	After *Bhramari*	Before *Bhramari*	After *Bhramari*	Before *Bhramari*	After *Bhramari*	Before *Bhramari*	After *Bhramari*
Male (n=25)	115.84±12.15	110.80±13.30	79.36±9.12	72.88*±8.73	91.51±9.31	85.51*±9.10	77.92±16.88	75.68±14.86
Female (n= 25)	109.04±9.40	104.32±8.59	73.60±6.05	69.44*±6.28	85.40±6.35	81.46*±6.32	81.60±12.31	78.96±11.73

* = $p<0.05$

systemic vascular resistance.[21] This response is initiated by pulmonary stretch receptors, which bring about withdrawal of sympathetic tone in the skeletal muscle blood vessels, leading to widespread vasodilatations, thus causing a decrease in peripheral resistance[22] and decreasing the diastolic as well as the mean blood pressure in both the sexes in our study.

Vibration of the nasal /laryngeal mucous membrane during exhalation along with the humming of "*O-U-Mmmma*" caused reflex apnoea by switching off inspiratory centre which causes bradycardia through chemoreceptor sinu-aortic mechanism.[23]

During prolonged voluntary expiration intra-thoracic pressure increases and blood from the lungs is squeezed into the heart leading to an increase in stroke volume; baro-receptors in carotid sinus experiences more pressure and discharge more. The increased baro-receptor discharge inhibit the tonic discharge of the vasoconstrictor nerves and excites the vagus innervations of the heart producing vasodilatation, a drop in blood pressure and bradycardia. [24]

Vagal cardiac and pulmonary mechanisms are linked, and there are reasons to expect that improvement in one vagal limb might spill over into the other. It has been suggested that chronic biofeedback-induced increases in baroreceptor gain reflect neuroplasticity.[25] Baroreceptor sensitivity can be enhanced significantly by slow breathing. This seems to occur through a relative increase in vagal activity, as could be argued by the small reduction in the heart rate observed during slow breathing and by reduction in both systolic and diastolic pressure.[26] Decrease in diastolic pressure was so significant that as a result mean blood pressure also decreased significantly.

Most of the volunteers felt calmness of mind, a sense of well-being, and some felt sleepy, thus supporting parasympathetic stimulation. This may be the effect of increased melatonin production after a regimen of slow breathing *pranayamic* exercises.[5] Slow *pranayamic* breathing was also reported to elicit alpha waves, indicating a parasympathetic dominance[27] and may be the cause of the sleepy feeling.

Slow-pace *Bhramari pranayama* (respiratory rate 3/min) exercise thus shows a strong tendency of improving or balancing the autonomic nervous system through enhanced activation of the parasympathetic system and thus can be practiced for mental relaxation and reduction of stress of daily life.

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