ISSN(O)3108-2246 https://doi.org/10.66328/ijprmh.2025.010104

International Journal of Public Research in Medicine and Health (IJPRMH)

Volume 1, Issue1, July-September, 2025

Original Research Article

EVALUATING YOGIC BREATHING INTERVENTIONS ON LUNG ENDURANCE IN YOUNG ADULT SMOKERS

David Mohan[1], Sonal Garg[2], Mudasir Ahmad Wani[3], Adil Abbass[4*]

1. Associate Professor Department of Physiology Maharishi Markandeshwar College of Medical Sciences and Research Sadopur Ambala.
2. Associate Professor Department of Physiology Maharishi Markandeshwar Institute of Medical Sciences and Research Mullana, Ambala.
3. Assistant Professor Department of Physiology Maharishi Markandeshwar College of Medical Sciences and Research Sadopur Ambala.
4. Tutor, Department of Physiology Maharishi Markandeshwar College of Medical Sciences and Research Sadopur Ambala.

Corresponding Author: Adil Abbass, Tutor, Department of Physiology Maharishi Markandeshwar College of Medical Sciences and Research Sadopur Ambala
Email Id: adilmagam@gmail.com

Received: 23/08/2025
Revised: 01/09/2025
Accepted: 10/09/2025

Abstract

Introduction: Cigarette smoking, a leading global cause of preventable mortality, induces subclinical respiratory damage long before symptoms manifest. Yogic practices like Pranayama and Om chanting are posited to improve respiratory function and resilience. This study investigates the efficacy of an 8-week intervention combining Alternate Nostril Breathing (ANB) and Om chanting on enhancing respiratory endurance and pulmonary function in asymptomatic young adult smokers. The study was conducted to evaluate the effects of a combined ANB and Om chanting intervention on parameters of respiratory endurance (BHTi, BHTe, 40 mmHg test) and Spirometric lung function (FEV1, FVC, FEF25-75%) in asymptomatic smokers.

Materials and Methods: A total of 100 asymptomatic smokers (aged 18-25 years) participated in this 8-week interventional study. Pre- and post-intervention assessments included anthropometric data, respiratory endurance tests, and spirometry. Participants underwent supervised sessions of ANB and Om chanting for 10 minutes daily, 6 days a week. Data were analyzed using descriptive statistics and a paired t-test.

Results: The cohort's mean age was 21.4 ± 2.1 years, and mean BMI was 22.6 ± 1.8 kg/m². Post-intervention, all parameters showed a highly significant improvement ($p < 0.001$). Respiratory endurance parameters (BHTi, BHTe, 40mmHg test) increased by 36.4%, 34.1%, and 44.6% respectively. Spirometric parameters also demonstrated significant enhancement, with FEV1 increasing from 3.21 ± 0.42 L to 3.45 ± 0.38 L ($p < 0.001$) and FEF25-75% from 3.85 ± 0.51 L/s to 4.12 ± 0.47 L/s ($p < 0.001$).

Conclusion: An 8-week regimen of Alternate Nostril Breathing and Om chanting significantly improves respiratory muscle endurance and pulmonary function in asymptomatic young adult smokers. These yogic techniques are effective complementary strategies to mitigate smoking-induced respiratory decline.

Keywords: Asymptomatic smokers, Pranayama, Om chanting, Respiratory endurance, Spirometry, BHTi, BHTe, 40mmHg test.

ISSN(O)3108-2246 https://doi.org/10.66328/ijprmh.2025.010104

International Journal of Public Research in Medicine and Health (IJPRMH)

Volume 1, Issue1, July-September, 2025

INTRODUCTION

Cigarette smoking constitutes a profound public health crisis, standing as the foremost cause of preventable death worldwide. (1,2) The combustion of tobacco releases over 7,000 chemicals, including toxicants like acrolein, formaldehyde, carbon monoxide, and nicotine, which directly assault the respiratory system. (2,3) This insult triggers chronic inflammation, oxidative stress, and an accelerated annual decline in lung function, often progressing insidiously for years before clinical symptoms like chronic bronchitis or COPD emerge. (1,3,4) A significant population of "asymptomatic smokers" exists—individuals with normal spirometry but underlying inflammatory changes and a heightened risk for future disease. (4)

Yogic breathing exercises, collectively known as Pranayama, offer a potential non-pharmacological intervention to counter these effects. These ancient practices involve the conscious regulation of breath, which has been shown to induce a state of psychophysiological calm, improve autonomic balance, and enhance respiratory efficiency. (5,6) Specific techniques like Alternate Nostril Breathing (ANB) are known to promote sympathovagal balance and reduce oxidative stress markers. (7) Similarly, Om chanting, a form of vocalized breathing, involves prolonged expiration, which may improve expiratory muscle strength and airway clearance. (6)

The physiological benefits of Pranayama are believed to include strengthened respiratory muscles, improved lung volumes, and altered chemoreceptor sensitivity, leading to enhanced breath-holding capacity—a marker of respiratory endurance. (8,9) While studies have demonstrated these benefits in healthy and diseased populations, there is a paucity of research focusing on the vulnerable cohort of asymptomatic young smokers, who stand to benefit significantly from early intervention. (10)

This study, therefore, aimed to investigate the impact of a combined ANB and Om chanting intervention on both respiratory endurance and dynamic Spirometric parameters in asymptomatic young adult smokers. We hypothesized that the regular practice of these yogic techniques would lead to significant improvements in all measured parameters.

MATERIALS AND METHODS

Study Design and Ethical Considerations

This prospective interventional study was conducted over an eight-week period within the Department of Physiology at the Faculty of Medicine and Health Sciences, SGT University, Gurugram, India. The study protocol received full approval from the Institutional Ethics Committee, ensuring adherence to the ethical principles outlined in the Declaration of Helsinki. Prior to enrolment, each participant provided written informed consent after a detailed discussion of the study's purpose, procedures, potential benefits, and risks.

Participant Recruitment and Selection Criteria

A cohort of one hundred young adults, comprising both males and females aged between 18 and 25 years, was recruited from the student and staff population of Dolphin PG College, Chandigarh. Participants were identified as asymptomatic smokers, defined according to the Global Adult Tobacco Survey India criteria as an individual who has smoked at least 100 cigarettes in their lifetime and currently smokes cigarettes daily. A

meticulous screening process was employed to ensure a homogeneous sample. Prospective participants were excluded if they had any history of significant systemic disorders, particularly those affecting the respiratory tract, known allergies, or were on long-term medication for any chronic condition. Individuals with structural deformities of the chest or spine, such as kyphosis or scoliosis, were also excluded. To isolate the effects of the intervention, we did not enroll pregnant or lactating women, or those with any prior consistent practice of yoga, Pranayama, meditation, or structured physical exercise.

Intervention Protocol

The intervention consisted of a supervised, structured practice of two yogic breathing techniques: Om chanting and Alternate Nostril Breathing (ANB). Sessions were conducted daily, six days a week, for eight consecutive weeks. Each 10-minute session was held in a quiet, well-ventilated room between 12:15 and 12:45 PM, preceding the lunch break to ensure consistency and avoid postprandial discomfort. The practice began with participants seated comfortably in the *Sukhasana* (easy pose) with their spines erect. The first five minutes were dedicated to Om Chanting. Participants were instructed to inhale deeply through their noses and, during a slow, controlled expiration, chant the sound "OM" in a steady, audible tone for the entire duration of their exhalation. This was repeated for the duration of the segment. This was immediately followed by five minutes of Alternate Nostril Breathing (Nadi Shodhana Pranayama)**.** Using the right thumb to close the right nostril and the right ring finger to close the left, participants were guided through a balanced breathing cycle. They would inhale gently through the left nostril, close both nostrils for a brief internal retention, exhale smoothly through the right nostril, inhale through the right nostril, close both, and finally exhale through the left nostril. This constituted one complete cycle, which was repeated rhythmically and slowly throughout the practice period. A trained instructor was always present to ensure correct technique and maintain the timing.

Assessment Measures and Data Collection

Comprehensive assessments were conducted for each participant at two time points: initially before the commencement of the intervention (baseline) and immediately after the eight-week program (post-intervention). Baseline demographic and anthropometric data, including age, height, and weight, were recorded to calculate Body Mass Index (BMI). The primary outcome measures focused on objective tests of respiratory function:

- Breath Holding Time (BHT) was measured using a digital stopwatch. BHT after inspiration (BHTi) was recorded following a maximal inspiration, while BHT after expiration (BHTe) was measured at the end of a normal tidal expiration. Participants were instructed to hold their breath for as long as they comfortably could, and the time was recorded in seconds.
- T**he 40 mmHg Endurance Test** was employed to assess expiratory muscle strength. The rubber tubing from a mercury sphygmomanometer was detached from its cuff. Participants were asked to take a deep breath and then exhale forcefully into the tube to raise and maintain the mercury column at the 40 mmHg mark for as long as possible. The duration of sustained pressure was recorded in seconds.

- **Spirometric parameters**, including Forced Expiratory Volume in the first second (FEV1), Forced Vital Capacity (FVC), and Forced Expiratory Flow between 25-75% of FVC (FEF25-75%), were measured using a calibrated spirometer in accordance with American Thoracic Society (ATS) guidelines to assess lung function.

Statistical Analysis

All statistical analyses were performed using SPSS software (Version 26.0). The normality of the data distribution for all continuous variables was confirmed using the Shapiro-Wilk test. Descriptive data for participant characteristics are presented as Mean ± Standard Deviation (SD). To determine the statistical significance of the changes observed after the eight-week intervention, a paired samples t-test was applied to compare the pre- and post-intervention values for all respiratory parameters. A p-value of less than 0.05 was considered statistically significant for all analyses.

RESULTS

All 100 recruited subjects completed the study. The baseline characteristics of the study participants are presented in Table 1.

Table 1: Baseline Descriptive Characteristics of the Study Participants (n=100)

Characteristic	Mean ± SD	Range
Age (years)	21.4 ± 2.1	18 - 25
Height (cm)	166.8 ± 8.7	152 - 182
Weight (kg)	62.9 ± 9.4	48 - 86
BMI (kg/m²)	22.6 ± 1.8	18.5 - 26.1
Pack Years*	2.8 ± 1.1	1.0 - 5.5
*Pack Years = (Number of cigarettes smoked per day / 20) x number of years smoked		

The 8-week intervention of combined ANB and Om chanting resulted in highly significant improvements across all measured parameters of respiratory endurance, as detailed in Table 2.

Table 2: Impact of Intervention on Respiratory Endurance Parameters (n=100)

Variable	Pre-Intervention (Mean ± SD)	Post-Intervention (Mean ± SD)	Mean Difference (Post-Pre)	% Change	p-value
BHTi (sec)	34.06 ± 5.21	46.45 ± 6.87	+12.39	+36.4%	< 0.001*
BHTe (sec)	23.12 ± 4.05	31.00 ± 5.14	+7.88	+34.1%	< 0.001*
40mmHg (sec)	24.43 ± 3.92	35.33 ± 5.26	+10.90	+44.6%	< 0.001*
*Statistically significant ($p < 0.05$)					

Spirometric parameters also demonstrated significant enhancement following the intervention, as shown in Table 3.

Table 3: Impact of Intervention on Spirometric Parameters (n=100)

Variable	Pre-Intervention (Mean ± SD)	Post-Intervention (Mean ± SD)	Mean Difference (Post-Pre)	% Change	p-value
FEV1 (L)	3.21 ± 0.42	3.45 ± 0.38	+0.24	+7.5%	<0.001
FVC (L)	3.98 ± 0.51	4.15 ± 0.48	+0.17	+4.3%	<0.001
FEF25-75% (L/s)	3.85 ± 0.51	4.12 ± 0.47	+0.27	+7.0%	<0.001
*Statistically significant ($p < 0.05$)					

DISCUSSION

The findings of this 8-week interventional study demonstrate that a combination of Alternate Nostril Breathing (ANB) and Om chanting elicits statistically significant and physiologically meaningful improvements in both respiratory endurance and pulmonary function among asymptomatic young adult smokers. The robust results (p

< 0.001 for all parameters) warrant a deeper exploration into the potential mechanisms and clinical implications of these changes.

Interpreting the Enhancement in Respiratory Endurance

The dramatic improvements in breath-holding time—both after inspiration (BHTi) and expiration (BHTe)—are the most pronounced outcomes of this study. The 36.4% increase in BHTi and 34.1% increase in BHTe suggest a fundamental enhancement in the body's tolerance to hypercapnia (elevated CO2) and hypoxia (reduced O2). This can be attributed to several adaptive mechanisms. Firstly, the regular, conscious suppression of the urge to breathe during Pranayama practice is believed to gradually desensitize the medullary chemoreceptors to the stimulatory effects of CO2.(5, 14) This is a trained response similar to that seen in deep-sea divers. Secondly, improved ventilatory efficiency from deeper, slower breathing may lead to better gas exchange at baseline, potentially creating a more favorable starting point for apnoea. The greater absolute improvement in BHTi is physiologically consistent, as breath-holding at total lung capacity provides a larger oxygen reservoir and stretches the pulmonary stretch receptors, which reflexively inhibit inspiration (the Hering-Breuer reflex), thereby delaying the breaking point of breath-hold. The 44.6% improvement in the 40 mmHg endurance test is a critical finding specific to this study's design. This test is a direct measure of expiratory muscle strength and endurance, requiring the subject to maintain a high intrathoracic pressure. The significant improvement here can be most directly linked to the mechanics of Om chanting**.** The prolonged, forceful expiration against the resistance created by the glottis during chanting acts as a form of resistance training for the expiratory muscles, primarily the abdominal wall muscles and the internal intercostals.(6) Strengthening these muscles enhances the ability to generate and sustain high expiratory pressures, which is not only reflected in this test but also has implications for effective coughing and airway clearance—a vital function often compromised in smokers.

Spirometric Improvements:

While the endurance tests reflect muscular and chemoreceptor adaptations, the significant improvements in spirometric parameters (FEV1, FVC, FEF25-75%) suggest a positive impact on airway function itself. The 7.5% increase in FEV1 and the 7.0% increase in FEF25-75% are particularly noteworthy. FEF25-75% is often considered a sensitive indicator of small airway disease, the very region where smoking-induced inflammation and obstruction begin years before FEV1 declines. (4) The improvement in these parameters suggests that the intervention may have led to reduced airway resistance and improved patency of the small airways. The mechanism for this is likely multifactorial. Alternate Nostril Breathing (ANB**)** has been strongly linked to improved autonomic function, promoting a parasympathetic dominance and reducing sympathetic tone.(7, 15) The airways are innervated by the autonomic nervous system, where sympathetic stimulation causes bronchodilation and parasympathetic stimulation causes bronchoconstriction. However, a state of chronic stress and inflammation (as induced by smoking) can dysregulate this system. The stress-reducing and autonomic-balancing effects of ANB may help counteract this dysregulation, leading to a reduction in baseline bronchomotor tone and thus bronchodilation. Furthermore, the deep, slow inspirations practiced in ANB promote better alveolar

expansion and recruitment, potentially improving lung compliance. The combination of these practices may also have an anti-inflammatory and antioxidant effect, as suggested by Bhattacharya et al.(7) Smoking induces a state of oxidative stress and systemic inflammation. Regular Pranayama practice has been shown to reduce markers of oxidative stress and increase levels of antioxidants like superoxide dismutase. By mitigating this inflammatory milieu, the practice could potentially reduce the edema and inflammatory cell infiltration in the airway walls, leading to a wider lumen and lower resistance to airflow.

Synergistic Effects and Clinical Relevance

The true novelty and strength of this intervention lie in the synergistic combination of the two techniques. ANB primarily focuses on balancing the nervous system, improving inspiratory depth, and inducing calm. Om chanting focuses on strengthening expiratory muscles, improving airway clearance, and potentially stimulating vagal afferents through the vibratory stimulus of the chant. Together, they offer a comprehensive respiratory training regimen that addresses both the autonomic dysregulation and the muscular weakness induced by smoking. For the population of asymptomatic smokers, these findings are highly relevant. These individuals are on a trajectory of accelerated lung function decline but are often unmotivated to quit and are "asymptomatic" in the traditional sense (4). This intervention provides a tangible, non-pharmacological strategy to potentially slow this decline. Improving respiratory endurance and baseline lung function could increase the respiratory reserve, delay the onset of symptomatic disease (like dyspnea on exertion), and improve overall functional capacity. It empowers individuals to take an active role in preserving their lung health alongside smoking cessation efforts.

Limitations and Future Directions

This study has limitations. The absence of a control group (e.g., smokers not practicing yoga or practicing a different exercise) makes it difficult to completely rule out placebo or Hawthorne effects. However, the objective nature of the spirometry and endurance tests strengthens the findings. Long-term follow-up was not conducted to see if the benefits were sustained after the intervention ceased. Future studies should incorporate a controlled design, include measures of inflammatory biomarkers (e.g., CRP, IL-6) to directly test the proposed anti-inflammatory mechanism, and follow participants over a longer period to assess the durability of the effects and the impact on the rate of lung function decline.

CONCLUSION.

An 8-week program of Alternate Nostril Breathing and Om chanting significantly improved respiratory endurance and lung function in asymptomatic young smokers. These simple, non-drug techniques effectively strengthen breathing muscles and enhance airway function. Incorporating these yogic practices offers a valuable complementary strategy to mitigate smoking-related respiratory damage.

Source of Funding: Nil
Conflict of Interest: None
Ethical approval: Institutional Research Committee

REFERENCES

1. Sophie K, Singh N, Dharvey AJ. Study of pulmonary function test in asymptomatic smokers and non-smokers between 30-50 years of age in a tertiary care hospital.

International Journal of Advances in Medicine. 2017 Jul 20;4(4):959.

2. Thenmozhi P, Bhuvaneswaran D. Suryanadi Pranayama on Physiological Indices among Smokers. International Journal of Research in Pharmaceutical Sciences. 2021 Jan 6;11(SPL4):841–7.
3. Malge M, Surendra BV. A Comparative Study of Pulmonary Function Tests among Smokers and Non-Smokers in a Tertiary Care Hospital. International Journal of Pharmaceutical and Clinical Research 2023; 15(2); 431-434.
4. Hernández-Zenteno R, Flores-Trujillo F, Jesús Javier Vázquez-Cortés. Symptomatic and Asymptomatic Smokers without Airflow Obstruction: A New Clinical Entity? the official journal of the mexican national institutes of health. 2019 Feb 4; 71:64-9.
5. Madanmohan N, Thombre DP, Balakumar B. Effect of yoga training on reaction time, respiratory endurance and muscle strength. Indian Journal of Physiology and Pharmacology. 1992 Oct 1;36(4):229–33.
6. Mooventhan A, Khode V. Effect of Bhramari pranayama and OM chanting on pulmonary function in healthy individuals: A prospective randomized control trial. International Journal of Yoga. 2014;7(2):104.
7. Bhattacharya S, Pandey US, Verma NS. Improvement in oxidative status with yogic breathing in young healthy males. Indian J Physiol Pharmacol. 2002 Jul; 46(3):349-54.
8. Bagade A, Bhonde M, Dhokane N. Effect of Pranayama on respiratory endurance in young adults. National Journal of Physiology, Pharmacy and Pharmacology. 2018 ;8(9):1175.
9. Mullur LM, Bagali SC, Khodnapur JP, Aithala MR. Role of short term yoga on pulmonary functions of young and middle aged healthy individuals. International Journal of Biomedical and Advance Research. 2012 Apr 30;3(4).
10. Rupareliya VP, Chauhan P, Gohil N. Immediate effects of slow Pranayama on cardio respiratory parameters in young adult tobacco smokers": Experimental study. International Journal of Research and Analytical Reviews [Internet]. 2022 Sep 15;9(3):671–80.
11. Dutt S, Gogia T, Gupta M. A comparative study on pulmonary function tests in smokers & nonsmokers. Indian Journal of Clinical Anatomy and Physiology. 2021 Apr 15;8(1):53–6.
12. Choudhary DS. Effects Of Yogic Asanas, Pranayam & Relaxation Techniques On Ventilatory Functions, Respiratory Pressures, Breath Holding Time And Respiratory Endurance. GJRA - Global Journal For Research Analysis. 2023;Volume 12 Issue 4(12).
13. Murugesan R. Physical Education Influence Of Pranayama Practices On Respiratory Endurance Among College Men Students. Star International Journal. 2017;5(11).
14. Joshi LN, Joshi VD, Gokhale LV. Effect of short term Pranayam practice on breathing rate and ventilatory functions of lung. Indian J Physiol Phannacol 1992; 36(2) : 105-108
15. Yadav A, Singh S, Singh KP. Role of Pranayam breathing exercise in rehabilitation of coronary artery disease patients- A pilot study.

Indian J Traditional Knowledge. Vol 8(3), July 2009, 455-458.

16. Cramer H, Krucoff C, Dobos G. Adverse events associated with yoga: a systematic review of published case reports and case series. PLoS One. 2013;8(10):e75515. (For context on safety, though the study found it safe).
17. Saoji AA, Raghavendra BR, Manjunath NK. Effects of yogic breath regulation: A narrative review of scientific evidence. J Ayurveda Integr Med. 2019 Jan-Mar;10(1):50-58. (For a modern review on mechanisms of Pranayama).

Cite this Article: Mohan D, Garg S, Ahmad M, Abbass A. Evaluating Yogic Breathing Interventions On Lung Endurance In Young Adult Smokers International Journal of Public Research in Medicine and Health. July- September 2025; 1(1):19-27.
https://doi.org/10.66328/ijprmh.2025.010104