International Journal of Physiology
Volume 10 No. 4, October-December 2022

Effect of Bhramari Pranayama Practice on Cognitive Functions in Healthy Volunteers

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How to cite this article: Latha R, Sarveghna Lakshmi S. Effect of Bhramari Pranayama Practice on Cognitive Functions in Healthy Volunteers. International Journal of Physiology 2022;10(4).

Abstract

Bhramari Pranayama (Humming bee breath) is one of the common slow pranayama practices, which involves inhaling through both nostrils and while exhaling produce sound of humming bee. Practicing pranayama reduces the effects of stress and strain on various systems by increasing the vagal tone. With the ongoing COVID-19 pandemic, there are heightened feelings of stress, anxiety and depression and pranayama can be an effective way to improve our mental and emotional well-being. This study has been chosen to assess the effect of Bhramari pranayama on cognitive functions and to compare the immediate and training effects of Bhramari pranayama in the study group. An observational study was conducted among 110 students in a medical college aged between 18-22 years for a period of 2 months. The participants were instructed to do 9 rounds of Bhramari Pranayama after which the immediate effect of the Pranayama and 3 weeks of Pranayama practice on cognitive functions was assessed. After training of Bhramari Pranayama for 3 weeks, a statistically significant improvement was observed. The study shows the possibility that Bhramari Pranayama has a beneficial effect on HRV in medical students, as the autonomic balance shifts towards the improvement of parasympathetic tone. The study also showed better attention, concentration and improved cognitive functions immediately after performing Bhramari pranayama which might be due to increased alertness and calmness.

Key Words: Cognitive functions, Pranayama, Stress, Vagal tone.

Introduction

Yoga is an ancient Indian science[1] as well as the way of life which includes the practice of specific posture (Asana) and regulated breathing (Pranayama)[2]. Yoga is a 3000-year-old spiritual and ascetic discipline, which has been designed to bring harmony to the physical, mental, emotional, and spiritual health of an individual[3]. Pranayama is one of the most important yogic practices which can produce different physiological responses in healthy individuals[4]. Pranayama involves manipulation of breath movement[5,6] where the breath is a dynamic bridge between the body and mind. It can be practiced in either slow or fast manner[7]. Pranayama is an art of prolongation and control of breath, which

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helps to bring conscious awareness in breathing, to reshape breathing habits and patterns. Practicing pranayama reduces the effects of stress and strain on various systems by increasing the vagal tone. With the ongoing COVID-19 pandemic, there are heightened feelings of stress, anxiety and depression and pranayama can be an effective way to improve our mental and emotional well-being.

Bhramari pranayama (Humming bee breath) is one of the common slow pranayama practices, which involves inhaling through both nostrils and while exhaling produce sound of humming bee[7]. It could be easily practiced by everyone irrespective of their age or gender. It changes the normal breathing rhythm, with short inhalation and prolonged exhalation producing significant impact in physiological system. Practice of Bhramari Pranayama continuously induces subjective feelings of mind refreshment and blissfulness[7].

Anxiety, stress and mental tensions have almost become inevitable companions of human life especially affecting healthcare course students[6]. Practice of pranayama has found to improve cognitive functions[6]. Cognition is the higher brain function enabling the individual to experience the world by a complex process of interpretation of sensory information. It includes evaluation, categorization and discrimination of stimulus. Executive functions refer to cognitive processes that regulate, control and manage other cognitive processes. Executive functions include working memory, concentration span, scanning and retrieval of stored information and mental flexibility i.e., the ability to shift from on criterion to another in sorting or matching tasks[6].

As there are very few studies on the effects of Bhramari pranayama[2,7] and none compares the immediate and training effect of Bhramari pranayama on cardiovascular and cognitive functions in healthy adolescents, this study has been chosen. The present study aimed to assess the effect of Bhramari pranayama on autonomic functions and cognitive functions and to compare the immediate and training effects of Bhramari pranayama in the study group.

Material and Methods

The observational study was conducted among 110 students in a medical college aged between 18-22 years for a period of 2 months from 30/08/2021 to 30/10/2021.

Data collection method:

The subjects were selected by convenient sampling technique and the selection is based on the following criteria:

Inclusion criteria:

1. Subjects aged between 18-22 years of either gender

Exclusion criteria:

1. Subjects who practiced yoga techniques in past 1 year
2. Subjects with history of previous or current organic diseases (likely to reduce cognition)
3. Subjects who were unable to practice pranayama due to physical abnormalities
4. Subjects with history of chronic respiratory illness
5. Subjects on medication
6. Subjects with history of any acute illness 3 months prior to the study
7. Subjects with history of any surgeries in recent past
8. Athletes, smokers and alcoholic

Brief procedure:

The study was carried out in the department of physiology in our Institution. The approval of the Institutional Research and Ethics committees was obtained prior to the commencement of the study. The subjects were recruited from our institution among the undergraduate medical students. Informed written consent was taken from all the subjects prior to the study. Bhramari Pranayama training was given by a qualified yoga instructor. The participants were instructed to sit in a comfortable posture with spine erect and eyes closed. They were asked to take slow and deep inhalation through both nostrils for 6 seconds, followed by deep and slow exhalation in the same way for 10 seconds with their index finger on both external auditory canal. While exhalation, they were instructed to chant a humming nasal sound like a bee. 9 rounds were done.

The participants were called in groups of 5 to the physiology lab and were instructed to do 9 rounds of Bhramari Pranayama after which the immediate effect of the pranayama on cognitive functions was done. The readings were noted within an interval of 5 minutes. Bhramari Pranayama training was given by the yoga instructor everyday in the evening for 15 minutes for 3 weeks after which training effect of Bhramari Pranayama was taken. A total of 110 subjects with age group (18-22 years) were recruited. The anthropometric measurements (Height and Weight) were recorded and BMI was calculated as: BMI = Weight (Kgs) / Height (Mts)^2.

Cognitive functions:

The following tests will be done to assess the Cognitive functions- Mini mental status examination (MMSE), Wechsler memory scale – revised (WMS-R), Digit letter substitution test (DLST), Digit Symbol Substitution Test (DSST). Scoring was done using the scale.

Mini Mental Status Examination (MMSE): It was done by asking a set of 11 questions under following sections like orientation, registration, attention, calculation, recall and language. The questions are very basic like what is the year, season, date, month etc. The total score was assessed and the participant was categorized as alert/ coma/ stupor/ drowsy.

Wechsler Memory Scale – Revised (WMSR- R): Two different tests were done in this type of cognitive function tests.

(a) **Spatial addition subtest:** It assess visuo-spatial storage and manipulation in working memory. The participant was shown a grid with blue or red dots on it for 5 seconds. They were asked to remember the location of the blue dots and ignore red dots that appeared on page. The participant was then shown a second page with blue and red dots for 5 seconds, participant then adds the two visual images together. The participant must place the blue dot in the grid in location where they saw blue dots on either pages and white dot in location where blue dots appeared in common.

(b) **Design subtest:** The participant was shown a page with designs placed in grid. There are 4 times having 4,6,6,8 designs for participant to remember respectively. The participant was asked to remember the designs and the location of designs. After seeing the stimulus page for 10 seconds, the participant was given puzzle grid and cards with designs on them. The participant must select the cards with correct designs and place them in puzzle grid in correct position. After 20-30 minutes of delay, the participant was given the cards to place in the grid. Following the delay recall task, a delayed recognition is administered and scores were calculated for total immediate, immediate content, immediate spatial, total delay, delayed content and delayed spatial.

Digit Letter Substitution Test (DLST): The test was done to assess cognitive function. It consists of one letter - digit pairs (eg. W/1, B/2, T/3, P/4, V/5…J/9) followed by list of alphabets. Under each alphabet, the participant was instructed to write down the corresponding digit within 60 seconds of time period. The correct digit was considered as a score.

Digit Symbol Substitution Test (DSST): The test was done to assess neuropsychological activity of brain. It consists of one digit – symbol pair (eg. 1/-, 7/^, 9/=…) followed by a list of digits. Under each digit the participant should write down the corresponding symbol as fast as possible within 60 seconds. The number of correct symbols within the allowed time is measured and score awarded.

Statistical Analysis

Data were entered in Microsoft - Excel and analysis was done using SPSS version 23. Categorical variable was expressed in frequency and percentage, continuous variables was expressed in mean and standard deviation and paired't' test was used to test the significant difference. p value less than 0.05 was considered to be statistically significant.

Results

Total of 110 MBBS students participated in the study. The demographic characteristics of the study

group like age, gender distribution and Body mass index are depicted in Table 1. The age distribution of participants (n=110). Data expressed in frequency (%). About 44% of study participants were belonged to 21 years of age and minimum belonged to 19 years of age with 15%. The gender distribution of participants (n=110). Data expressed in frequency (%). Maximum number study participants were female with 64.5%. The Body Mass Index of the participants (n=110). Data expressed in frequency (%). About 65% of the study participants were in normal weight category according to WHO classification.

Table 1: The cognitive functions on immediate and after the practice of Bhramari Pranayama expressed in mean ± SD

Parameters Measured	Immediate Effect of Bhramari Pranayama	After Bhramari Pranayama Practice	P Value
Mini Mental Status Examination (MMSE)	28.3 ±0.51	27.6 ± 0.53	0.000**
Wechsler Memory Scale-Revised (WMS-R) 1	4.7 ±0.49	4.5 ±0.72	0.045*
Wechsler Memory Scale-Revised (WMS-R) 2	5.6 ±0.60	5.4 ±0.72	0.020*
Digit Letter Substitution Test (DLST)	46.2 ±4.81	43.4 ±5.76	0.000**
Digit Symbol Substitution Test (DSST)	47.9 ±4.76	44.1 ±6.86	0.000**

Comparison of immediate and training values of Bhramari Pranayama on cognitive test parameters. Expressed in mean ± SD. Statistical analysis was done by students' paired 't' test. *p value <0.05, **p value < 0.01.

Table 1 shows the cognitive functions on immediate and after the practice of Bhramari Pranayama expressed in mean ± SD in which there is a statistically significant change in values of MMSE, WMSR 1, WMSR 2, DLST, DSST. $p < 0.05$ was considered to be statistically significant.

Discussion

Yoga is a science that facilitates homeostasis, an ancient way of life intended to improve the quality of life of an individual[8]. Pranayama practice includes voluntary breath regulation, which allows a practicioner to modify physiological functions and mental state within physiological limits[9]. The present study was undertaken to assess the immediate and training effect of Bhramari Pranayama on cognitive functions.

According to the Ancient Yoga Tradition, the breath and the mind are closely interconnected and their influence is bidirectional[10]. The results of our study showed better cognitive functions, immediately after doing the Bhramari Pranayama. This might be because, during pranayama, participants initially focus on breathing at different frequencies of respiration and intend to relax, attention is drawn away from extraneous distracting stimuli. Vagal afferents from peripheral receptors are connected with the nucleus tractus solitarius from which fibers ascend to the thalamus, limbic areas, and anterior cortical areas[3]. During above tidal volume inhalation as seen in Hering Breuer reflex ,stretch of lung tissue produce inhibitory signals in the vagus nerve which ultimately shifts the autonomic nervous system into parasympathetic dominance, that results in a calm and alert state of mind[3,6].

Therefore with continuous pranayama practice, the ability to concentrate will enhance and the changes in mental processing (Eg.focussed attention and reduced stress) are rapidly expressed in the body via the autonomic and neuro endocrine systems. This reorganizes neural representation within the CNS and improve bidirectional communication between the cerebral cortex and the limbic, autonomic, neuroendocrine and behavioural activation[6]. Hence, it is evident that the beneficial psychological effects observed with Pranayama are likely to be a result of both neurohumoral mechanisms, predominantly involving the sympathetic-parasympathetic nervous system[11]. The slight decrease in cognitive function after training may be because of external stress. The immediate effect of bhramari pranayama on cognitive functions was done in a group of 5, but the training effect was done in the classroom due to inevitable reasons which may have lead to distractions.

Conclusion

The present study throws light on how Pranayama is extremely beneficial to mankind in maintaining sound physical and mental health. The findings of the study concludes that, Bhramari pranayama is beneficial for stress reduction. The study also showed better attention, concentration and improved cognitive functions immediately after performing Bhramari pranayama which might be due to increased alertness and calmness. This study was conducted on healthy adolescents, future studies should broaden the current research and should include patients with cardiovascular problems and psychiatric disorders, whose cognitive functions are adversely compromised.

Source of funding: The financial support given by Indian Council of Medical Research, New Delhi is greatly acknowledged.

Conflict of interest: Nil

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