

Effect of a One-Week Combined Practice of Bhramari Pranayama and Shambhavi Mudra on Autonomic Modulation in Young Adults: A Prospective Pre-Post Interventional Study

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Abstract

Background: Breathing exercises like pranayama improves autonomic function. Effect on sympathetic or parasympathetic activity has been observed. Hence, here the effect of breathing exercises on sympathetic and parasympathetic activity was studied in young subjects between 18-30 years age group. Bhramari Pranayama and Shambhavi Mudra improve autonomic function individually. However very few studies regarding their combined short-term effect in young adults is there. Hence this study has been planned.

Aim & Objective: To assess the pre- and post-intervention effects of one week combined practice of Bhramari pranayama and Shambhavi mudra on HRV, blood pressure and perceived stress level in young adults by using the pulse based HRV monitoring device, sphygmomanometer and perceived stress scale.

Methods: One-week combined practice of Bhramari pranayama and Shambhavi mudra a pre-post interventional study was performed on N=36 apparently healthy adults. Autonomic function tests were performed before and after the Bhramari pranayama and Shambhavi mudra. Statistical analysis was done using SPSS v26.

Results: The increased parasympathetic activity and decreased sympathetic activity were observed by the improved HRV parameters. Significant reduction in perceived stress scores was observed. Decrease in resting heart rate and blood pressure was observed.

Conclusion: One-week combined practice of Bhramari Pranayama and Shambhavi Mudra significantly improves autonomic modulation.

Keywords: Autonomic Functions, Breathing Exercises, Parasympathetic Activity, Sympathetic Activity.

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Introduction

Cardiovascular diseases and stress-related disorders are increasing globally, with autonomic nervous system imbalance playing a central role in their pathophysiology.

Young adults, especially college students, are exposed to academic, psychological, and lifestyle stressors that can adversely affect autonomic regulation.[1]

Reduced parasympathetic activity and sympathetic dominance are early indicators of cardiovascular and stress-related morbidity.

Regular breathing exercise improves the autonomic functions by reducing the sympathetic activity or increasing the vagal activity. Different pranayamas increases the sympathetic or decreases the vagal tone.[1] Yogic practices such as pranayama and mudras have shown promising effects in improving autonomic balance through non-pharmacological means. While Bhramari Pranayama and Shambhavi Mudra individually improve the autonomic function, evidence regarding their combined short-term effect in young adults is limited forming the basis of this study. Heart rate variability (HRV) reports about the autonomic imbalance.[2]

Sympathovagal balance is reported by the LF to HF power ratio. Increased LF and LF/HF power reports the increased sympathetic activity.[3]

Material and Methods: Institutional ethical clearance was taken. It was an interventional study.

Study Design: It was a prospective pre-post interventional study and duration of was 14 days. Participants were recruited (n=36) based on inclusion and exclusion criteria. Apparently healthy individuals aged 18–30 years willing to give written informed consent were enrolled. They were not practicing regular yoga, pranayama, or meditation in the last 6 months. Baseline assessment of HRV, blood pressure, heart rate, and perceived stress was done. BMI (kg/m²) was calculated from height and weight.[4] One-week combined intervention of Bhramari pranayama and Shambhavi mudra was done. In post-intervention assessment, same tools were repeated after 1 week.

Exclusion Criteria: Cardiovascular disorders such as hypertension, arrhythmias, ischemic heart disease, or heart failure, any respiratory disorders such as asthma, chronic obstructive pulmonary disease (COPD), or bronchitis were excluded. Neurological disorders including epilepsy, multiple sclerosis, peripheral neuropathy, or Parkinson's disease were excluded. Psychiatric disorders

including major depression, anxiety disorders, or schizophrenia or diabetes mellitus or thyroid dysfunction were excluded. Medications affecting autonomic function (e.g., beta-blockers, calcium channel blockers, antidepressants) or acute illness or infections during the study period were excluded from the study.

Statistical Analysis: It was done using SPSS v26. Descriptive statistics showing Mean $\pm$ SD of study parameters before and after the intervention. Heart rate variability, blood pressure, heart rate, and perceived stress levels were analysed before and after the intervention

Result

It demonstrates a favorable change in autonomic, cardiovascular, and perceived stress parameters following one week of combined Bhramari Pranayama and Shambhavi Mudra practice. (Table 2). It shows a statistically significant improvement in heart rate variability, blood pressure, heart rate, and perceived stress levels after the intervention compared to baseline.(Table 3)

The graph demonstrates increased SDNN and RMSSD with a reduction in LF/HF ratio following the intervention, indicating improved autonomic balance.(Graph 1)

Table 1: Baseline demographic and anthropometric characteristics of participants included in the study

Parameter	Mean $\pm$ SD / n (%)
Age (years)	22.4 $\pm$ 2.6
Gender (Male/Female)	18 / 18
Height (cm)	168.3 $\pm$ 7.4
Weight (kg)	63.8 $\pm$ 8.9
BMI (kg/m ²)	22.4 $\pm$ 2.3

Table 2: Comparison of pre- and post-intervention parameters

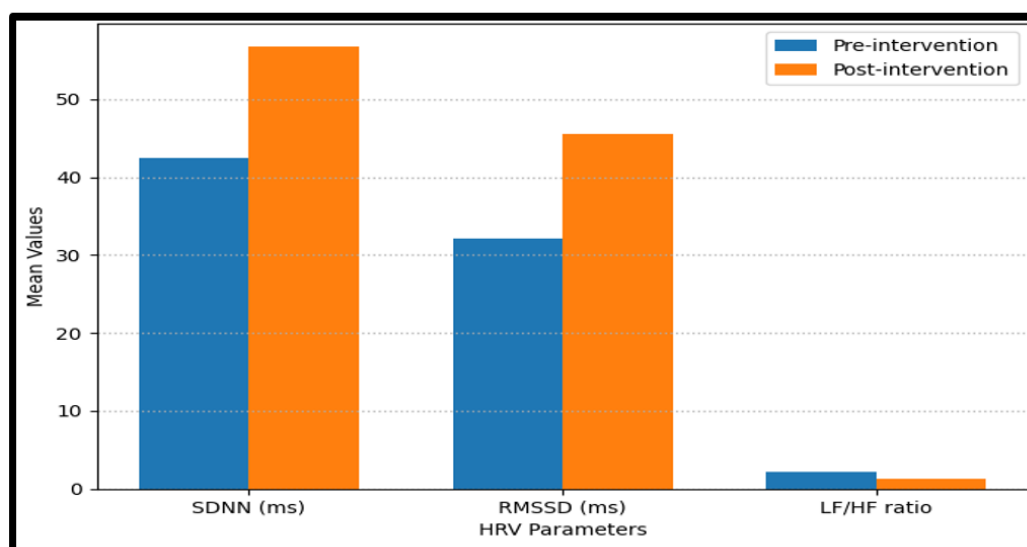
Parameter	Pre-intervention	Post-intervention
Heart Rate (bpm)	74.6 $\pm$ 6.8	69.2 $\pm$ 6.1
Systolic BP (mmHg)	118.4 $\pm$ 8.2	112.6 $\pm$ 7.5
Diastolic BP (mmHg)	76.8 $\pm$ 6.1	72.3 $\pm$ 5.4
SDNN (ms)	42.5 $\pm$ 10.3	56.8 $\pm$ 12.1
RMSSD (ms)	32.1 $\pm$ 8.4	45.6 $\pm$ 9.7
LF/HF Ratio	2.1 $\pm$ 0.6	1.3 $\pm$ 0.4
PSS Score	21.6 $\pm$ 4.5	14.2 $\pm$ 3.9

Descriptive statistics showing Mean $\pm$ SD of study parameters before and after Intervention.

Table 3: Comparison of pre- and post-intervention parameters

Parameter	Mean Difference	p-value
Heart Rate	$\downarrow$ 5.4 bpm	<0.01
Systolic BP	$\downarrow$ 5.8 mmHg	<0.01
Diastolic BP	$\downarrow$ 4.5 mmHg	<0.01
SDNN	$\uparrow$ 14.3 ms	<0.001*
RMSSD	$\uparrow$ 13.5 ms	<0.001*
LF/HF Ratio	$\downarrow$ 0.8	<0.01
PSS Score	$\downarrow$ 7.4	<0.01

(Paired t-test, p < 0.05 considered significant) *P< 0.001, Highly significant.



Graph 1: Effect of One-Week Combined Bhramari Pranayama and Shambhavi Mudra Practice on HRV Parameters

The graph demonstrates increased SDNN and RMSSD with a reduction in LF/HF ratio following the intervention, indicating improved autonomic balance.

Discussion

One-week combined practice of Bhramari pranayama and Shambhavi mudra significantly improves autonomic functions. Perceived stress levels decreased significantly.

The intervention is simple, safe, and cost-effective. The one-week combined yogic intervention significantly improved HRV parameters. Post-intervention a shift towards parasympathetic dominance was reported. Reduction in LF/HF ratio suggests a shift toward autonomic balance with reduced sympathetic dominance.[3] Decrease in resting heart rate and blood pressure reflects improved cardiovascular autonomic control.

This study is supported by the practice of Bhramari pranayama which gives good results, reduces blood pressure and the stress levels. Pranayama reduces the dead space ventilation and also decreases the work of breathing of the subjects. During Bhramari pranayama whole lung is ventilated in comparison to shallow breathing which ventilates the bases of lungs only.[5]

Studies reported that yogic breath-based techniques are effective as compared to conventional therapy for anxiety and depression. [6,7] Significant reduction in perceived stress scores highlights the psychophysiological benefits of the intervention. Even short-term combined practice was sufficient to produce measurable autonomic changes. Findings support the role of integrated yogic practices as preventive strategies in young adults. A breath-based kriya yoga intervention in mood or anxiety disorders performed breath practices as in

Shambhavi Mahamudra, a significant reduction in symptoms after intervention was reported.[8] Another breath-based techniques reduced the perception of stress and pain in breast cancer patients.[9] yoga reduces the stress responses. The cardiovascular, endocrine and immunological changes have been reported and improved psychological response to stress was studied. [7,10] Pranayama techniques improved stress response and antioxidant status in healthy subjects similar to Shambhavi Mahamudra.[11]

Pranayama increases the thoracic volume which produces the inhibitory signals to increase the parasympathetic responses. [12] Yoga research is underrepresented and more studies related to clinical utility must be conducted.

Limitation of the study: Due to the small sample size there is limitation in generalizing to large population. A control group is also required. Intervention was given for a very short period. The self-reported compliance may introduce bias in the study. HRV measured using pulse-based device rather than ECG-based system. Long-term sustainability of effects was not assessed.

Conclusion

Yogic practices can be recommended as preventive lifestyle interventions in young adults. This non-pharmacological intervention can be adopted in medical curricula as a stress-management tool. It demonstrates the potential for mind-body interventions to foster resilient, healthy future doctors.

Future Scope of the study: Further research as a larger randomized controlled trials are also needed to confirm the reports. Effects of these practices on mood and stress response is required. Inclusion of biochemical stress markers like cortisol is there.

Future studies required as a longer intervention and follow-up duration will be important. Comparison with individual yogic practices can be done. Application in high-stress populations such as medical students can be done.

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