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# A Cross-Sectional Study of Pulmonary Function Parameters among Healthy Young Adults in a Tertiary Care Teaching Institution.

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## Abstract

***Background:*** Pulmonary function parameters in healthy young adults provide a practical physiological baseline for early identification of respiratory deviation and for comparison with regional normative standards. ***Objectives:*** To assess spirometric pulmonary function parameters among healthy young adults and to compare the values between male and female participants. ***Methods:*** This institution-based cross-sectional study was conducted at Prathima Institute of Medical Sciences, Karimnagar, Telangana, from June 2025 to November 2025. One hundred apparently healthy young adults aged 18–25 years were enrolled. Standardized spirometry was performed and forced vital capacity [FVC], forced expiratory volume in one second [FEV1], FEV1/FVC ratio, peak expiratory flow rate [PEFR], and forced expiratory flow at 25%–75% of pulmonary volume [FEF25–75] were recorded. Data were analyzed using descriptive statistics and sex-wise comparison tests. ***Results:*** The mean age of the participants was 21.1 ± 1.7 years; 52.0% were males and 48.0% were females. The mean FVC was 3.61 ± 0.62 L, FEV1 was 3.18 ± 0.54 L, FEV1/FVC ratio was 88.1 ± 5.2%, PEFR was 6.92 ± 1.28 L/s, and FEF25–75 was 3.82 ± 0.72 L/s. Male participants showed significantly higher mean FVC, FEV1, PEFR, and FEF25–75 values than females, whereas the FEV1/FVC ratio was significantly higher among females. Normal spirometry was observed in 88.0% of participants, while 9.0% showed a mild restrictive pattern and 3.0% showed a borderline obstructive pattern.
***Conclusion:*** Healthy young adults in this tertiary care teaching institution demonstrated pulmonary function values within normal physiological limits, with clear sex-based differences in absolute lung volumes and flow rates. The findings provide useful local baseline data for physiological research, student health screening, and future comparative studies in similar populations.

**Keywords:** spirometry, pulmonary function, healthy young adults, FVC, FEV1, tertiary care teaching institution.



## INTRODUCTION

Pulmonary function testing is a fundamental, non-invasive method for evaluating respiratory mechanics, airway function, and ventilatory capacity. Among the various pulmonary function tests, spirometry remains the most widely used because it is reproducible, relatively inexpensive, and clinically informative when performed under standardized conditions [1,2]. Parameters such as forced vital capacity [FVC], forced expiratory volume in one second [FEV1], the FEV1/FVC ratio, peak expiratory flow rate [PEFR], and mid-expiratory flow indices offer objective insight into lung volumes, expiratory airflow, and large as well as small airway performance. Even in apparently healthy individuals, these parameters vary according to age, sex, height, ethnicity, nutritional status, and environmental exposure [3-6].

Healthy young adulthood represents an important physiological window because lung growth is nearly complete and peak lung function is usually achieved during this phase. Establishing baseline spirometric values in this age group is useful for academic physiology, preclinical respiratory assessment, sports medicine, occupational screening, and longitudinal research [3,7,8]. Several Indian studies have shown that pulmonary function values differ across geographic regions and populations, emphasizing the importance of locally relevant data rather than sole dependence on extrapolated international equations [4-9]. Regional variation has been attributed to differences in body habitus, ethnicity, socioeconomic conditions, environmental background, and secular trends affecting growth and lung development [3-7,9].

Sex-based variation in spirometric performance has also been reported consistently. Male participants generally demonstrate higher absolute lung volumes and flow rates than female participants of similar age, largely because of differences in height, thoracic dimensions, respiratory muscle strength, and lean body mass [8-12]. At the same time, indices expressed as ratios, especially the FEV1/FVC ratio, can show a different pattern because they reflect proportional

airflow relative to lung volume rather than absolute volume alone [8,11,12]. Anthropometric influences, including adiposity and central obesity, have also been studied in young adults, with some reports showing an adverse relationship between excess body fat and pulmonary mechanics [13,14]. These observations highlight the value of examining pulmonary function in carefully selected healthy young populations.

The present study was undertaken to describe pulmonary function parameters among healthy young adults studying in a tertiary care teaching institution in Telangana. In view of the limited institution-specific data from this age group, the study aimed to generate local baseline values using standardized spirometric techniques. The objectives of the study were to assess FVC, FEV1, FEV1/FVC ratio, PEFR, and FEF25–75 among healthy young adults and to compare these pulmonary function parameters between male and female participants.

## METHODOLOGY

### Study design and setting:

This institution-based cross-sectional study was conducted at Prathima Institute of Medical Sciences, Karimnagar, Telangana, India, over a six-month period from June 2025 to November 2025. The study was planned to evaluate pulmonary function parameters among apparently healthy young adults in a tertiary care teaching environment. The protocol was developed in accordance with established spirometry standards and the recommendations for performance, acceptability, repeatability, and interpretation outlined in international and Indian guidance documents [1,2].

### Study population:

The study population comprised apparently healthy young adults aged 18 to 25 years who were available within the institution during the study period. Participants were recruited from the student community after explanation of the purpose and procedure of the study. A total sample size of 100 participants was included. Both male and female participants were enrolled, and all eligible individuals who consented during the study period were evaluated.
Inclusion criteria. Apparently healthy young adults aged 18–25 years, willing to participate, able to understand the spirometry procedure, and capable of giving informed written consent were included in the study.

### Exclusion criteria:

Individuals with a history of asthma, chronic cough, recurrent wheeze, chronic respiratory disease, acute respiratory infection within the preceding two weeks, smoking history, known cardiovascular illness, neuromuscular disorder, structural chest wall abnormality, recent thoracic or abdominal surgery, or any condition interfering with forceful respiratory maneuvers were excluded. Participants with unsatisfactory spirometric efforts after repeated coaching were also excluded from the final analysis.

### Study procedure:

After obtaining informed written consent, a brief clinical screening was performed to confirm eligibility. Age and sex were recorded. Height was measured in centimeters using a stadiometer with the participant standing erect without footwear. Weight was measured in kilograms using a calibrated weighing scale with light clothing and no footwear. Body mass index [BMI] was calculated as weight in kilograms divided by the square of height in meters. Spirometry was performed using a calibrated computerized spirometer in a quiet room under supervised conditions. Participants were instructed regarding the maneuver and were allowed practice attempts before actual recording. Each participant performed at least three acceptable forced expiratory maneuvers, and the best acceptable value was retained for analysis. Calibration checks, test acceptability, and repeatability standards were maintained in line with ATS/ERS and Joint Indian Chest Society recommendations [1,2].

### Variables studied:

The primary pulmonary function parameters recorded were forced vital capacity [FVC], forced expiratory volume in one second [FEV1], FEV1/FVC ratio, peak expiratory flow rate [PEFR], and forced expiratory flow during the middle half of expiration [FEF25–75]. Baseline demographic and anthropometric variables were also documented. Spirometric patterns were categorized as normal, mild restrictive pattern, or borderline obstructive pattern on the basis of the recorded indices and standard interpretative principles [1-3].

### Statistical analysis:

Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences [SPSS] software, version 25.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were summarized as frequencies and percentages. Comparison of mean pulmonary function parameters between male and female participants was performed using the independent samples t-test. A p value of less than 0.05 was considered statistically significant. Exploratory analysis was also undertaken to examine the relationship of anthropometric variables such as height and BMI with selected spirometric parameters.

**Ethical considerations:**

The study was conducted after approval from the Institutional Ethics Committee of Prathima Institute of Medical Sciences, Karimnagar. Written informed consent was obtained from all participants prior to enrollment. Confidentiality of participant information was maintained throughout the study, and all procedures were performed in accordance with institutional ethical standards and the principles of biomedical research involving human participants.

## RESULTS

A total of 100 healthy young adults were included in the study and all participants completed spirometric assessment successfully. The age of the participants ranged from 18 to 25 years, with a mean age of 21.1 ± 1.7 years. Among them, 52 [52.0%] were males and 48 [48.0%] were females. The mean height, weight, and body mass index [BMI] of the study population were 166.6 ± 8.0 cm, 61.8 ± 10.2 kg, and 22.2 ± 3.1 kg/m², respectively. The baseline characteristics of the study participants are shown in Table 1.

**Table 1. Baseline characteristics of study participants [N = 100]**

| Variable | Category / Value | n | % / Mean ± SD |
|---|---|---|---|
| Age group [years] | 18–20 | 42 | 42.0 |
| | 21–23 | 46 | 46.0 |
| | 24–25 | 12 | 12.0 |
| Sex | Male | 52 | 52.0 |
| | Female | 48 | 48.0 |
| Age [years] | 21.1 ± 1.7 | | |
| Height [cm] | 166.6 ± 8.0 | | |
| Weight [kg] | 61.8 ± 10.2 | | |
| BMI [kg/m²] | 22.2 ± 3.1 | | |

The mean pulmonary function parameters of the overall study population demonstrated values within normal physiological limits. The mean forced vital capacity [FVC] was 3.61 ± 0.62 L, mean forced expiratory volume in one second [FEV1] was 3.18 ± 0.54 L, and mean FEV1/FVC ratio was 88.1 ± 5.2%. The mean peak expiratory flow rate [PEFR] was 6.92 ± 1.28 L/s, while the mean forced expiratory flow at 25%–75% of the pulmonary volume [FEF25–75] was 3.82 ± 0.72 L/s. These findings indicate an overall normal spirometric profile among the healthy young adults studied [Table 2].

**Table 2. Overall pulmonary function parameters of study participants [N = 100]**

| Parameter | Mean ± SD |
|---|---|
| FVC [L] | 3.61 ± 0.62 |
| FEV1 [L] | 3.18 ± 0.54 |
| FEV1/FVC ratio [%] | 88.1 ± 5.2 |
| PEFR [L/s] | 6.92 ± 1.28 |
| FEF25–75 [L/s] | 3.82 ± 0.72 |

On comparison by sex, male participants had significantly higher mean FVC, FEV1, PEFR, and FEF25–75 values than female participants. The mean FVC among males was 4.02 ± 0.49 L compared to 3.16 ± 0.41 L among females [$p < 0.001$]. Similarly, mean FEV1 was 3.49 ± 0.42 L in males and 2.85 ± 0.36 L in females [$p < 0.001$]. Mean PEFR was also significantly higher in males [7.62 ± 1.19 L/s] than in females [6.17 ± 0.98 L/s] [$p < 0.001$]. However, the FEV1/FVC ratio was slightly higher among females, and the difference was statistically significant [$p = 0.011$]. These observations are shown in Table 3.

**Table 3. Comparison of pulmonary function parameters between male and female participants**

| Parameter | Male [n = 52] Mean ± SD | Female [n = 48] Mean ± SD | p value |
|---|---|---|---|
| FVC [L] | 4.02 ± 0.49 | 3.16 ± 0.41 | <0.001 |
| FEV1 [L] | 3.49 ± 0.42 | 2.85 ± 0.36 | <0.001 |
| FEV1/FVC ratio [%] | 86.8 ± 4.8 | 89.4 ± 5.3 | 0.011 |
| PEFR [L/s] | 7.62 ± 1.19 | 6.17 ± 0.98 | <0.001 |
| FEF25–75 [L/s] | 3.96 ± 0.74 | 3.67 ± 0.69 | 0.045 |

The distribution of spirometric patterns showed that the majority of participants had normal pulmonary function. Normal spirometry was observed in 88 [88.0%] participants. Mild restrictive pattern was seen in 9 [9.0%] participants, while borderline obstructive pattern was noted in 3 [3.0%]. No participant demonstrated severe ventilatory impairment. The spirometric pattern distribution is presented in Table 4.

**Table 4. Distribution of spirometric patterns among the study participants**

| Spirometric pattern | n | % |
|---|---|---|
| Normal | 88 | 88.0 |
| Mild restrictive pattern | 9 | 9.0 |
| Borderline obstructive pattern | 3 | 3.0 |
| Total | 100 | 100.0 |

Further analysis showed a positive relationship between height and absolute lung volume parameters. Participants with greater height tended to have higher FVC and FEV1 values. In contrast, BMI showed a weak inverse trend with FEV1/FVC ratio, though this did not reach statistical significance. Overall, the pulmonary function profile of the study population remained within expected normal limits for healthy young adults, with sex-related differences observed mainly in absolute lung volume and flow parameters.

## DISCUSSION

The present cross-sectional study evaluated spirometric pulmonary function parameters among 100 healthy young adults in a tertiary care teaching institution. The overall mean values of FVC, FEV1, FEV1/FVC ratio, PEFR, and FEF25–75 were within normal physiological ranges, indicating that the study population had preserved ventilatory function. This broad finding is consistent with the established role of spirometry as a reliable tool for defining normative respiratory performance in healthy adults when performed under standardized conditions [1-3]. The present observations also support the need for institution-level and region-specific baseline data, particularly in India, where pulmonary function values vary across populations and currently used equations are influenced by ethnicity, body habitus, and geography [4-9].

A major finding of the study was the significant sex-wise difference in absolute pulmonary function parameters. Male participants showed higher mean FVC, FEV1, PEFR, and FEF25–75 values than female participants, whereas the FEV1/FVC ratio was modestly but significantly higher among females. Similar sex-related differences have been documented in Indian and international studies of healthy young adults [8-12]. Nayak et al. reported significant gender differences in young Indian adults and identified height as a major determinant of FVC and FEV1 [8]. Vijayan et al. also observed that pulmonary function in healthy young South Indian adults differed by sex and anthropometric profile [9]. Comparable trends were reported in young male and female populations from Kolkata and in Malaysian young adults, where males generally demonstrated higher lung volumes and expiratory flow indices [10-12].

These differences are commonly explained by variation in thoracic size, airway dimensions, respiratory muscle mass, and lean body composition.The predominance of normal spirometry in 88.0% of participants suggests that the inclusion criteria were effective in selecting a healthy sample. The small proportion with mild restrictive or borderline obstructive patterns is not unexpected in a volunteer population, as subclinical variation, effort dependence, and minor physiological heterogeneity can influence test interpretation even in asymptomatic individuals [1-3]. The present findings therefore remain useful as a practical physiological baseline rather than a definitive community reference equation. The observed positive relation of height with FVC and FEV1 agrees with previous Indian studies from northern, western, and eastern regions, all of which emphasize height as one of the strongest predictors of lung function [4-7]. This reinforces the importance of anthropometric adjustment during spirometric interpretation.

In the present study, BMI showed only a weak inverse trend with the FEV1/FVC ratio and did not demonstrate a strong adverse effect on the spirometric profile. This pattern likely reflects the relatively healthy composition of the sample and the limited spread of BMI values. Some earlier studies among young Indian adults have described a clearer negative influence of obesity or abdominal adiposity on pulmonary mechanics, especially on flow rates and volume parameters [13,14]. The weaker trend seen here therefore indicates that mild variation in BMI within an otherwise healthy young institutional population exerts a smaller effect than sex and height. Overall, the study provides useful local data from Telangana and contributes to the growing Indian literature supporting population-specific pulmonary function assessment.

### Limitations

The study was conducted in a single tertiary care teaching institution with a modest sample size and a narrow age range, which limits broader generalizability. Participants were institutional volunteers rather than a randomly selected community sample. Only spirometric indices were evaluated, while static lung volumes and diffusion capacity were not assessed. These factors should be considered when interpreting the external applicability of the findings.

## CONCLUSION

This study demonstrated that healthy young adults at Prathima Institute of Medical Sciences had pulmonary function parameters within normal physiological limits, with clear sex-based differences in absolute lung volumes and expiratory flow measures. Male participants showed significantly higher FVC, FEV1, PEFR, and FEF25–75 values, whereas females had a higher FEV1/FVC ratio. Height showed a positive association with major lung volume parameters, while BMI

displayed only a weak inverse trend. The predominance of normal spirometric patterns supports the suitability of the studied population for baseline physiological assessment. These findings provide useful local reference data for teaching, screening, and future comparative respiratory research in similar young adult populations.

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