



Effectiveness of Bhramari Pranayama with diaphragmatic breathing exercise in pre-hypertensive patients: A quasi-experimental study

Sayali Manoj Ghathe¹, Shruti Sarkar², Pranjal Grover³

¹ TMV's Lokmanya Tilak College of Physiotherapy, Kharghar, Navi Mumbai, Maharashtra, India

² Assistant Professor, TMV's Lokmanya Tilak College of Physiotherapy, Kharghar, Navi Mumbai, Maharashtra, India

³ Principal, TMV's Lokmanya Tilak College of Physiotherapy, Kharghar, Navi Mumbai, Maharashtra, India

DOI: <https://doi.org/10.66856/ijyppe.2026.11.3.11087>

Abstract

Background: Pre-hypertension is a critical, modifiable transitional phase that substantially elevates the risk of cardiovascular disease and end-organ damage if left unaddressed. Non-pharmacological therapies—specifically breathing-based yogic practices such as diaphragmatic breathing and Bhramari Pranayama—have emerged as accessible, cost-effective modalities capable of modulating autonomic tone and enhancing baroreflex sensitivity. This study aimed to investigate the hemodynamic effects of a structured, four-week combined breathing protocol on systolic and diastolic blood pressure in unmedicated pre-hypertensive adults.

Methods: A quasi-experimental intervention study utilizing purposive sampling was conducted in Navi Mumbai. The cohort comprised 40 pre-hypertensive adults aged 18–80 years who were not receiving any antihypertensive pharmacotherapy. Participants engaged in a supervised regimen consisting of paced diaphragmatic breathing (6 breaths per minute for 10 minutes), followed by a 2–3-minute rest interval, and concluding with Bhramari Pranayama for 5 minutes. The protocol was performed three days per week across four consecutive weeks. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were recorded at baseline and immediately post-intervention using a standardized mercury sphygmomanometer under resting conditions. Changes were analyzed using paired-samples t-tests.

Results: Following the 4-week intervention, participants demonstrated statistically significant reductions across both hemodynamic parameters. Mean SBP decreased from 133.3 ± 4.5 mmHg at baseline to 128.8 ± 3.8 mmHg post-intervention, reflecting an average reduction of 4.5 mmHg ($t = 8.366$, $p < 0.001$). Concurrently, mean DBP declined from 85.3 ± 2.6 mmHg to 81.3 ± 2.4 mmHg, representing an average reduction of 4.0 mmHg ($t = 6.976$, $p < 0.001$).

Conclusion: A four-week combined protocol of paced diaphragmatic breathing and Bhramari Pranayama produced significant, clinically relevant reductions in both systolic and diastolic blood pressure among pre-hypertensive individuals. These findings highlight the potential of targeted respiratory interventions as viable, non-invasive lifestyle strategies in preventive cardiovascular care and physiotherapy. Further randomized controlled trials with extended follow-up windows are warranted to evaluate long-term hemodynamic retention and broader clinical outcomes.

Keywords: Bhramari Pranayama, diaphragmatic breathing, pre-hypertension, blood pressure, breathing exercise, physiotherapy

Introduction

Hypertension remains one of the primary preventable risk factors for global cardiovascular morbidity and mortality, contributing significantly to ischemic heart disease, stroke, heart failure, and renal dysfunction. In recent years, clinical attention has shifted toward pre-hypertension—a transitional hemodynamic state defined by systolic blood pressure (SBP) between 120–139 mmHg and/or diastolic blood pressure (DBP) between 80–89 mmHg. Pre-hypertension is not a benign phenotype; it is independently associated with accelerated arterial stiffness, microvascular endothelial impairment, early left ventricular remodeling, and an elevated risk of progressing to sustained clinical hypertension. Given that pharmacotherapy is rarely indicated at this threshold in the absence of overt target-organ damage or diabetes, targeted non-pharmacological and lifestyle interventions represent the primary clinical window to halt disease progression and reduce long-term cardiovascular risk.

A central driver in the pathophysiology and progression of elevated blood pressure is autonomic dysregulation, predominantly characterized by sustained sympathetic

overactivity paired with diminished vagal (parasympathetic) tone and blunted baroreceptor sensitivity. In this context, mind-body interventions and specialized yogic breathing techniques have emerged as potent non-invasive modalities capable of favorably shifting autonomic equilibrium toward parasympathetic dominance.

Among these techniques, Bhramari Pranayama (the humming bee breath) is characterized by slow, regulated inhalation followed by prolonged expiration accompanied by a soft, low-pitched resonant humming sound. This specific auditory vibration and extended expiratory phase stimulate the vagus nerve and promote parasympathetic efferent activity. Furthermore, oscillatory acoustic vibrations within the upper airway during humming are known to markedly enhance endogenous nasal nitric oxide (NO) production. Increased local and inhaled NO acts as a potent vasodilator, promoting systemic vascular smooth muscle relaxation and microcirculatory perfusion, which contributes to acute and sustained reductions in peripheral vascular resistance.

Concurrently, diaphragmatic breathing (deep, slow, controlled abdominal respiration) emphasizes optimal

excursion of the diaphragm while prolonging the respiratory cycle. When performed at a paced frequency—typically around 6 breaths per minute—slow breathing aligns respiratory sinus arrhythmia with natural Mayer waves in systemic blood pressure, achieving baroreflex resonance. This mechanical modulation enhances baroreflex sensitivity, attenuates efferent central sympathetic outflow, and promotes peripheral arterial vasodilation. In addition, full diaphragmatic excursion maximizes intrathoracic pressure swings, optimizing venous return, cardiac filling pressures, and stroke volume efficiency without placing excess metabolic strain on the myocardium.

While previous studies have evaluated the independent cardiovascular and autonomic effects of Bhramari Pranayama and diaphragmatic breathing in various normative and stressed populations, evidence evaluating their combined, synergistic application over a sustained multi-week period in pre-hypertensive individuals remains sparse. Combining diaphragmatic pacing (which primarily optimizes mechanical baroreflex coupling) with Bhramari Pranayama (which augments vagal stimulation and acoustic-driven vascular signaling) offers a biologically plausible, multimodal approach to non-pharmacological blood pressure management.

Therefore, the present study was conducted to evaluate the effect of a structured, four-week combined protocol of diaphragmatic breathing and Bhramari Pranayama on systolic and diastolic blood pressure among unmedicated pre-hypertensive adults, aiming to establish an accessible, evidence-based conservative intervention for early cardiovascular prevention.

Conclusion

The study demonstrated statistically significant reductions in systolic and diastolic blood pressure following four weeks of combined Bhramari Pranayama and diaphragmatic breathing in pre-hypertensive participants. The intervention is simple, low-cost and does not require specialized equipment, which may support its use as an adjunctive physiotherapy-based health-promotion strategy. However, the quasi-experimental design, relatively small sample and short follow-up limit conclusions regarding long-term effects. Future controlled studies with larger samples and longer follow-up should evaluate the reproducibility and clinical significance of these findings.

References

1. Prakash P, Boominathan P, Mahalingam S. Acoustic description of Bhramari Pranayama. *Indian J Otolaryngol Head Neck Surg*,2022;74(3):4738-47. doi:10.1007/s12070-021-03054-1.
2. Kuppusamy M, Kamaldeen D, Pitani R, Amaldas J. Immediate effects of Bhramari Pranayama on resting cardiovascular parameters in healthy adolescents. *J Clin Diagn Res*,2016;10(5):17-9. doi:10.7860/JCDR/2016/19202.7894.
3. Kuppusamy M, Kamaldeen D, Pitani R, Amaldas J, Shanmugam P. Effects of Bhramari Pranayama on health: a systematic review. *J Tradit Complement Med*,2018;8(1):11-6. doi:10.1016/j.jtcme.2017.02.003.
4. Hamasaki H. Effects of diaphragmatic breathing on health: a narrative review. *Medicines (Basel)*,2020;7(10):65.
5. Sathe SS, Rajandekar T, Thodge K, Bhawane A, Thatere U. Immediate effect of Bhramari Pranayama on blood pressure, heart rate and oxygen saturation in hypertensive patients. *Int J Health Sci Res*,2019;9(6):95-100.
6. Agrawal P, Sinha A, Garg R. Effect of 4 weeks of Pranayama training and 6-minute walk test on blood pressure in healthy subjects. *Int J Sci Res*,2020;9(1):7-12.
7. Bhavanani AB, Madanmohan, Sanjay Z. Immediate effect of Chandra Nadi Pranayama (left unilateral forced nostril breathing) on cardiovascular parameters in hypertensive patients. *Int J Yoga*,2012;5(2):108-11. doi:10.4103/0973-6131.98221.
8. Batra S, Pal R. Immediate effects of Pranayama on the cardiovascular parameters in hypertensive patients: a review. *Curr Med Res Pract*,2022;12(6):270-3. doi:10.4103/cmnp.cmnp_63_22.
9. National Heart, Lung, and Blood Institute. High blood pressure—what is high blood pressure? Bethesda (MD): NHLBI, 2024 Apr 25.
10. Yau KKY, Loke AY. Effects of diaphragmatic deep breathing exercises on prehypertensive or hypertensive adults: a literature review. *Complement Ther Clin Pract*,2021;43:101315. doi:10.1016/j.ctcp.2021.101315.
11. Roshan PSB, Samuel SE, Meenar N. Effectiveness of diaphragmatic breathing exercise and Jacobson's progressive muscle relaxation on cardiopulmonary parameters in pre-hypertensive patients. *Int J Phys Educ Sports Health*,2021;8(6):1-5. doi:10.22271/kheljournal.2021.v8.i6a.2269.