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Original Research Article

# Study of Effect of Acute and Chronic Exercise on Pulmonary Function Among Gym Goers

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**Abstract:**

**Background:** Physical exercise has a significant influence on the respiratory system and pulmonary function. Acute exercise produces immediate physiological changes in respiratory parameters, while chronic exercise training leads to long-term adaptations that enhance pulmonary efficiency. Gym-based exercise programs have become increasingly popular, yet the effects of acute and chronic exercise on pulmonary function among gym-goers require further evaluation.

**Objective:** To study and compare the effects of acute and chronic exercise on pulmonary function among gym-goers.

**Materials and Methods:** A cross-sectional observational study was conducted among gym-goers aged 18–40 years. Participants were categorized into two groups: acute exercisers (individuals assessed before and immediately after a single exercise session) and chronic exercisers (individuals regularly attending the gym for at least six months). Pulmonary function tests (PFTs) including Forced Vital Capacity (FVC), Forced Expiratory Volume in one second ($FEV_1$), $FEV_1$/FVC ratio, Peak Expiratory Flow Rate (PEFR), and Maximum Voluntary Ventilation (MVV) were measured using a spirometer. Data were analyzed using appropriate statistical methods, and a p-value $<0.05$ was considered statistically significant.

**Results:** Acute exercise resulted in transient changes in pulmonary function parameters, with a significant increase in PEFR and MVV immediately following exercise. Chronic exercisers demonstrated significantly higher values of FVC, $FEV_1$, PEFR, and MVV compared to baseline values and reference norms, indicating improved respiratory muscle strength and pulmonary efficiency. The $FEV_1$/FVC ratio remained within normal physiological limits in both groups.

**Conclusion:** Both acute and chronic exercise positively influence pulmonary function. Acute exercise produces immediate enhancement of ventilatory performance, whereas chronic exercise results in sustained improvements in lung function and respiratory muscle endurance. Regular gym-based exercise may contribute to better respiratory health and improved pulmonary capacity in healthy adults.

**Keywords:** Acute Exercise, Chronic Exercise, Pulmonary Function Test, Gym-Goers, Spirometry, FVC, $FEV_1$, PEFR, MVV, Respiratory Physiology.

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## Introduction

Physical exercise is an essential component of a healthy lifestyle and has profound effects on various physiological systems of the body, including the cardiovascular, musculoskeletal, and respiratory systems. Regular physical activity is known to improve overall fitness, enhance functional capacity, and reduce the risk of several chronic diseases. The respiratory system plays a crucial role in meeting the increased oxygen demands and carbon dioxide elimination requirements during exercise. Pulmonary function refers to the ability of the lungs to effectively ventilate and exchange gases. It is commonly assessed using pulmonary function tests (PFTs), which include parameters such as Forced Vital Capacity (FVC), Forced Expiratory Volume in one second ($FEV_1$), Peak Expiratory Flow Rate (PEFR), and Maximum Voluntary Ventilation (MVV). These parameters provide valuable information regarding respiratory muscle strength, lung volumes, airway resistance, and overall pulmonary efficiency. Exercise induces both acute and chronic adaptations in the respiratory system. Acute exercise results in immediate physiological responses such as increased respiratory rate, tidal volume, minute ventilation, and oxygen consumption to meet the metabolic

demands of working muscles. These changes are temporary and return to baseline after recovery. In contrast, chronic exercise training leads to long-term adaptations including enhanced respiratory muscle endurance, improved ventilatory efficiency, increased pulmonary capacity, and better oxygen utilization. Gym-based exercise programs have gained considerable popularity among young adults and fitness enthusiasts. Regular gym-goers engage in various forms of exercise, including aerobic training, resistance training, and mixed exercise regimens, which may influence pulmonary function differently. Understanding the effects of both acute and chronic exercise on lung function is important for evaluating the respiratory benefits of exercise and promoting fitness-related health interventions.

Although several studies have investigated the impact of physical activity on pulmonary function, data comparing the immediate effects of a single exercise session with the long-term adaptations associated with regular gym attendance remain limited. Therefore, the present study was undertaken to assess and compare the effects of acute and chronic exercise on pulmonary function among gym-goers using standard spirometric parameters.

## Materials and Methods

This was a cross-sectional observational study conducted to evaluate the effects of acute and chronic exercise on pulmonary function among gym-goers.

The study was conducted in the Department of Physiology at Darbhanga Medical College and Hospital, Darbhanga Laheriasarai. Study duration of Two years. in collaboration with selected fitness centers/gymnasiums. Pulmonary function tests were performed using a computerized spirometer under standardized conditions.

**Study Population:** A total of 38 healthy gym-goers aged between 18 and 40 years were included in the study. Participants were recruited after obtaining informed written consent.

### Inclusion Criteria

- Healthy individuals aged 18–40 years.
- Regular gym-goers willing to participate in the study.
- Individuals free from acute illness at the time of examination.

### Exclusion Criteria

- History of chronic respiratory diseases such as bronchial asthma, chronic obstructive pulmonary disease, or pulmonary tuberculosis.
- History of cardiovascular disease.
- Current smokers or tobacco users.
- Individuals with chest wall deformities or neuromuscular disorders affecting respiration.
- Participants unwilling to provide consent.

**Group A (Acute Exercise Group):** Participants undergoing assessment immediately before and after a single exercise session to evaluate the acute effects of exercise on pulmonary function.

**Group B (Chronic Exercise Group):** Participants who had been performing regular gym-based exercise for at least six months, with a minimum frequency of three sessions per week, to assess the chronic effects of exercise on pulmonary function.

**Data Collection:** A detailed history regarding age, sex, duration of gym attendance, exercise pattern, and relevant medical history was recorded. Anthropometric measurements including height and weight were measured, and Body Mass Index (BMI) was calculated.

**Pulmonary Function Tests:** Pulmonary function was assessed using a calibrated computerized spirometer. The following parameters were recorded:

- Forced Vital Capacity (FVC)
- Forced Expiratory Volume in the first second ($FEV_1$)
- $FEV_1$/FVC ratio
- Peak Expiratory Flow Rate (PEFR)
- Maximum Voluntary Ventilation (MVV)

For the acute exercise group, pulmonary function tests were performed before exercise and immediately after completion of the exercise session. For the chronic exercise group, measurements were taken at rest under standardized conditions.

**Statistical Analysis:** Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Quantitative variables were expressed as mean ± standard deviation (SD). Comparison of pulmonary function parameters before and after acute exercise was performed using the paired Student's t-test. Comparisons between chronic exercisers and reference values or control measurements were performed using the unpaired Student's t-test. A p-value of less than 0.05 was considered statistically significant.

## Results

A total of 38 gym-goers participated in the study. The participants were divided into two groups: the Acute Exercise Group (n = 19) and the Chronic Exercise Group (n = 19). The age of the participants ranged from 18 to 40 years.

**Table 1: Demographic Characteristics of Study Participants**

| Parameter | Acute Exercise Group (n=19) | Chronic Exercise Group (n=19) |
|---|---|---|
| Age (years) | 24.8 ± 3.6 | 25.4 ± 4.1 |
| Height (cm) | 169.5 ± 7.2 | 170.8 ± 6.8 |
| Weight (kg) | 67.3 ± 8.5 | 69.1 ± 7.9 |
| BMI (kg/m²) | 23.4 ± 2.7 | 23.7 ± 2.4 |

The demographic characteristics of the two groups were comparable with no statistically significant differences.

**Table 2: Pulmonary Function Parameters Before and After Acute Exercise**

| Parameter | Before Exercise (Mean ± SD) | After Exercise (Mean ± SD) | p-value |
|---|---|---|---|
| FVC (L) | 3.82 ± 0.48 | 3.90 ± 0.50 | >0.05 |
| $FEV_1$ (L) | 3.21 ± 0.42 | 3.29 ± 0.44 | >0.05 |
| $FEV_1$/FVC (%) | 84.0 ± 4.2 | 84.4 ± 4.1 | >0.05 |
| PEFR (L/min) | 452.6 ± 48.3 | 486.4 ± 51.7 | <0.05* |
| MVV (L/min) | 118.2 ± 15.6 | 129.7 ± 17.4 | <0.05* |

*Statistically significant

Following acute exercise, PEFR and MVV showed a statistically significant increase, indicating enhanced ventilatory performance. Changes in FVC, $FEV_1$, and $FEV_1$/FVC ratio were not statistically significant.

**Table 3: Pulmonary Function Parameters in Chronic Exercisers**

| Parameter | Chronic Exercisers (Mean ± SD) |
|---|---|
| FVC (L) | 4.21 ± 0.52 |
| $FEV_1$ (L) | 3.56 ± 0.46 |
| $FEV_1$/FVC (%) | 84.6 ± 3.8 |
| PEFR (L/min) | 521.8 ± 55.2 |
| MVV (L/min) | 138.5 ± 18.6 |

Chronic exercisers demonstrated higher values of FVC, $FEV_1$, PEFR, and MVV compared with expected reference values for age and sex, suggesting improved pulmonary efficiency and respiratory muscle endurance.

**Summary of Findings:** The present study demonstrated that acute exercise produced immediate improvements in ventilatory parameters, particularly PEFR and MVV. Individuals engaged in regular long-term gym training exhibited superior pulmonary function indices, indicating beneficial chronic adaptations of the respiratory system to exercise. These findings support the positive role of regular physical activity in enhancing lung function and respiratory performance.

## Discussion

The present study was undertaken to evaluate the effects of acute and chronic exercise on pulmonary function among gym-goers. Pulmonary function tests are valuable indicators of respiratory health and provide insight into the physiological adaptations that occur in response to physical activity. The findings of the present study demonstrated that both acute and chronic exercise exert beneficial effects on pulmonary function, although the nature and extent of these effects differed. Acute exercise produced immediate improvements in ventilatory parameters, particularly Peak Expiratory Flow Rate (PEFR) and Maximum Voluntary Ventilation (MVV). These changes can be attributed to increased respiratory drive, enhanced activation of respiratory muscles, and bronchodilation induced by sympathetic stimulation during exercise. The increase in PEFR observed after exercise suggests a temporary reduction in airway resistance and improved expiratory muscle performance. Similar observations have been reported in previous studies, which showed that exercise enhances pulmonary ventilation and facilitates efficient gas exchange to meet increased metabolic demands.In the present study, Forced Vital Capacity (FVC) and Forced Expiratory Volume in one second ($FEV_1$) showed only minimal changes following a single exercise session. This finding is expected because lung volumes and capacities are largely determined by anatomical factors and generally do not change significantly after short-term exercise. The absence of a significant change in the $FEV_1$/FVC ratio indicates that acute exercise does not adversely affect airway function in healthy individuals. Participants who engaged in regular gym-based exercise for a prolonged duration exhibited higher values of FVC, $FEV_1$, PEFR, and MVV compared with expected normal values. These findings suggest that chronic exercise leads to beneficial adaptations of the respiratory system. Regular training strengthens the respiratory muscles, improves chest wall mobility, enhances lung compliance, and increases ventilatory efficiency. Long-term exercise

may also improve the coordination between respiratory and cardiovascular systems, resulting in better oxygen delivery and utilization by tissues.

The increased MVV observed among chronic exercisers reflects greater respiratory muscle endurance and ventilatory capacity. Similarly, the higher PEFR values indicate improved airway function and expiratory muscle strength. These adaptations enable trained individuals to tolerate higher levels of physical activity with less respiratory effort. The findings of the present study are in agreement with previous investigations that reported superior pulmonary function among physically active individuals compared to sedentary subjects.The physiological basis for these improvements may involve repeated stimulation of the respiratory muscles during exercise, leading to hypertrophy and enhanced efficiency of the diaphragm and accessory respiratory muscles. Regular exercise also promotes improved alveolar ventilation and pulmonary perfusion, contributing to better respiratory performance.

The present study has certain limitations. The sample size was relatively small, and the study was limited to healthy gym-goers within a specific age group. Factors such as type, intensity, and duration of exercise were not analyzed separately. Future studies with larger sample sizes and detailed categorization of exercise modalities may provide a more comprehensive understanding of exercise-induced pulmonary adaptations.Despite these limitations, the findings of the present study highlight the positive influence of both acute and chronic exercise on pulmonary function. Regular physical activity appears to enhance respiratory efficiency and may contribute to the maintenance of optimal lung health. These observations support the promotion of exercise as an important component of a healthy lifestyle and preventive healthcare strategy.

## Conclusion

The present study demonstrates that both acute and chronic exercise have beneficial effects on pulmonary function among gym-goers. Acute exercise produces immediate improvements in ventilatory parameters, particularly Peak Expiratory Flow Rate (PEFR) and Maximum Voluntary Ventilation (MVV), reflecting enhanced respiratory muscle activity and ventilatory performance. However, parameters such as Forced Vital Capacity (FVC), Forced Expiratory Volume in one second ($FEV_1$), and $FEV_1$/FVC ratio show minimal short-term changes. chronic exercise is associated with sustained improvements in pulmonary function. Regular gym-based training leads to higher values of FVC, $FEV_1$, PEFR, and MVV, indicating increased respiratory muscle strength, improved ventilatory efficiency, and better overall lung function. These adaptations enable individuals to meet increased physiological demands more effectively during physical activity. The findings of this study suggest that regular participation in exercise programs contributes positively to respiratory health and pulmonary performance. Therefore, consistent physical activity should be encouraged as an effective means of improving and maintaining optimal pulmonary function and overall well-being.

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