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Original Research Article

Static Lung Function Tests using Student Spirometer among First-Year MBBS Students

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Abstract:

The assessment of lung function is a critical component of clinical medicine, offering insights into the respiratory health of individuals. Spirometry, a key test in evaluating pulmonary function, is commonly used to measure static lung volumes and capacities. The present study evaluates the use of a student spirometer in performing static lung function tests among first-year MBBS students. The study aims to assess the feasibility, accuracy, and educational value of student spirometers in medical education. A cohort of 100 first-year MBBS students participated in this study, where spirometric measurements were performed to evaluate forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), and the FEV1/FVC ratio. The results demonstrated good correlation with standard spirometric values, highlighting the effectiveness of student spirometers for educational purposes. This research emphasizes the potential role of spirometry in early medical education, providing students with foundational knowledge in respiratory physiology and diagnostic techniques.

Keywords: Static lung function, spirometry, student spirometer, first-year MBBS students, respiratory health, forced vital capacity (FVC), forced expiratory volume (FEV1), pulmonary function.

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Introduction

Lung function assessment plays a crucial role in both diagnosing and managing respiratory diseases. Spirometry, one of the most common pulmonary function tests, measures various lung volumes and capacities, offering valuable information about airway patency and overall pulmonary health. Pellegrino, R., et al. (2005) [2]. In medical education, it is essential for students to become familiar with techniques that evaluate lung function. Spirometry not only serves as a diagnostic tool but also reinforces concepts related to respiratory physiology, clinical medicine, and patient care. While conventional spirometers are widely used in clinical settings, student spirometers—compact, portable devices designed for educational purposes—are becoming increasingly available. These devices enable students to perform lung function tests and understand the underlying physiological principles in a controlled, hands-on environment. Duling, M. G., et al. (2018) [3]. This study aims to evaluate the feasibility, accuracy, and educational value of using student spirometers to perform static lung function tests among first-year MBBS students. Specifically, the study focuses on assessing Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 second (FEV1), and the FEV1/FVC ratio, comparing the results to standard spirometric values.

Materials and Methods

Study Design: This was a cross-sectional observational study conducted over a period of three months at the Department of Physiology, Narendra Modi Medical College, Ahmedabad. The study included 100 first-year MBBS students who volunteered to participate. All participants were provided with informed consent.

Inclusion and Exclusion Criteria

Inclusion Criteria:

- First-year MBBS students aged between 18 and 22 years.
- Healthy individuals without known respiratory diseases.

Exclusion Criteria:

- Students with a history of asthma, chronic obstructive pulmonary disease (COPD), or any other significant respiratory disorders.
- Students unable to perform the spirometry tests due to technical issues or physical limitations.

Instrumentation

The primary instrument used was a student computerised spirometer, Prakash, P., & Kaur, S. (2016) [5]. A portable and user-friendly device capable of measuring static lung volumes and peak flow rates. The specific model used in this study was the Spiroxcel Spirometer designed for educational purposes. This device was calibrated according to the manufacturer's instructions before use. Kandasamy, A., & Aravindan, A. (2019) [9].

Procedure

Each participant underwent a series of spirometry tests to measure:

- **Forced Vital Capacity (FVC)**: The total amount of air that can be forcefully exhaled after a deep inspiration. Gandevia, S. C., & Wilson, P. J. (1991) [4].
- **Forced Expiratory Volume in 1 second (FEV1)**: The volume of air that can be forcefully exhaled in the first second after a full inspiration.
- **FEV1/FVC ratio**: The ratio of FEV1 to FVC, an indicator of airway obstruction.

The participants were instructed to:

1. Sit upright and perform a maximal inspiration.
2. Exhale forcefully into the spirometer as quickly and completely as possible.
3. Repeat the procedure three times to ensure reproducibility and accuracy, with a minimum of two acceptable efforts.

The best values of FVC, FEV1, and the FEV1/FVC ratio from the three attempts were recorded for analysis. Lee, J. H., & Kim, S. Y. (2017) [6].

Statistical Analysis

Data were analysed using MS Excel. Descriptive statistics (mean, standard deviation) were used to summarize the lung function parameters.

A comparison of the obtained values was made with the predicted normal values for age, gender, and height.

The correlation between student spirometer measurements and predicted values was assessed using the Pearson correlation coefficient.

Results

Demographic Characteristics of Participants

A total of 100 first-year MBBS students participated, consisting of 50 male and 50 female students.

The age range was 18–22 years, with a mean age of 19.5 ± 1.2 years. The mean height of male students was 170 ± 6 cm, while the mean height of female students was 160 ± 5 cm.

Spirometry Values

The spirometric measurements for FVC, FEV1, and the FEV1/FVC ratio are presented in Table 1.

Table 1: Statistical Analysis results demonstrating mean and predicted values

Parameter	Mean Value (Male)	Mean Value (Female)	Predicted Value (Male)	Predicted Value (Female)
FVC (L)	4.5 ± 0.6	3.8 ± 0.5	4.8 ± 0.5	4.1 ± 0.4
FEV1 (L)	3.8 ± 0.5	3.2 ± 0.4	4.2 ± 0.4	3.5 ± 0.3
FEV1/FVC Ratio (%)	84 ± 3	84 ± 4	87 ± 2	85 ± 3

Comparison with Predicted Values

- **FVC**: The average FVC was slightly lower than the predicted value for both males and females. The mean difference was 0.3 L in males and 0.3 L in females.
- **FEV1**: The mean FEV1 was also lower than the predicted value, with a difference of 0.4 L in males and 0.3 L in females.
- **FEV1/FVC Ratio**: The ratio was found to be within the normal range, with no significant difference from the predicted values.

Correlation between Student Spirometer and Predicted Values

The correlation between spirometer measurements and predicted normal values was as follows:

- **FVC**: $r = 0.92$ ($p < 0.01$)
- **FEV1**: $r = 0.88$ ($p < 0.01$)
- **FEV1/FVC Ratio**: $r = 0.90$ ($p < 0.01$)

These results indicate a strong positive correlation, suggesting that the student spirometer provides reliable data for educational purposes.

Discussion

The findings of this study indicate that the student spirometer is a feasible and reliable tool for measuring static lung function among first-year MBBS students. The spirometric values obtained from the participants showed a strong correlation with predicted normal values for both FVC and FEV1, with no significant deviations in the FEV1/FVC ratio.

The slight differences observed between the measured and predicted values could be attributed to several factors, including individual variability, technical aspects of the spirometer, and the

relatively small sample size. However, these differences were not substantial enough to undermine the educational value of the student spirometer. The use of student spirometers in medical education allows for hands-on learning, enabling students to understand the practical aspects of spirometry while reinforcing theoretical knowledge in respiratory physiology. Moreover, such devices are portable, cost-effective, and easy to use, making them an ideal choice for educational settings.

Educational Value

The study highlights the educational potential of student spirometers, which can be integrated into physiology and clinical teaching curricula. By performing spirometry tests, students can develop practical skills in pulmonary function testing and enhance their understanding of diseases like asthma, COPD, and restrictive lung diseases. Early exposure to such tools also encourages a proactive approach to respiratory health in clinical practice.

Conclusion

The use of student spirometers for conducting static lung function tests among first-year MBBS students is both feasible and effective. The results demonstrate that these devices provide reliable measurements of FVC, FEV1, and the FEV1/FVC ratio, with good correlation to predicted normal values. Incorporating spirometry into the medical curriculum provides significant educational value, equipping students with essential skills for clinical practice and respiratory health assessment. Zhang, J., et al. (2020) [13] Agarwal, R., & Gupta, D. (2012) [14] Further studies with larger and more diverse populations may help refine the utility and accuracy of these devices in clinical and educational settings.

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