

Immediate Effect of a Short-Term Yoga-Based Intervention on Peak Expiratory Flow Rate among Healthy Adults: An Age- and Gender-Wise Pre–Post Analysis

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ABSTRACT

Background: Peak expiratory flow rate (PEFR) is a simple and reliable indicator of pulmonary function and airway performance. Yoga-based interventions incorporating breathing exercises, postures, and relaxation techniques have been reported to improve respiratory function; however, evidence regarding their immediate effects in healthy individuals across different age groups and genders remains limited. This study evaluated the immediate effect of a short-term yoga-based intervention on PEFR among healthy adults participating in a community-based World Yoga Day program.

Methods: A prospective single-group pre–post observational study was conducted among volunteers attending a World Yoga Day event. Of the 110 participants enrolled, 93 (28 males and 65 females) with complete data were included in the final analysis. Participants underwent a supervised 60-minute yoga session comprising warm-up exercises, yoga postures, pranayama, diaphragmatic breathing, light aerobic stretching, and relaxation. PEFR was measured before and immediately after the intervention using a standardized peak

expiratory flow meter, and the best of three readings was recorded. Paired *t*-test was used to compare pre- and post-intervention values, with statistical significance set at $p < 0.05$.

Results: The mean PEFR increased significantly from 354.4 ± 140.8 L/min before the intervention to 376.1 ± 137.0 L/min after the session (mean difference: 21.7 L/min; $p < 0.001$; Cohen's $d = 0.49$). Significant improvements were observed among female participants ($p < 0.001$) and participants aged ≤ 30 years ($p < 0.001$), whereas changes among males and older age groups were not statistically significant.

Conclusion: A single supervised 60-minute yoga session was associated with an immediate improvement in PEFR among healthy adults, with greater benefits observed in younger participants and females. These findings suggest that short-term yoga-based practices may provide immediate respiratory benefits and support their integration into community health promotion initiatives. Further controlled studies with larger samples and long-term follow-up are warranted.

Keywords: Yoga; Pulmonary Function; Peak Expiratory Flow Rate; Respiratory

**Function Tests; Breathing Exercises;
Community Health Promotion.**

INTRODUCTION

Pulmonary health plays an essential role in maintaining overall physical well-being, as it directly influences exercise tolerance, functional capacity, and quality of life. Peak expiratory flow rate (PEFR) is a simple, reliable, and widely accepted measure of pulmonary function that reflects the maximum speed of expiration. It is commonly used as an indicator of airway patency and respiratory muscle performance^[10, 11]. A decline in PEFR has been associated with advancing age and reduced respiratory efficiency^[6]. Yoga, an ancient mind-body practice, combines physical postures (asanas), breathing exercises (pranayama), and relaxation techniques to enhance both physical and mental health^[1, 5, 8]. In recent years, yoga has received increasing attention as a complementary approach for improving respiratory function because of its emphasis on controlled breathing, thoracic expansion, and mindful movement. Regular yogic breathing practices have been reported to improve ventilatory efficiency, strengthen respiratory muscles, and promote better breathing coordination^[2, 5]. Several studies have demonstrated that yoga positively influences pulmonary function by improving parameters such as forced vital capacity (FVC), forced expiratory volume in one second (FEV₁), and peak expiratory flow rate (PEFR)^[1, 5, 7, 8] in both healthy individuals and those with respiratory disorders. Interestingly, even short-term yoga interventions have been shown to produce measurable improvements in respiratory function, suggesting that the respiratory system can respond rapidly to breathing-focused practices^[8]. Despite these encouraging findings, the extent of improvement may differ among individuals. Factors such as age and gender can influence baseline lung function and physiological responses to exercise and breathing interventions^[3, 6]. Although the

respiratory benefits of yoga have been well documented, limited evidence is available regarding its immediate effect on peak expiratory flow rate (PEFR) across different age groups and genders. Therefore, the present study aimed to evaluate the immediate effect of a short-term yoga-based intervention on PEFR using age- and gender-wise pre-post analysis.

METHODOLOGY

This pre-post observational study was conducted during a community-based health promotion event organized on World Yoga Day at Suryadatta Group of Institutes. The objective was to evaluate the immediate effect of a structured yoga-based session on pulmonary function. Participants attending the World Yoga Day event were recruited through voluntary participation. Students and faculty members from various disciplines participated in the assessment. Individuals of both genders and different age groups were included. Participants with acute respiratory illness, recent thoracic or abdominal surgery, or those unwilling to provide consent were excluded. Prior informed consent was obtained from all participants before enrollment. The intervention consisted of a single supervised 60-minute session, which included: Warm-up – 10 minutes Tadasana – 2 min Bhujangasana – 3 repetitions × 30 sec Gomukhasana – 2 min Anulom Vilom – 5 min Bhramari – 5 min Deep diaphragmatic breathing – 5 min Light aerobic stretching – 10 min Shavasana – 10 min. The session was conducted under certified yoga instructor to ensure uniformity and participant safety. Pulmonary function was assessed using Peak Expiratory Flow Rate (PEFR), measured in liters per minute (L/min) using a peak expiratory flow meter. Baseline (pre-intervention) PEFR measurements were recorded prior to the yoga session, and post-intervention values were obtained immediately after completion of the 60-minute session. Each participant performed three maximal expiratory efforts, and the best of three readings was recorded

as per standard recommendations [9,10] for analysis. All assessments were conducted by faculty members and students from the College of Physiotherapy under standardized instructions. Strict hygiene protocols were followed throughout the assessment process, including disinfection of the peak flow meter mouthpiece between participants and adherence to standard

infection control practices. Of the 110 participants enrolled, 93 were included in the final analysis. Seventeen participants were excluded due to incomplete PEFR readings or failure to complete the full session.

RESULT

Table 1: Overall Pre-Post Comparison of PEFR (n = 93)

Parameter	Value
Pre-intervention PEFR (Mean $\pm$ SD)	354.4 $\pm$ 140.8
Post-intervention PEFR (Mean $\pm$ SD)	376.1 $\pm$ 137.0
Mean Difference	21.7
t-value	-4.68
p-value	< 0.001
Effect size (Cohen's d)	0.49

Table 1 shows the overall comparison of PEFR before and immediately after the yoga intervention. A statistically significant

increase in mean PEFR was observed following the intervention ($p < 0.001$).

Table 2: Gender-Wise Pre-Post PEFR Comparison

Gender	n	Pre-PEFR (Mean $\pm$ SD)	Post-PEFR (Mean $\pm$ SD)	p-value
Male	28	469.0 $\pm$ 140.6	475.0 $\pm$ 138.9	0.513
Female	65	305.0 $\pm$ 120.4	333.5 $\pm$ 118.6	< 0.001

Table 2 presents the gender-wise comparison of PEFR. Female participants demonstrated a statistically significant

improvement in PEFR ($p < 0.001$), whereas the improvement among male participants was not statistically significant.

Table 3: Age Group-Wise Pre-Post PEFR Comparison

Age Group	n	Pre-PEFR (Mean $\pm$ SD)	Post-PEFR (Mean $\pm$ SD)	p-value
≤ 30 years	51	316.8 $\pm$ 128.9	341.4 $\pm$ 126.7	< 0.001
31–45 years	32	421.3 $\pm$ 141.2	437.5 $\pm$ 138.5	0.082
46–60 years	7	359.1 $\pm$ 152.6	387.1 $\pm$ 150.4	0.183
>60 years	3	269.3 $\pm$ 110.8	286.7 $\pm$ 108.5	0.658

Table 3 shows the age group-wise comparison of PEFR. A significant improvement was observed in participants aged ≤ 30 years, while changes in the older age groups were not statistically significant. Overall, the results showed a significant increase in PEFR following the yoga intervention. As presented in Table 1, the overall PEFR improved significantly after the session. Table 2 shows that the improvement was statistically significant among female participants but not among males. Similarly, Table 3 demonstrates that

participants aged ≤ 30 years showed a significant improvement, whereas the changes observed in the older age groups were not statistically significant.

DISCUSSION

The present study investigated the immediate effect of a short-term yoga-based intervention conducted on World Yoga Day on pulmonary function, as measured by peak expiratory flow rate (PEFR). The findings demonstrated a significant improvement in PEFR immediately after the

60-minute yoga session, suggesting that even a single supervised session can produce measurable short-term improvements in expiratory flow. The observed increase in PEFR may be attributed to improved activation of the respiratory muscles, enhanced thoracic mobility, and better coordination of breathing achieved through yogic postures and pranayama techniques^[2,4,5] and light aerobic exercises these Controlled breathing practices are known to enhance ventilatory efficiency, optimize respiratory muscle function, and facilitate more effective expiratory efforts^[2]. These physiological adaptations may explain the immediate improvement in PEFR observed following the intervention. Gender-wise analysis showed that female participants experienced a statistically significant improvement in PEFR, whereas the change among male participants was not statistically significant. One possible explanation is that females had comparatively lower baseline PEFR values, providing greater potential for improvement after the intervention. In addition, established physiological differences in lung volumes and respiratory function between males and females may have contributed to the observed variation in response^[3]. Age-wise analysis revealed that participants aged ≤ 30 years demonstrated a significant improvement in PEFR following the intervention. Younger individuals generally have greater respiratory system compliance, better neuromuscular adaptability, and a higher capacity to respond to breathing-based exercises. In contrast, advancing age is associated with reduced lung elasticity, diminished respiratory muscle efficiency, and gradual physiological changes that may limit the immediate response to such interventions^[6]. It is important to note that the present study evaluated only the immediate effects of a single yoga session rather than the long-term benefits of regular practice. Previous studies have consistently reported sustained improvements in pulmonary function following long-term yoga training^[5,7,8,12]. The findings of the

present study suggest that even one supervised yoga session can produce beneficial short-term changes in pulmonary function. These improvements are likely to reflect acute neuromuscular and ventilatory adaptations rather than permanent structural changes in the respiratory system.

Limitations

This study assessed only the immediate effects of a single 60-minute yoga session using PEFR, study was conducted using a single-group pre-post design without a control group; therefore, causal inferences cannot be made. Convenience sampling during a yoga day event and the relatively small sample size in the older age groups may limit the applicability of the findings. Future randomized controlled studies with larger and more diverse populations and long-term follow-up are recommended.

CONCLUSION

The present study demonstrated that a single 60-minute yoga-based session resulted in a significant immediate improvement in peak expiratory flow rate (PEFR). The improvement was more pronounced among younger participants and females. These findings suggest that even a single session of yoga may produce short-term enhancements in pulmonary function and highlight its potential as a simple, safe, and accessible approach for promoting respiratory health. Further studies are recommended to evaluate the sustainability of these benefits

Declaration by Authors

Ethical Approval: This study was approved by the Institutional Ethics Committee, Suryadatta Institute of Health Sciences – College of Physiotherapy, Pune, vide approval no. SIHS-COP/21/6/2025/01

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