

**Effect of Pranayama on Peak Expiratory Flow Rate in Healthy Volunteers**Kalpana Kumari Singh<sup>1</sup>, Rita Kumari<sup>2</sup>, Nishi Verma<sup>3</sup><sup>1</sup>Tutor, Department of Physiology, NMCH, Patna<sup>2</sup>Prof.& Head, Department of Physiology, NMCH, Patna<sup>3</sup>Junior Resident, Department of Physiology, NMCH, Patna

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**Abstract:**

**Background:** Pranayama, a yogic breathing technique originating from ancient India, is believed to improve respiratory efficiency and lung function. Peak Expiratory Flow Rate (PEFR) is a simple, reliable measure of airway function and respiratory muscle strength. This study aimed to evaluate the effect of regular pranayama practice on PEFR in healthy volunteers.

**Methods:** A prospective interventional study was conducted among healthy adult volunteers aged 18–35 years. Baseline PEFR was measured using a standardized peak flow meter. Participants were instructed to practice pranayama techniques (including Anulom Vilom, Bhastrika, and Kapalabhati) for 20–30 minutes daily over a period of 6–8 weeks under supervision. Post-intervention PEFR was recorded and compared with baseline values. Statistical analysis was performed using paired t-test, with  $p < 0.05$  considered statistically significant.

**Results:** A statistically significant increase in mean PEFR was observed after regular practice of pranayama compared to baseline values ( $p < 0.05$ ). Improvement was noted in both male and female participants, suggesting enhanced expiratory muscle strength and airway function following the intervention.

**Conclusion:** Regular practice of pranayama significantly improves Peak Expiratory Flow Rate in healthy individuals. Incorporating pranayama into daily routine may enhance pulmonary function and overall respiratory health.

**Keywords:** Pranayama, Peak Expiratory Flow Rate, PEFR, Pulmonary Function, Healthy Volunteers, Yoga Breathing Exercises.

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**Introduction**

Pranayama, a fundamental component of yoga described in ancient Indian texts, refers to controlled and regulated breathing techniques designed to enhance physical, mental, and spiritual well-being. The term “pranayama” is derived from the Sanskrit words prana (life force) and ayama (expansion or control). Regular practice of pranayama is believed to improve respiratory efficiency, strengthen respiratory muscles, and enhance lung capacity. Pulmonary function tests are essential tools for assessing respiratory health. Among them, Peak Expiratory Flow Rate (PEFR) is a simple, non-invasive, and reliable measure of maximum expiratory flow achieved during a forceful expiration after full inspiration. PEFR reflects airway caliber, respiratory muscle strength, and overall pulmonary function. It is widely used in both clinical and research settings to evaluate airway function. Modern lifestyle factors such as physical inactivity, environmental pollution, and stress can adversely affect respiratory function even in healthy individuals. Non-pharmacological interventions like yogic breathing exercises have gained increasing

attention for their potential role in improving lung function and promoting preventive health care. Several studies have demonstrated beneficial effects of pranayama on various pulmonary parameters, including vital capacity, forced expiratory volume, and PEFR. However, the extent of improvement in healthy individuals requires further evaluation. Therefore, the present study was undertaken to assess the effect of regular pranayama practice on Peak Expiratory Flow Rate in healthy volunteers.

**Materials and Methods**

**Study Design:** This was a prospective interventional study conducted to evaluate the effect of pranayama on Peak Expiratory Flow Rate (PEFR) in healthy volunteers.

**Study Setting:** The study was conducted in the Department of Physiology at Nalanda Medical College and Hospital Patna, Bihar. and tertiary care teaching institution. Study duration is Two years.

**Study Population:** A total of 50 healthy volunteers aged between 18–35 years were included in the

study.

#### Inclusion Criteria

- Healthy individuals of either gender
- Age between 18–35 years
- Non-smokers
- Willing to participate and provide informed consent

#### Exclusion Criteria

- History of respiratory diseases such as asthma, COPD, or tuberculosis
- Cardiovascular disorders
- Recent respiratory tract infection
- Smokers or individuals with a history of chronic smoking
- Individuals already practicing yoga or pranayama regularly

Written informed consent was obtained from all participants prior.

**Baseline Assessment:** Detailed medical history was recorded and general physical examination was performed. Baseline PEFR was measured using a standardized peak flow meter. Each subject performed three trials in standing position after full inspiration, and the highest value was recorded for analysis.

**Intervention:** Participants were trained in pranayama techniques including:

- Anulom Vilom
- Bhastrika
- Kapalbhathi

They practiced pranayama for 20–30 minutes daily under supervision, five days per week, for a period of 6 weeks.

**Post-Intervention Assessment:** At the end of 6 weeks, PEFR was measured again using the same procedure and instrument as baseline.

**Statistical Analysis:** Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Results were expressed as mean  $\pm$  standard deviation (SD). Pre- and post-intervention PEFR values were compared using paired Student's t-test. A p-value  $< 0.05$  was considered statistically significant.

#### Results

A total of 50 healthy volunteers completed the study. Among them, 28 (56%) were males and 22 (44%) were females. The mean age of participants was  $22.4 \pm 3.1$  years.

**Comparison of PEFR Before and After Pranayama:** The mean baseline Peak Expiratory Flow Rate (PEFR) was  $412.6 \pm 52.4$  L/min. After 6 weeks of regular pranayama practice, the mean

PEFR increased to  $445.8 \pm 55.1$  L/min.

The mean increase in PEFR was 33.2 L/min, which was found to be statistically significant ( $p < 0.001$ ) using paired Student's t-test.

#### Gender-wise Analysis

- **Males:** Baseline PEFR:  $455.2 \pm 48.6$  L/min  
Post-intervention PEFR:  $492.3 \pm 50.2$  L/min  
Mean increase: 37.1 L/min ( $p < 0.001$ )
- **Females:** Baseline PEFR:  $358.4 \pm 41.7$  L/min  
Post-intervention PEFR:  $384.6 \pm 43.3$  L/min  
Mean increase: 26.2 L/min ( $p < 0.001$ )

Both male and female participants showed significant improvement in PEFR following regular pranayama practice.

**Summary:** There was a statistically significant increase in PEFR after 6 weeks of pranayama training in healthy volunteers, indicating improved expiratory muscle strength and airway function.

#### Discussion

The present study was conducted to evaluate the effect of regular pranayama practice on Peak Expiratory Flow Rate (PEFR) in healthy volunteers. The results demonstrated a statistically significant increase in PEFR after six weeks of pranayama training, indicating improved pulmonary function. PEFR reflects airway caliber and expiratory muscle strength. The significant improvement observed in the present study suggests that regular practice of pranayama enhances respiratory muscle efficiency and reduces airway resistance. Controlled breathing techniques such as Anulom Vilom, Bhastrika, and Kapalbhathi involve deep inhalation and forceful exhalation, which may strengthen respiratory musculature, improve lung compliance, and increase ventilatory capacity. The improvement in PEFR observed in both male and female participants indicates that the beneficial effects of pranayama are independent of gender. However, absolute PEFR values were higher in males, which may be attributed to greater lung volumes and respiratory muscle mass compared to females.

The physiological mechanisms underlying the improvement in pulmonary function may include:

- Strengthening of diaphragm and intercostal muscles
- Improved alveolar ventilation
- Enhanced airway clearance
- Reduction in sympathetic overactivity and stress-induced bronchoconstriction
- Increased lung compliance and chest wall expansion

Regular yogic breathing practices are also known to improve autonomic balance by enhancing parasympathetic tone, which may contribute to

improved airway dynamics.

The findings of the present study are consistent with previous research that reported significant improvement in pulmonary parameters such as vital capacity, forced vital capacity, forced expiratory volume, and PEFR following pranayama practice. These findings support the role of pranayama as a simple, cost-effective, and non-pharmacological intervention to enhance respiratory efficiency even in healthy individuals.

#### Limitations

- Small sample size
- Short duration of intervention
- Lack of control group
- Study limited to young healthy adults

Further studies with larger sample sizes, longer duration, and randomized controlled design are recommended to strengthen the evidence.

#### Conclusion

The present study demonstrates that regular practice of pranayama significantly improves Peak Expiratory Flow Rate (PEFR) in healthy volunteers. The observed increase in PEFR after six weeks of training indicates enhanced expiratory muscle strength, improved airway function, and better overall pulmonary efficiency. Pranayama, being a simple, safe, cost-effective, and non-pharmacological intervention, can be easily incorporated into daily routine to promote

respiratory health. Regular practice may serve as a preventive strategy to maintain optimal lung function and improve quality of life. Further large-scale, randomized controlled studies with longer follow-up are recommended to validate these findings and explore the long-term benefits of pranayama on pulmonary function.

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