

## Immediate effect of Bhramari pranayama on reaction time in healthy adolescents

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### Abstract

**Background:** The improvement in the reaction time is important, as it is the indicator of the cognitive function. Therefore, there is a need, especially for adolescents, for techniques or courses that can improve the reaction time. Yoga has been found to cause an improvement in the health of the individuals. **Aim:** The present study intended to determine the immediate effects of Bhramari pranayama (Bhr.P) on reaction time in the healthy adolescents. **Materials and Methods:** 35 healthy adolescents (18 boys and 17 girls) with a mean age of  $14.60 \pm 2.28$  participated in the study. The Auditory Reaction Time (ART) and the Visual Reaction Time (VRT) were assessed before and after Bhr.P pranayama practice. **Results:** There was a statistically significant shortening ( $P < 0.05$ ) of ART and VRT response in both the hands after Bhr.P practice. **Conclusion:** This study revealed a shortening of ART and VRT in healthy adolescents after Bhr.P practice. This beneficial effect of Bhr.P on reaction time can be used for improving cognitive function in adolescents and their academic performance.

**Keywords:** adolescents, cognition, pranayama, reaction time

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### Introduction

The reaction time (RT) is a simple and inexpensive method commonly used in cognitive and sports physiology to assess the sensory-motor performance of an individual.<sup>1</sup> It is the time taken to respond to the sensory stimulus, which includes recognition of the stimulus, cognitive processing, and the motor reaction.<sup>2</sup> The perceptual cognitive processing competence of the central nervous system

(CNS) is indirectly measured using RT. It has been reported that yoga training improves the overall human performance which includes changes in the CNS processing.<sup>3</sup> Sage Patanjali in his yoga sutras says that practice of pranayama has a greater impact on physiological systems than the asana (posture) practice.<sup>4</sup> It can improve one's ability to focus concentration, it enhances cognitive abilities and reduces stress.<sup>5</sup>

Bhramari pranayama (Bhr.P) is one of the simplest pranayamas, which involves producing a humming sound during exhalation and there are studies on the use of Bhr.P that show significant effects on the cardiovascular system (CVS)<sup>6,7</sup> and the electroencephalogram (EEG) waves<sup>8</sup> among practitioners. Although the effect of various pranayama and comprehensive yoga practice in shortening RT by different durations have been reported earlier, no studies have been done so far on Bhramari Pranayama (Bhr.P).<sup>9-11</sup> So the present study was conducted to find the immediate effect of Bhr.P practice on sensory-motor coordination in the form of visual reaction time (VRT) and auditory reaction time (ART) in healthy adolescents.

### Materials and Methods

Healthy adolescents (n=35, 18 boys and 17 girls) with mean age of  $14.60 \pm 2.28$  years, who had never undergone any kind of yoga training earlier participated in the present study. All the participants were right handed and did not have any acute or chronic diseases; they were not on any regular medication and did not give any history of surgery in the recent past. Institutional ethical clearance was obtained and informed consent from their parents also exercised after explaining the nature of the experiment clearly. As a volunteer participation a separate assent also obtained from the participants. Qualified yoga professionals gave the Bhr.P training as per standard procedure.<sup>12</sup> Accordingly, the subjects were made to sit in any comfortable posture with erect spine and with their eyes closed and were asked to take deep and slow inhalation followed with a deep exhalation through both nostrils, while closing their two external auditory canals with their thumbs.<sup>12</sup> They were asked to produce an "AUMMM" sound which resembles the humming wasp while exhaling.<sup>12</sup> They were allowed to do the Bhr.P practice for ten minutes. Participants were allowed to familiarize themselves with the instruments and the pranayama training. RT was recorded

before and after the Bhr.P practice for all the participants.

A PC 1000 Hertz Reaction Timer was used in this study.<sup>13</sup> It has in built add on device, which is used for measuring the auditory and visual reaction time. It's a 1000 hertz square wave oscillator which has a soft key for start and stop function.<sup>13</sup> The start button was operated by the examiner and the stop button handled by the subjects. The examiner gave the stimulus with the start button which was out of the view of the subjects. Subjects were instructed to press the stop button when they received either auditory or visual stimulus. A red light emitting diode (LED) light and a beep sound through head phone (1000 Hz tone) were used for the visual and auditory stimulus. The index finger of the right and left hands of the subjects were used and each time three trials were done, out of which the best one was taken for analysis. Audacity city software was used to record the reaction time in wave format (with 0.001 sec accuracy).

The data was expressed as Mean  $\pm$  SD. Student's paired t-test was done with R statistical software to compare the before and after values of VRT and ART.

### Results

The anthropometric details of the participants are shown in Table 1.

**Table 1: Anthropometric details of the participants**

Parameter	Mean $\pm$ SD
Age (years)	14.60 $\pm$ 2.28
Height (cm)	154.38 $\pm$ 16.50
Weight (kg)	56.72 $\pm$ 10.64
Pulse rate (bpm)	70.49 $\pm$ 9.27
Systolic blood pressure (mm Hg)	117.28 $\pm$ 12.48
Diastolic blood pressure (mm Hg)	73.59 $\pm$ 9.36

There was a significant shortening ( $p < 0.05$ ) in visual reaction time (VRT) and auditory reaction time (ART) in both right and left hand after Bhr.P practice (Table 2).

**Table 2: ART and VRT before and after Bhr.P practice**

Reaction time (msec)		Before Bhr.P	After Bhr.P	p value
ART	R	198.62 ± 9.66	184.57 ± 11.92	0.02
	L	208.36 ± 13.49	197.18 ± 13.70	0.04
VRT	R	217.48 ± 16.80	204.92 ± 12.46	0.02
	L	223.71 ± 19.63	211.38 ± 11.60	0.02

Reaction time values expressed as Mean ± SD. Student's paired t-test was done and  $p < 0.05$  set as significant. ART = auditory reaction time; VRT = visual reaction time; R = Right; L = Left; Bhr.P = Bhramari pranayama

### Discussion

The present study showed significant shortening in both VRT and ART immediately after Bhr.P practice in the adolescents. A similar kind of response was reported earlier in studies using short term and long term practice of various pranayama and yogic techniques.<sup>14-16</sup> The shortening of VRT and ART after Bhr.P training signifies better awakening, enhanced attention and faster responsiveness among the adolescents. It may enhance the sensory-motor transmission velocity and faster information processing in the central nervous system.<sup>17</sup> Physiologically as well as clinically, shorter RT means better and faster performance of an individual which is a prerequisite criteria for surgeons and in various fields like sports, etc.<sup>18</sup>

Cohen *et al.*, found that cerebral blood flow was increased following yoga training, which had a greater impact on the right hemisphere, especially in the frontal lobe.<sup>19</sup> Now, it can be

postulated that the enhancement in the reaction time may be connected to the above changes because of the role of the frontal lobe in working memory, logical thinking, etc.<sup>20</sup> Pranayama is one of the effective practices in yoga for bringing harmony and psychosomatic integration. A calm and peaceful mind can process the task much faster and respond appropriately than a restless one. The ART values of all the subjects in our study were less than the VRT values which is supported by previous studies.<sup>11,12</sup> The shortening of ART and VRT after Bhr.P practice could imply an improvement in the information processing and reflexes and this beneficial effect could be used for improving cognitive function in adolescents for their academic performances.

In the present study, the immediate effect of Bhr.P on reaction time has been reported with a small sample size. In future, long term practices in larger group are planned, to validate this finding.

### Conclusion

This study conducted to determine the immediate effects of Bhramari pranayama (Bhr.P) on reaction time in healthy adolescents revealed that there was a shortening of both auditory and visual reaction times after Bhr.P practice.

**Acknowledgment:** Nil

**Conflicts of interest:** Nil

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