

## Original Research

# Effect of Bhramari Pranayama and Yoga Nidra on cardiovascular hyper-reactivity to cold pressor test

Ritu Bajpai, Chanda Rajak, Sanjeev Rampalliwar

Department of Physiology, Shyam Shah Medical College, Rewa, Madhya Pradesh, India

## ABSTRACT

**Aim:** The aim of this study was to investigate whether regular practice of Bhramari Pranayama and Yoga Nidra for 3 months can reduce cardiovascular hyper-reactivity to the cold pressor test in young healthy medical students.

**Background:** A number of studies support the beneficial effect of Bhramari Pranayama and Yoga Nidra in hypertension. No study has been done to evaluate combined effect of pranayama and meditation in hyper-reactors to cold pressor test.

**Materials and Methods:** A total of 94 young medical students were selected who performed Bhramari Pranayama and Yoga Nidra for duration of 3 months. Cold pressor test was done on each student before and after yoga. **Results:** There was 79% reduction in hyper-reactivity to cold pressor test as number of hyper-reactors reduced from 32 before the study to 7 after 3 months of yoga. Systolic rise of blood pressure to cold pressor test reduced from  $20.1 \pm 3.5$  mm Hg to  $15.2 \pm 3.7$  mm Hg ( $P < 0.001$ ) and diastolic rise reduced from  $13.81 \pm 3.4$  mm Hg to  $10.37 \pm 2.62$  mm Hg ( $P < 0.001$ ) in hyper-reactors. Mean systolic blood pressure in all the 94 subjects reduced from  $119.87 \pm 12.01$  mm Hg to  $117.68 \pm 11.89$  mm Hg whereas mean diastolic blood pressure reduced from  $77.08 \pm 9.3$  mm Hg to  $75.11 \pm 9.07$  mm Hg ( $P < 0.001$ ). **Conclusion:** Bhramari Pranayama and Yoga Nidra together can significantly alleviate stress induced changes in cardiovascular parameters.

**Keywords:** Bhramari, Cold pressor test, Hyper-reactors, Yoga Nidra

## INTRODUCTION

Stress-induced hypertension is a major cause of cardiovascular mortality and morbidity in modern times. World Health Organization (WHO) global burden of disease survey estimates that stress-related disorders, will be the second leading cause of disability by the year 2020.<sup>1</sup>

Yoga is one of the most precious inheritances of Indian civilization. There is evident literature support on the beneficial effect of pranayama. Studies show that Bhramari Pranayama induces parasympathetic dominance on the cardiovascular system reducing systolic and diastolic pressures and heart rate.<sup>2</sup>

Yoga Nidra is probably the best known technique to induce complete physical, mental, and emotional relaxation.<sup>3</sup> Very few studies have been done on combined effect of pranayama with meditation on blood pressure<sup>4</sup> and none by performing cold pressor test and seeing effect on hyper-reactors. Our study does the same.

## MATERIALS AND METHODS

The present study was carried out in the Department of Physiology, Shyam Shah Medical College Rewa (Madhya Pradesh), India. Total 94 medical students aged 17-27 years participated in the study after obtaining clearance from an ethical committee of the institute and after taking written informed consent. They performed Bhramari Pranayama and Yoga Nidra under expert supervision for the duration of 3 months. Each subject served as its own control. Subjects excluded from the study were those suffering from respiratory or cardiac diseases or those on some sort of respiratory medication. Cold pressor test was done before and after yoga, and systolic and diastolic hyper-reactivity of blood pressure measured. Statistical analysis was done by MS Excel 2010 software.

## RESULTS

Of 94 students, 32 (18 females and 14 males) were found to be hyper-reactors to cold pressor test before

### Corresponding Author:

Dr. Ritu Bajpai, Department of Physiology, Shyam Shah Medical College, Rewa, Madhya Pradesh, India. E-mail: dramitharitwal@yahoo.com

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yoga. Most of the students were systolic hyper-reactors (Table 1).

Systolic rise of blood pressure to cold pressor test and diastolic rise was measured in all the subjects. Mean systolic and diastolic blood pressure in all the 94 subjects was also measured (Table 2).

There was 79% reduction in hyper-reactivity to cold pressor test as number of hyper-reactors reduced from 32 before the study to 7 after 3 months of yoga (Table 3).

**Table 1: Distribution of hyper-reactors as systolic/diastolic before Yoga**

| Category                 | Number and percentage | Male subjects (14) | Female subjects (18) | Total subjects (32) |
|--------------------------|-----------------------|--------------------|----------------------|---------------------|
| Systolic hyper-reactors  | Number                | 8                  | 9                    | 17                  |
|                          | Percentage            | 25                 | 28                   | 53                  |
| Diastolic hyper-reactors | Number                | 4                  | 4                    | 8                   |
|                          | Percentage            | 12.5               | 12.5                 | 25                  |
| Hyper-reactors to both   | Number                | 2                  | 5                    | 7                   |
|                          | Percentage            | 6.4                | 15.6                 | 22                  |

**Table 2: Basal blood pressure and effect of cold stress on basal blood pressure with their mean value and standard deviation**

| Subjects                                       | BP        | Basal BP (mmHg) |       | Rise in BP due to cold stress (mmHg) |        |
|--|-----------|-----------------|-------|--------------------------------------|--------|
|  |           | Mean value      | SD    | Mean value                           | SD     |
| All Subjects                                   | Systolic  | 119.87          | 6.01  | 13                                   | 5.86   |
|  | Diastolic | 77.08           | 4.65  | 9.29                                 | 4.35   |
| Hypo-reactors (62)                             | Systolic  | 121.29          | 6.202 | 9.39                                 | 2.796  |
|  | Diastolic | 78.58           | 4.29  | 6.97                                 | 2.584  |
| Hyper-reactors (32)                            | Systolic  | 117.125         | 4.47  | 20.125                               | 3.533  |
|  | Diastolic | 74.187          | 3.88  | 13.812                               | 3.441  |
| Systolic hyper-reactors (17)                   | Systolic  | 117.33          | 4.46  | 21.83                                | 1.724  |
|  | Diastolic | 74.08           | 3.89  | 12.833                               | 3.411  |
| Diastolic hyper-reactors (8)                   | Systolic  | 116             | 4.32  | 18.93                                | 4.725  |
|  | Diastolic | 74              | 3.65  | 16.8                                 | 0.98   |
| Both systolic and diastolic hyper-reactors (7) | Systolic  | 115.43          | 4.101 | 23.43                                | 1.761  |
|  | Diastolic | 73.43           | 3.332 | 16.857                               | 0.9897 |

BP: Blood pressure, SD: Standard deviation

**Table 3: Change in hyper-reactivity to cold pressor test after 3 months of Yoga**

| Category                 | Hyper-reactors to CPT before Yoga | Subjects became hypo-reactors after Yoga | Subjects remained hyper-reactors after Yoga | Hyper-reactors to CPT before Yoga |
|--------------------------|-----------------------------------|--|---|-----------------------------------|
| All hyper-reactors       | No. of subjects                   | 32                                       | 25  | 07                                |
|                          | Percentage                        | 34                                       | 26.6  | 7.4                               |
| Systolic hyper-reactors  | No. of subjects                   | 17                                       | 13  | 04                                |
|                          | Percentage                        | 18                                       | 13.8  | 4.2                               |
| Diastolic hyper-reactors | No. of subjects                   | 08                                       | 06  | 02                                |
|                          | Percentage                        | 8.5                                      | 6.4   | 2.1                               |
| Hyper-reactor to both    | No. of subjects                   | 07                                       | 06  | 01                                |
|                          | Percentage                        | 7.4                                      | 6.4   | 1                                 |

Systolic rise of blood pressure to cold pressor test reduced from  $20.1 \pm 3.5$  mm Hg to  $15.2 \pm 3.7$  mm Hg and diastolic rise reduced from  $13.81 \pm 3.4$  mm Hg to  $10.37 \pm 2.62$  mm Hg in hyper-reactors.

Mean systolic blood pressure in all the 94 subjects reduced from  $119.87 \pm 12.01$  mm Hg to  $117.68 \pm 11.89$  mm Hg whereas mean diastolic blood pressure reduced from  $77.08 \pm 9.3$  mm Hg to  $75.11 \pm 9.07$  mm Hg. The difference in the mean values of all the above parameters was found to be statistically significant with a  $P < 0.001$  (Table 4).

## DISCUSSION

Our study found that hyper-reactivity to the cold pressor test reduced by doing regular Bhramari Pranayama and Yoga Nidra for 3 months. Furthermore, there was a reduction in mean systolic and diastolic blood pressure which was statistically significant. The reason for this can be parasympathetic dominance on autonomic activity which has been given in numerous studies.

Many studies have showed a beneficial effect of pranayama on blood pressure.<sup>4,6</sup> Pal *et al.* have explained this is due to increased parasympathetic activity.<sup>7</sup> Pramanik *et al.* found 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.<sup>2</sup>

Deepa *et al.*<sup>3</sup> showed a significant reduction of supine systolic blood pressure from  $(151.33 \pm 14.1)$  mm of Hg to  $(132.4 \pm 18.1)$  mm of Hg. The supine diastolic pressure showed decrease after Yoga Nidra practice from  $(90.67 \pm 9.0)$  mm of Hg to  $(76.93 \pm 9.6)$  mm of Hg. Their study found that in Yoga Nidra an attempt is made to activate the parasympathetic system, and slowly a new balance between the sympathetic and parasympathetic systems is achieved by inducing complete physical, emotional and mental relaxation. In their study one patient in the study group, the electrocardiogram showed improvement in left ventricular function following a significant reduction in systemic blood pressure. The decreased systolic pressure can be attributed to the relaxation of mind produced as a result of Yoga Nidra, which reduces stress and discharge of sympathetic nervous system. A decrease in diastolic pressure is most likely to be due to relaxation techniques that the patient has gradually learnt which finally resulted in peripheral vasodilation.

**Table 4: Changes in BP in mm Hg during cold pressor test in hyper-reactors before and after 3 months Yoga**

| Parameters                                | Before Yoga |       | After 3 months of Yoga |       |
|---|-------------|-------|------------------------|-------|
|   | Mean value  | SD    | Mean value             | SD    |
| <b>BP (mm Hg)</b>                         |             |       |                        |       |
| Basal BP                                  |             |       |                        |       |
| Systolic                                  | 117.12      | 4.470 | 114.18                 | 4.103 |
| Diastolic                                 | 74.18       | 3.884 | 71.37                  | 2.570 |
| BP after hand dip in 4°C water for 1 min. |             |       |                        |       |
| Systolic                                  | 137.12      | 5.383 | 129.5                  | 5.172 |
| Diastolic                                 | 87.69       | 3.909 | 81.75                  | 3.562 |
| Rise in BP                                |             |       |                        |       |
| Systolic                                  | 20.125      | 3.533 | 15.19                  | 3.669 |
| Diastolic                                 | 13.812      | 3.441 | 10.375                 | 2.619 |

BP: Blood pressure, SD: Standard deviation

Meditation ensures better peripheral circulation was reported by Bhargava *et al.*<sup>8</sup> and blood flow to the tissues reported by Gopal *et al.*<sup>9</sup>

Several EEG studies have shown sleep like changes during meditation with increased alpha activity in the beginning and theta activity towards the end of meditation practice.<sup>10-12</sup>

Recent EEG studies on Yoga Nidra showed similar results with alpha wave patterns with theta wave patterns occurring at later stages.<sup>13</sup> Alpha rhythm in meditation and Yoga Nidra is an expected finding under these circumstances. But the appearance of theta waves may indicate deep cortex induced relaxation in an awakened subject.

Harinath *et al.*<sup>14</sup> have shown a positive effect of hatha yoga and meditation together on cardio-respiratory performance. Our study is the first to show a beneficial effect of pranayama and meditation when practiced together on cardiovascular hyperreactivity to stress.

## CONCLUSION

We can conclude that Bhramari Pranayama and Yoga Nidra if practiced together can significantly alleviate the stress induced changes in cardio-respiratory parameters. Yoga is an easy and cost effective way to reduce damaging effects of stress and if incorporated in our lifestyle yoga can reward us with a long, healthy and disease-free life.

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## PEER REVIEW

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## CONFLICTS OF INTEREST

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