

Effect of Increased Body Mass Index (BMI) on Pulmonary Function Tests: A Pilot Study

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Abstract:

Introduction: Obesity is a prevalent has been associated with various health complications. However, studies on its effects on the respiratory system are very less. Medical students are more prone to stress and which can lead to overweight or obesity. This study aimed to investigate the impact of body mass index (BMI) on pulmonary function tests (PFTs) among medical students.

Aims and Objectives: The main aim of study to observed association between BMI and lung functions.

Materials and Methods: A cross-sectional study conducted among medical students at Smt. N.H.L. Municipal Medical College. Total 30 participants were included in the study. Anthropometric and spirometry parameters, such as forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), and peak expiratory flow rate measured using a computerized spirometer. Statistical analysis performed using Graph-pad Software.

Results: FVC, FEV1, PEFr, FEV1/FVC values are reduced in obese compared to normal subjects. Reduction in FEV1/FVC was statistically significant.

Conclusion: People with high BMI are prone to respiratory disorders. Hence, preventive measures should be taken for healthy lifestyle to avoid obesity.

Keywords: PFT, Obesity, Medical Students.

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Introduction

Pulmonary function tests recorded with the help of spirometer provide vital information regarding large and small airways of lungs as well as pulmonary circulation. They are measure of lung volume against time. They are of two types- dynamic or static. Spirometry measures the ability of inhalation and/or exhalation relative to time. They used for diagnosis and prognosis of many respiratory disorders like asthma, chronic obstructive pulmonary diseases. The primary PFT's are Forced vital capacity (FVC), Forced expiratory volume exhaled in first second (FEV1), PEFr and FEV1/FVC ratio.

Obesity is a widespread chronic non-communicable disease characterized by excessive body fat accumulation and has been linked to various health complications. Despite extensive research on the health effects of obesity, its impact on the respiratory system has received relatively less attention. Prevalence of obesity is increasing day by day¹ due to unhealthy lifestyle and stress among medical students. Medical students, often exposed to stress

and unhealthy lifestyles, are at risk of developing overweight or obesity.

Obesity, if untreated can lead to various complications like hypertension, diabetes. In spite of this, there are very few studies to study the effect of BMI on PFT's. Given the potential implications of obesity on lung function, it is crucial to investigate its correlation with pulmonary function tests (PFTs) in this vulnerable population. The primary aim of this study was to assess the correlation between body mass index (BMI) and PFTs among medical students. Understanding the relationship between BMI and lung function in this specific group can provide insights into potential respiratory health risks associated with obesity.

Aims and Objectives:

The main aim of study to observed association between BMI and lung function.

Materials and Methods

Ours was a pilot cross sectional study in a medical college. Thirty medical students- were included in

the study, as it was a pilot study. Age, height and gender of the participants matched. Students who consented and those who were free from any cardiopulmonary diseases were included in the study. Exclusion criteria were subjects having history of smoking, any addiction, respiratory or cardiovascular disease or those on any type of medication. Consent of the students taken before commencement of the study. Height and Weight of the students obtained, and BMI calculated using the formula: $BMI = \text{Weight (kg)} / \text{Height (m)}^2$ [2]. For spirometry measurement, participants given a rest for 15 minute prior to measurements. Then they asked sit comfortably and then exhale forcefully after forceful inspiration in the mouthpiece of spirometer. Spirometry parameters, such as forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), and peak expiratory flow rate

(PEFR), measured using a computerized spirometer. Only these three parameters selected, as these parameters are enough to predict the relationship between BMI and changes in pulmonary function. The participants were categorized into two groups based on BMI (<25 and >30). Statistical analysis performed using Graph-pad Software to determine the associations between BMI and PFTs.

Results

Mean age of the participants was 19 years.

The mean BMI for non-obese participants was Non-obese was 21.80 and for Obese, it was 38.4. There were 15 obese (9 females, 6 males) and 15 non-obese participants (8 females, 7 males). The mean BMI for the non-obese group was 21.80, while the obese group had a mean BMI of 38.4.

Table 1: Pulmonary function tests in non-obese and obese participants

Parameters	Non-Obese (N=15) Mean \pm Sd	Obese (N=15) Mean \pm Sd	P-Value
FVC (L)	2.73 \pm 0.18	2.72 \pm 0.19	0.90
FEV1 (L)	2.59 \pm 0.25	2.44 \pm 0.28	0.11
FEV1/FVC	94.84 \pm 1.47	89.61 \pm 2.02	0.014
PEFR (L/s)	6.83 \pm 0.31	6.68 \pm 0.23	0.177

All parameters were more in males compared to females but the difference was not statistically significant.

As shown in Table 1, FVC value in non-obese group was mean 2.73L and in obese it was 2.72L. Though the value of FVC was more in non-obese, the difference was not statistically significant ($p > 0.1$).

FEV1 value in non-obese group was mean 2.59L and in obese it was 2.44L. Though the value of FEV1 was more in non-obese, the difference was not statistically significant ($p > 0.1$).

FEV1/FVC in non-obese group was mean 94.84 and in obese it was 89.61. Hence, the value of FEV1/FVC more in non-obese, the difference was statistically significant ($p < 0.1$).

PEFR value in non-obese group was mean 6.83L/s and in obese it was 6.68L/s (0.23). Though the value of PEFR was more in non-obese, the difference was not statistically significant ($p > 0.1$).

Discussion

Pulmonary function tests are one of the basic and simple tests to ascertain the respiratory status of an individual. Out of the entire PFT's, FVC, FEV1, PEFR and FEV1/FVC ratio considered vital in determining the pulmonary status of individuals. According to our study, all these parameter were more in males compared to females, but the difference was not statistically significant.

In our study, FVC value in obese group less compared to non-obese group. FVC is the amount of

air expired through the lungs after deep inspiration. It mainly used to distinguish between obstructive and restrictive group of lung diseases. Our results are similar to observations by a study by Shah H et al [2]. Though the value of FVC was more in non-obese, the difference was not statistically significant in our study, maybe because of young age of the participants.

FEV1 value in non-obese group was mean 2.59L and in obese it was less, 2.44L. Shah H et al [2], had similar observations. FEV1 shows the amount of air exhaled forcefully in first second after most forceful inspiration. Though the value of FEV1 was more in non-obese, the difference was not statistically significant in our study.

PEFR value in non-obese group was 6.83L/s mean and in obese it was 6.68L/s. These results are similar to other studies by Shah H et al [2], Kharodi C et al [3]. PEFR is the maximum flow rate generated during forceful expiration after full inspiration. It primarily depends upon the strength of the respiratory muscles and elastic recoil pressure of the lungs. Due to excessive deposition of fat, the function of respiratory muscles hampered due to increased resistance. Though the value of PEFR was more in non-obese, the difference was not statistically significant. This maybe because the age group in our study were young students, who had strength that is more physical.

Mean FEV1/FVC in non-obese group was high 94.84 (1.47) compared to in obese 89.61 (2.02) and the difference was statistically significant ($p < 0.1$).

Similar findings have been concluded in other studies too [4,5,6]. Bhatti U et al [4] found significant association between pulmonary function parameters and BMI concluding that obesity caused detrimental effects on the respiratory system.

However according to a study by Y González et al [7], there was normal spirometry pattern in obese people and reduced FVC observed in severe obesity only.

FEV1/FVC represents the ratio of amount of vital capacity one is able to expire in first second of forced expiration to forced vital capacity. Ratio less than 0.7 indicates chronic obstructive pulmonary disease. In our study, since the ratio was less than normal in obese participants, they are at risk of developing respiratory problems in future.

Limitations

Ours was a pilot study hence, several limitations should be considered in the interpretation of the study findings. Firstly, the study conducted among medical students from a specific institution, which may limit the generalizability of the results to other populations. The sample size was relatively small, which may affect the statistical power of the analysis.

Conclusion

The findings suggest that individuals with higher BMI, particularly in the obese range, may be at a higher risk of developing respiratory disorders. The observed association between increased BMI and reduced lung function, especially the FEV1/FVC ratio, highlights the importance of addressing obesity as a potential risk factor for respiratory health in medical students.

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