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ORIGINAL RESEARCH ARTICLE

Immediate Effect of *Bhramari Pranayama* on the Level of Verbal Retention on College-going Students

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ABSTRACT

Background: Learning is a cognitive process that heavily relies on attention and memory, and good learning is essential for effective retention. Verbal retention, including preservation and recall of language-based information, serves as essential for academic performance. Yoga-based breathing techniques are well known for their ability to enhance cognitive functioning through mind-body integration. Bhramari pranayama, defined by slow breathing with a humming sound during exhale, is known to stimulate the vagal activity, boost parasympathetic dominance, and induce a relaxed yet vigilant mental state.

Aim: The present study is aimed to examining the immediate effects of Bhramari pranayama on verbal retention in college-going students.

Materials and Methods: A pre-post experimental design was employed, comprising 30 students from Morarji Desai National Institute of Yoga, aged 18–25. Participants conducted 12 cycles of Bhramari pranayama in a single session. Verbal retention has been evaluated before and immediately following the intervention employing subtests 7 (similar pairs) and 8 (dissimilar pairs) of the PGI Memory Scale. The data were examined with paired samples t-tests.

Results: The results showed a statistically significant improvement in verbal retention scores post-intervention for boys ($P < 0.001$), females ($P < 0.01$), and the overall sample ($P < 0.001$). The findings indicate that the Bhramari pranayama practice can improve verbal retention.

Discussion: The findings revealed a significant improvement in verbal retention was observed in both boys and girls, as well as in the total sample. Therefore, the immediate practice of Bhramari pranayama seems to promote focused awareness and relaxation, which may help to improve verbal retention.

Conclusion: Bhramari pranayama technique has been shown to enhance the level of verbal retention among college students. Indicating its potential as an effective intervention for cognitive improvement, which may enhance mental well-being in college-going students.

1. INTRODUCTION

The process of learning is a multifaceted and relies on attention and memory, where sustained attention improves memory function and retention. Effective learning involves both physical and mental abilities, such as better memory, intelligence, and attention, which contribute to better motor performance and reward.[1] The capacity to retain acquired knowledge is a crucial component of a whole learning process, as learning is not complete without effective retention.[2] Verbal retention, an ability to preserve and retrieve language-based information across time, is influenced by both the informativeness and timing of feedback. Sturges (1969) demonstrated how prolonged and informative feedback can enhance long-term retention of verbal material, emphasizing the role of feedback characteristics in learning.[3] In other words, retention has been stated as a persistent learned behavior over a long period of time without practice.[4]

Recent studies have demonstrated that yoga can enhance memory, increase attention and concentration, recognition, retention, and

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potentially support neural network regeneration.[1,5,6] Growing research highlights yoga as a mind-body intervention capable of improving cognitive functioning through integrated physical, respiratory, and meditative practices.[7] Yoga is an ancient traditional system that has increasingly evolved as a scientific discipline whose structured practice aims to regulate muscle activity, respiratory processes, and the mental system to achieve balanced and holistic development of personality.[8] Maharishi Patanjali introduced the principle of ashtanga yoga, which comprises eight limbs (*Yama, Yiyama, Asana, Pranayama, Pratyahara, Dharna, Dyana, and Samadhi)*. Every practice aims to purification and integration of mind and body, besides the higher level of human awareness.[9,10] Pranayama is the foundation of all mind-body-focused activities and the integral component of yoga philosophy. This type of yogic breathing practice as an effective technique to improve physical and mental well-being.[11] Bhramari pranayama is a form of classical pranayama that involves the production of a humming bee-like sound during exhalation, which creates vibration that activate the vagus nerve, enhancing parasympathetic activity and promoting relaxation and previous evidence showed that regular practice improves attention span, memory recall, and mental clarity.[12]

Multiple studies investigated the acute impacts of Bhramari pranayama on physiological and psychological outcomes in clinical and non-clinical populations. One study illustrated the Bhramari pranayama's immediate effect on resting circulatory parameters in healthy teenagers. The result showed greater lowering of blood pressure (BP) and heart rate (HR), which indicates that this technique induces relaxation. Parasympathetic activity takes predominance over sympathetic activity in this state.[13] Another study also showed the acute outcomes of Bhramari pranayama, a slow-paced breathing technique, on BP and HR in 50 males and females who were healthy, non-smoker, and sedentary volunteers. They found that performing Bhramari pranayama for 5 min has significantly decreased mean pressure and diastolic BP (DBP). Furthermore, a modest drop in systolic BP (SBP) and HR was noticed.[14] In addition, one study determined how Bhramari pranayama affected hypertension patients' BP, HR, and SpO_2 immediately. The result suggested that SBP significantly decreased in the Bhramari pranayama group after 5 min of practice.[15] Moreover, Bhramari pranayama's immediate and training effect on HR variability (HRV) in 110 MBBS students was investigated. They observed a notable decrease in SBP, DBP, pNN50, and frequency-domain HRV parameters, such as normalized low frequency and the low frequency to high frequency (LF/HF) ratio. This indicates that Bhramari pranayama enhances autonomic balance by improving parasympathetic activity, which in turn enhances HRV.[16] One study examined school children', reported sleep quality and perceived stress were affected by the short-duration practice of Bhramari pranayama. After the post-intervention, the greater enhancement in sleep quality and also the perceived stress reduction was observed.[17] Another experimental trial showed how medical students explored the cognitive abilities by performing Om Chanting, breathing practices, include (Bhramari pranayama, and Nadi Shodhana Pranayama). They found that these practices effectively enhance focus, memory, metacognition, and reaction time in medical students.[18]

Numerous studies demonstrated the acute outcomes of Bhramari pranayama on physiological variables such as heart rate, BP, and HRV among clinical and non-clinical populations. Short-term practices of Bhramari Pranayama have also been reported to exert a positive impact on mental health, including improvement in cognitive functioning such as attention, memory, and improvement in quality of life, and reduces stress.[13-18] Scientific validation of their immediate effect could strengthen their therapeutic application. Although individual study of pranayama exists, research examining the immediate effects of Bhramari pranayama on the level of verbal retention on college-going student remains limited. Therefore, this study is aimed to identifying the immediate effects of Bhramari pranayama on the level of verbal retention in college-going students.

2. MATERIALS AND METHODS

2.1. Variables

The following variables were investigated in this study: Bhramari pranayama was the independent variable, and the level of verbal retention was a dependent variable.

2.2. Expected Outcomes

The following Hypothesis has been formulated for the current research as per the review of the literature.

- H_1: There would be a significant enhancement in the level of verbal retention after intervention in college students
- H_2: There would be a significant enhancement in the level of verbal retention after intervention in college-going boys
- H_3: There would be a significant enhancement in the level of verbal retention after intervention in college-going girls.

2.3. Ethical Consideration

Morarji Desai National Institute of Yoga, Ministry of Ayush, Government of India, carried out the current pre-post-test study. The dissertation project synopsis was delivered on February 21, 2025. The Institutional Ethics Committee of Morarji Desai National Institute of Yoga approved the study, file number: Res012/2/2023-TEACH.-Part (1). Each participant provides a written consent form after being informed of the study methods. The research was undertaken in April and May of 2025.

2.4. Sample Size Calculation

The investigator asked all the students who studied in the institute to voluntarily participate in the study after providing detailed information about its procedure and purpose. Random sampling was carried out. The study employed a single experimental group with no control group, and it examined only the immediate effects of the intervention. The consent forms were obtained from all the participants before their participation in this project.

2.5. Inclusion and Exclusion Criteria

Both males and females aged 18–25 were included in this study. All the students were subjectively assessed as being in good physical and mental health at the time of the study. Participants who were studying only in the institute were included in the study. Individuals who did not meet the age requirement were excluded from the study. Participants with any physical injury, chronic disease, or mental issue were not involved in this study. All the teachers, staff, other faculty, and experienced yoga practitioners of the institute were excluded from the study.

2.6. Assessment Tool

In this study, data were gathered by using one questionnaire: the PGI memory scale measured verbal retention for similar and dissimilar pairs through specific subtests (7^{th} and 8^{th}). Verbal retention for similar pairs (subtest 7): Measures the ability to remember associated words with semantic connection. Example: bed-chair, day-night, etc. Verbal retention for dissimilar pairs (subtest 8): Measure the ability to recall

associated words which have no similar link. Example: table-cloud, bike-bottle, etc.[19]

2.6.1 How to measure

The investigator reads a list of words at a predetermined speed, pausing between pairs. After a brief interval, the investigator provides the word of a pair and asks the subjects to recall the second word. This is done for both similar and dissimilar lists. Each correctly recalled associated word gets one point. The total number of correct responses for each set (similar and dissimilar) forms the raw score. Scores are compared with the range of standardized percentiles: P80-P100 = Excellent memory, P60-P80 = Above average memory, P40-P60 = Average memory, P20-P40 = Below average memory, P00-P20 = Low level memory.

2.7. Intervention

The intervention was given one-on-one to a total of 30 participants, comprising both male and female participants, with each participant receiving the intervention separately to ensure uniformity and minimize external influences. Before the main intervention, preliminary practices given as a 1-min prayer were carried out to promote calm and normalization. Each participant receives 12 rounds of Bhramari pranayama as the main intervention in order to evaluate its immediate effects. The session was concluded with a 1-min prayer.

2.8. Data Collection

Data collection was carried out using a pre-test and post-study design. Subtests 7 and 8 of the PGI memory scale, which measure verbal retention via similar and dissimilar pairs of words, were administered before and after the intervention. During the pre-test, subjects were provided with five similar and dissimilar word pairs, and their responses were noted. Following the pre-test, a 1-min prayer was conducted; after that practiced 12 rounds of Bhramari pranayama technique, and the session closed with prayer. Immediately after the intervention, the same set of word pairs was provided again for the post-test intervention to assess the verbal retention. The gathered information was arranged in a pre-post-intervention format in Microsoft Excel before the statistical analysis. A systematic representation of data collection is presented in Figure 1.

2.9. Statistical Analysis

The paired sample t-tests were used to analyze the pre- and post-data scores. Data are expressed as mean, standard deviation, and t-value, with significance at $P < 0.05$. The verbal retention score was extracted from the PGI memory scale, subtests 7th as verbal retention with similar word pairs and 8th as verbal retention dissimilar word pairs, and arranged in pre-post format in Excel. Excel and GraphPad InStat were used for the analyses.

3. RESULTS

The pre- and post-intervention findings indicated an improvement in verbal retention levels following the practice of the intervention. The intervention resulted in a statistically significant improvement in the level of verbal retention scores in the boys' group, the girls' group, and the total sample. The calculated statistical analysis measures are shown in Table 1 and Figures 2-4 for reference and analyses.

3.1. Interpretation of Result

3.1.1. Boy's group

The statistical analyses examining the immediate effects of Bhramari pranayama on the level of verbal retention in the boy's group resulted in a highly significant improvement. The mean score for verbal retention increased from 3.67 ± 0.89 pre-intervention assessment to 4.87 ± 0.35 post-intervention assessment, and this improvement in the mean was found to be highly statistically significant ($P < 0.001$).

3.1.2. Girl's group

The statistical analyses of the girl's group revealed a significant enhancement in the verbal retention score following the Bhramari pranayama. The mean score of verbal retention increased from 3.85 ± 0.98 pre-intervention assessment to 4.92 ± 0.28 in the post-intervention assessment. This improvement of the means score was statistically significant ($P < 0.01$).

3.1.3. Total sample

For the total sample, the means of the verbal retention score increased from 3.83 ± 0.95 pre-intervention assessment to 4.90 ± 0.31 post-intervention assessment. This enhancement in the mean was observed to be highly statistically significant ($P < 0.001$), indicating the effectiveness of Bhramari pranayama in improving verbal retention. These findings show that the immediate effects of Bhramari pranayama practice improve verbal retention in college-going students, both individually and collectively.

4. DISCUSSION

The purpose of the current study is to determine the immediate effects of Bhramari pranayama on the level of verbal retention among college-going students. Bhramari pranayama is a traditional breathing technique characterized by the production of a humming sound during the exhalation phase. It activated the vagus nerve, enhancing parasympathetic activity, facilitating relaxation, and improving attention, memory recall, and cognitive clarity.[12] Verbal retention is a critical cognitive function associated with learning and memory consolidation.[3]

The persistent practice of Bhramari pranayama consistently produces subjective sensations of mental restoration and blissfulness.[20] The practice of pranayama has been shown to enhance cognitive function. The term executive function defined cognitive process that regulate to order, control, and manage additional cognitive activities. Working memory, concentration span, scanning and retrieval of stored information, and mental flexibility, which is the capacity to transition between criteria in sorting or matching activities, are examples of executive functioning.[21] During pranayama, first concentrate on breathing at varying respiration frequencies with the ultimate objective of relaxation, shifting their attention from unnecessary distracting stimuli. Peripheral receptor vagal afferents are linked to the nucleus tractus solitarius, from which fibers ascend to the limbic regions, anterior cortical areas, and thalamus.[22] Stretching lung tissue generates inhibitory impulses in the vagus nerve during above tidal volume inhalation, as noticed in the Hering-Breuer reflex. This ultimately leads the autonomic nervous system from sympathetic into parasympathetic dominance, which produces alertness and calmness.[21,22]

As a result, regular pranayama practice leads to enhanced concentration, and the autonomic and neuroendocrine systems immediately manifest the changes in mental processes such as focused attention and decreased tension. This improves bidirectional communication between the cerebral cortex and the limbic, autonomic, neuroendocrine, and behavioral activation and reorganizes neural representation within the central nervous system.[21] Therefore, it is evident that both neurohumoral pathways, primarily involving the autonomic nervous system, are probably responsible for the positive psychological impacts of pranayama.[23]

The results of current study show greater enhancement in level of verbal retention in the boys' group, the girls' group, and the total sample size. A significant improvement in pre- and post- data indicates that immediate practice of Bhramari pranayama has a positive effect on enhancing the ability to retain and recall the verbal information.

The immediate effects of Bhramari pranayama on physio-psychological measures are supported by prior research. One study showed the 5 min of Bhramari pranayama on healthy medical students' cognitive function. They found that Bhramari pranayama is beneficial for stress reduction, better attention, concentration, and improved cognitive functioning.[24] Another study showed that 20 days of Bhramari pranayama intervention have positive effect on mental health and raise mental level. This suggests that Bhramari pranayama gives a way to achieve personal tranquility, happiness, develops an optimism attitude, self-worth, and appropriate mental-body synchronization.[25] Pranayama has been shown to stimulate theta brain activity, which is linked to improved memory and decreased anxiety. The primary findings indicate that Bhramari pranayama performed with short humming durations (<9 s) generates a significant improvement in theta-band brain activity, which is associated with relaxation, focused attention, and improved cognitive functioning.[26] Another study, which reported symmetric prefrontal cortical activation during 10–20 rounds of Bhramari pranayama, attributed to the self-generated humming sound, suggesting that the role of humming duration in regulates brain activity.[27] Previous studies found that Bhramari pranayama produces immediate enhancements in physiological parameters, including significant reductions in HR, SBP, and DBP, and mean arterial pressure, reflecting enhanced parasympathetic dominance and autonomic balance.[13-15] Moreover, Bhramari pranayama has been shown to improve HRV outcomes, such as reduced LF/HF ratio, suggesting a shift toward cardiovascular relaxation and parasympathetic activity.[16]

These findings support the original hypothesis that Bhramari pranayama significantly improves the level of verbal retention among college-going students, and the results are consistent with the predicted outcomes. According to the scientific evidence, Bhramari pranayama boosts mental serenity, attentional control, and cognitive clarity through optimizing parasympathetic activity and neural synchronization. The immediate practice of Bhramari pranayama seems to promote focused awareness and relaxation, which may help to improve verbal retention. Therefore, regular practice of Bhramari pranayama may help to improve memory functions and overall cognitive proficiency, supporting academic achievement and psychological well-being.

5. CONCLUSION

This current study evaluated the immediate effects of Bhramari pranayama on 30 college-going students aged 18–25. The level of verbal retention assessed by the using PGI memory scale, through specific Subtests 7th and 8th before and after the 12 rounds of Bhramari pranayama intervention. The result showed a significant improvement in the verbal retention after the post-intervention in all college students, which indicates enhanced concentration, memory level and overall cognitive functioning. These findings suggest that incorporating Bhramari pranayama into college wellness programs may enhance mental well-being in college-going students.

6. LIMITATIONS

The present study has a certain limitation. The sample size for appropriate differentiation between gender-based groups; further research may have large gender-based groups. As this was an immediate-effect study with a short intervention duration, the long-term effects of Bhramari pranayama could not be assessed; further investigation could have a longer duration for broader validation. The absence of a control group, which restricted comparative analysis, means further research may include a control group in their study, inclusion of psychological assessments tools to strengthen the validity and applicability of the findings.

7. ACKNOWLEDGMENTS

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8. AUTHOR'S CONTRIBUTIONS

All the authors have read and approved the final version of the manuscript.

8. FUNDING

The authors declare that no financial support was received from any organization for the submitted work. In addition, all authors declare that they have no financial relationships with organizations that might be interested in the submitted work.

9. ETHICAL STATEMENT

The Institutional Ethics Committee of Morarji Desai National Institute of Yoga approved the study, file number: Res012/2/2023-TEACH. Part (1).

10. CONFLICTS OF INTERESTS

The authors declare no conflicts of interest regarding the publication of this paper.

11. DATA AVAILABILITY STATEMENT

The data analyzed in this review were obtained from publicly available sources, including peer-reviewed articles, observational studies, and surveys accessible through databases.

12. PUBLISHERS NOTE

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Table 1: Pre-test and post-test score of the level of verbal retention in boys' group, girls' group, and total sample size

Group	Number of participants	Baseline (Mean±SD)	After 12-rounds (Mean±SD)	df	t-value	Level of significance
Boys group	16	3.67±0.89	4.87±0.35	15	6.00***	Highly statistically significant
Girls group	14	3.85±0.98	4.92±0.28	13	4.07**	statistically significant
Total Sample	30	3.83±0.95	4.90±0.31	29	6.73***	Highly statistically significant

SD: Standard deviation, ***P*<0.01 (statistically significant), ****P*<0.001 (highly statistically significant)

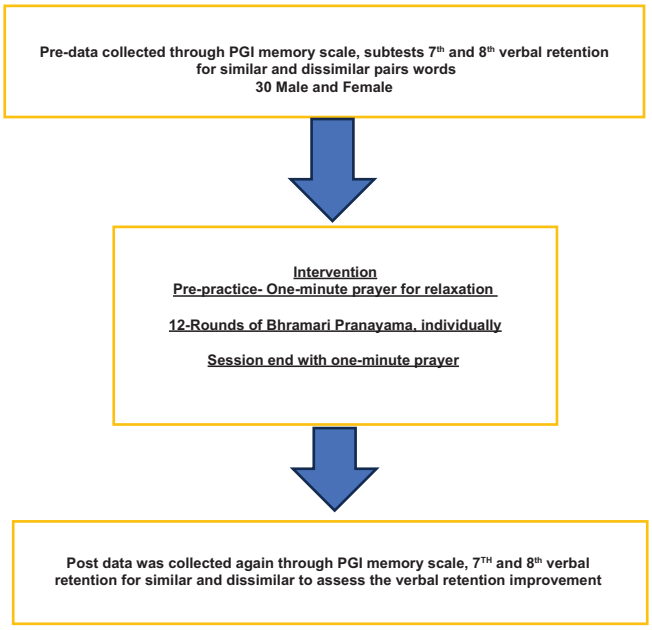

Figure 1: Systematic representation of data collection and intervention.

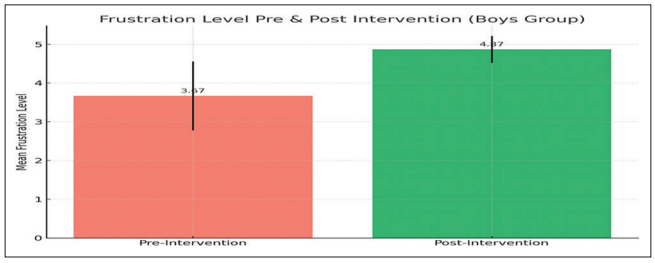

Figure 2: Depict the pre-test and post-test intervention score of Bhramari pranayama in boy's group

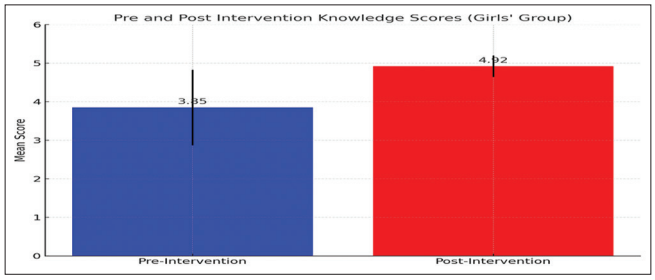

Figure 3: The mean score of pre-test and post-test intervention of Bhramari pranayama in girl's group

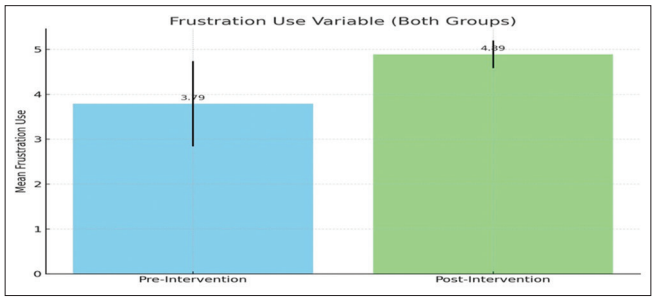

Figure 4: Presents means score of pre-test and post-test intervention of Bhramari pranayama in the total sample both girls and boys