

## NEffect of *Bhramari Pranayama* on Volunteers Having Cardiovascular Hyper-reactivity to Cold Pressor Test

Gaurav Jain<sup>1\*</sup>, Chanda Rajak<sup>2</sup> and Sanjeev Rampalliwar<sup>3</sup>

<sup>1</sup>MD Physiology (PG student.), Dept. Of Physiology, S S Medical College Rewa, (M.P.)

<sup>2</sup>Associate Professor, Dept. Of Physiology, S S Medical College Rewa, (M.P.)

<sup>3</sup>Associate Professor, Dept. Of Physiology, S S Medical College Rewa, (M.P.)

### Abstract

**Background:** *Pranayama* has been reported to be beneficial in treating a range of stress related disorders, improving autonomic functions, relieving symptoms of asthma, stuttering and reducing signs of oxidative stress. The aim of the present study was to investigate whether regular practice of *Bhramari Pranayama* for 3 months can reduce the cardio-vascular hyper-reactivity induced by cold pressor test.

**Methods and results:** The study group comprised of 54 healthy medical students of 18 to 24 yr age group. Initially there were 21 volunteers hyper-reactive to cold pressor test; which after 3 months of regular practice of *Bhramari Pranayama* reduced to 04 (≈ 81 % reduction). Initially mean systolic BP after 1min cold stress was  $139 \pm 8.83$  mmHg which was reduced to  $134 \pm 5$  mmHg ( $t = 2.94$ ,  $p < 0.01$ ), while diastolic blood pressure reduced from  $91 \pm 7.5$  mmHg to  $88 \pm 4.42$  mmHg ( $t = 4.74$ ,  $p < 0.01$ ). Initially the rise in systolic blood pressure due to cold stress (Hand immersed at  $3^{\circ} - 4^{\circ}$  C for one minute) was  $19.24 \pm 4.17$  mmHg that became  $15.71 \pm 2.85$  mmHg ( $t = 6.4$ ,  $p < 0.01$ ), and initial rise in diastolic blood pressure was  $14.67 \pm 2.85$  mmHg which became  $11.62 \pm 1.86$  mmHg ( $t = 5.6$ ,  $p < 0.01$ ) after regular practice of *Bhramari Pranayama* for 3 months.

**Conclusion:** We concluded that regular practice of *Bhramari Pranayama* for 3 months reduced the cardiovascular hyper-reactivity to cold pressor test in subjects who were hyper-reactive to cold stress, possibly by inducing parasympathetic predominance and corticohypothalamo medullary inhibition.

**Keywords:** *Bhramari Pranayama*; Cold pressor test; Hyper-reactive persons

### Introduction

Paroxysmal Gamma brain waves produced during the *Bhramari Pranayama* [1] which are associated with positive thought, feeling of happiness and acts as natural antidepressant [2].

Lots of diseases occur due to stress in a modern society. Hypertension is one of the commonest stress-induced cardiovascular disorder, posing a major public health challenge to population in socioeconomic and epidemiological transition [3]. Relief of stress and regular aerobic exercise are employed as general non drug therapeutic intervention in all patients with hypertension [4].

In the study of hypertension, cold pressor test, introduced by Hines and Brown [5,6] was employed to measure the cardiovascular reactivity [6,12]. The persons hyper-reactive to cold pressor test are susceptible for early onset of hypertension [7-11]. We tested whether regular practice of *Bhramari pranayama* for 3 months can reduce the cardiovascular hyper-reactivity.

### Subjects and Methods

For the present study, subjects selected were healthy, sedentary, nonsmoker- first year medical students of Shyam Shah Medical College, Rewa (M. P.) [age group 18 to 24 yrs] with no cardio respiratory disorders. Total subjects were 54 (32 females and 22 males). Study design chosen was pre and post test and we included only the experimental group.

Blood pressure was measured in supine posture by Sphygmomanometer [12].

For cold pressor test, a thick walled thermocol box measuring 38

cm × 26 cm × 18 cm, closed from all sides, was used. A hole was made in the centre of the top of the box to allow entry to one hand of the subject. Another small hole was made at the corner of the top of the box for laboratory thermometer. Before starting the experiment the box was filled a mixture of ice and water and the laboratory thermometer was placed such that its mercury bulb was immersed in the mixture of ice and water [8].

Temperature inside the box was measured about  $3^{\circ}-4^{\circ}$  C. The hand was immersed in cold water up to the wrist for one minute (cold stress). An elevation above the basal level of more than 20 mm of Hg in systolic or of more than 15 mm in diastolic was considered as hyper-reactive response [13].

We made subjects to perform *Bhramari Pranayama*. Volunteers performed expiration (*Rechak*) after inspiration (*Poorak*) and to produce sound like flying wasp during expiration [14].

First of all detailed history and the general examination of all subjects was done and then casual BP was recorded. For 90 days they performed *Bhramari pranayama* daily. The schedule for *pranayama* was as follows:-

**\*Corresponding author:** Dr. Gaurav Jain, MD Physiology, Department of Physiology, S. S. Medical College Rewa, Tel: 08871801696; E-mail: [drgrvjain7@gmail.com](mailto:drgrvjain7@gmail.com)

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Morning: - Performed 15 times and relaxed.

Evening: - Performed 15 times and relaxed.

*Pranayama* was performed in empty stomach, in morning before breakfast and in evening before dinner [15]. Before and after *pranayama* 5 min relaxation posture was maintained.

Statistical analysis was done by students paired t test, using SPSS software version 11.

## Results

Our results showed that *Bhramari pranayama* (a type of slow breathing) caused significant reduction in the cardiovascular hyper-reactivity. There was no significant change in basal BP but BP rise after 1 min cold stress showed a significant reduction. Initially mean systolic BP after 1 min cold stress was  $139 \pm 8.83$  mm Hg which reduced to  $134 \pm 5$  mm Hg ( $t = 2.94, p < 0.01$ ), while diastolic blood pressure reduced

from  $91 \pm 7.5$  mm Hg to  $88 \pm 4.42$  mm Hg ( $t = 4.74, p < 0.01$ ). Also initially the rise in systolic blood pressure due to cold stress was  $19.24 \pm 4.17$  mm Hg that became  $15.71 \pm 2.85$  mm Hg with ( $t = 6.4, p < 0.01$ ), and initial rise in diastolic blood pressure was  $14.67 \pm 2.85$  mm Hg which became  $11.62 \pm 1.86$  mm Hg ( $t = 5.6, p < 0.01$ ) (Tables 1-5).

## Discussion

Earlier study showed a significant reduction of blood catecholamine level in subjects following the practice of *shavasana* for 3 months [16]. In this study, significant reduction in BP after cold stress was noted which might be due to low catecholamine in blood.

Study to evaluate the effects of slow breathing training, *Bhramari pranayama* on cardio-respiratory system modulation in patients with essential hypertension reported a reduction in SBP, DBP and mean arterial pressure (MAP); a decline in respiratory rate, increase in tidal volume and thoracic expansibility [17]. Present study corroborates the

Category	Male Subjects (22)	Female Subjects (32)	Total Subjects (54)	Percentage
Hypo-reactors	13	20	33	61.11 %
Hyper-reactors	9	12	21	38.89 %

Table 1: No. of Hyper-reactor Subjects. Out of 54 subjects, 21 subjects were hyper-reactor to Cold Pressor Test.

S. No.	Subjects	Blood Pressure	Mean Value	Standard Deviation	Rise in B.P. due to Cold Stress	Mean Value
1	All Subjects	Systolic	117 (100-132)	6.89	Systolic	15.52 (8-26)
		Diastolic	75.4 (64-86)	5.85	Diastolic	11.26 (4-20)
2	Hypo-reactors (33)	Systolic	114.73 (100-126)	6.7	Systolic	13.15 (8-18)
		Diastolic	74.73 (64-86)	5.93	Diastolic	9.09 (4-14)
3	Hyper-reactors (21)	Systolic	119 (110-132)	6.3	Systolic	19.24 (10-26)
		Diastolic	76.4 (68-86)	5.71	Diastolic	14.67 (8-20)
4	Systolic Hyper-reactors (14)	Systolic	120.4 (110-132)	6.94	Systolic	22 (20-26)
		Diastolic	77.6 (68-86)	5.6	Diastolic	13.6 (8-18)
5	Diastolic Hyper-reactors (7)	Systolic	118.86 (110-128)	5.98	Systolic	14.29 (10-18)
		Diastolic	74.29 (70-80)	5.35	Diastolic	17.14 (16-20)

Table 2: Table Showing Basal Blood Pressure and effect of Cold Stress on Basal Blood Pressure with their Mean Value & Standard Deviation.

S. No.	Parameters	Before Pranayama		After 3 months of Pranayama		t value	P Value	
		Mean Value	S. D.	Mean Value	S. D.			
1	Basal B. P.	Systolic	119	6.3	118	4.86	1.6	Insignificant
		Diastolic	76.4	5.71	76.4	4.88	0	Insignificant
2	B.P. after Hand dip in 4° C water for 1 min.	Systolic	139	8.83	134	5	2.94	Significant (p<0.01)
		Diastolic	91	7.5	88	4.82	4.74	Significant (p<0.01)
3	Rise in Blood Pressure	Systolic	19.24	4.17	15.71	2.85	6.4	Significant (p<0.01)
		Diastolic	14.67	2.85	11.62	1.86	5.6	Significant (p<0.01)

Table 3: Table showing changes in blood pressure in mm Hg during cold pressor test in hyper-reactors before and after three months pranayama.

S. No.	Parameters	Before Pranayama		After 3 months of Pranayama		Difference between initial and	P Value
		Mean Value	S.D.	Mean Value	S.D.		
1	Pulse Rate (per Minute)	79.05	5.19	71.29	5.43	-7.76	Significant (p<0.01)
2	Respiratory Rate (per minute)	20.43	2.18	16.5	1.4	-3.93	Significant (p<0.01)

Table 4: Table showing comparison of various Parameters (Pulse Rate, Respiratory Rate) in the hyper-reactor subjects before and after Pranayama.

Parameters		Hyper-Reactors to CPT Before Pranayama	Subjects became Hypo-reactors after Pranayama	Subjects remained Hyper-reactors after Pranayama
All Hyper-reactors	No. of Subjects	21	17	4
	Percentage		80.95 %	19.05 %
Syst. Hyper-reactors	No. of Subjects	14	11	3
	Percentage		78.57 %	21.43 %
Diast. Hyper-reactors	No. of Subjects	7	6	1
	Percentage		85.71 %	14.29 %

Systolic Hyper-reactors:- Hyper-reactivity either in Systolic BP or both Systolic and Diastolic BP.  
Diastolic Hyper-reactors:- Hyper-reactivity in Diastolic BP

**Table 5:** Table showing change in hyper-reactivity to cold pressor test after 3 months of pranayama.

results of the previous study and we noted reduction in blood pressure produced due to cold stress.

It was also reported that the stress level was reduced after a practice of various *pranayamas* for 2 months indicating reduction in sympathetic drive and increase in parasympathetic dominance to the heart [18].

As a result of excessive stress, both the cerebral cortex and subcortical areas (the limbic system and the hypothalamic areas) become disturbed. These emotional disturbances ultimately lead to changes in functions of autonomic nervous system [19]. We produced similar autonomic disturbance including cardiac sympathetic activation and parasympathetic withdrawal by application of cold pressor test [20] and found that these disturbances were counterbalanced by doing regular practice of *Bhramari Pranayama* for 3 months.

*Bhramari Pranayama* probably relaxes the cerebral cortex (supported by the presence of gamma waves) and by increasing parasympathetic predominance and/or inhibition of vasomotor centre (VMC) in medulla by cortico-hypothalamic descending pathway which was reflected by reduced hyper-reactivity to cold pressor test after 3 months training of *Bhramari Pranayama*.

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