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Evaluation of Dynamic Pulmonary Function Test in Overweight MBBS Students

(Original Article)

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Abstracts

Obesity is one of the most frequently found health risks and the prevalence of obesity is rapidly escalating globally in all age groups. Our aim was to determine and compare the possible alterations of pulmonary function tests among healthy controls and overweight individuals irrespective of gender. These findings serve as a reaffirmation, for the proven fact that increasing BMI leads to defective lung functions. All the four parameters were found to have statistical significance, which proves overweight to be a major risk factor for defective lung functions.

Keywords: *Body mass index, Overweight and Pulmonary function tests.*

Introduction

Obesity is one of the most frequently found health risks and the prevalence of obesity is rapidly escalating globally in all age groups.[1] Overweight and obesity has become a major health problem in India. In the recent few years sedentary life style and dietary habits had played an important role in the occurrence of overweight and obesity. Obesity can profoundly alter pulmonary function and diminish exercise capacity by its adverse effects on respiratory mechanics, resistance within the respiratory system, respiratory muscle function, lung volumes, control of breathing and gas exchange.[2-10] Our aim of this study was to determine and compare FVC, FEV1, FEV1/FVC and PEFR among controls and overweight individuals irrespective of gender.

Material and Methods

The present study was conducted in the Department of physiology, Hi-Tech Medical College & Hospital Bhubaneshwar, Odisha, India, during the period from March 2013 to March 2016. The study protocol was approved by the Ethics committee of Hi-Tech Medical College & Hospital Bhubaneshwar. The present study consists of total 80 subjects between the age group 17-25 years who are further subdivided into two groups;

i. **Group-A :** Includes total 40 healthy individual as controls.
ii. **Group-B :** Consists of 40 overweight as cases. Subjects were selected based on the following inclusion and exclusion criteria.

Inclusion criteria

1. Subjects between 17 to 25 years of age including both males and females
2. Subjects with willingness to participate in the study
3. Subjects who falls in the category of normal and overweight according to BMI.

Exclusion criteria

1. History of smoking, alcohol intake, occupational hazards, medical(asthmatic) or surgical illness, upper respiratory tract infection in the past 4 weeks
2. Physical examination findings suggestive of respiratory illness or skeletal deformity
3. Intake of drugs which influences lipid metabolism, upper abdominal surgeries, Diabetes Mellitus, Cardiovascular Disorders, Endocrinology Disorders. Then subjects were made to undergo pulmonary function test using RMS Computerised (Helios 401) Spirometer.

All values were expressed as mean±SD. We used student t-test to find the statistical significance. A P-value <0.05 was to be considered statistically significant.

Results and Discussion

The present study group consisted of 80 subjects between 17- 25 years of age of both genders. Among which 40 were controls (normal weight) and 40 were cases (overweight). The mean age of the control group (n=40) was 20.16±4.01 (Male: 15, 37.5%; Female:25, 62.5%). Similarly, The mean age of the overweight group (n=40) was 21.06±2.14 (Male: 17, 42.5%; Female:23, 57.5%). Mean BMI of the overweight and normal weight groups were 28.45 ± 2.41and 22.31 ± 1.03 respectively. The BMI percentile of the study group was above 95th percentile. Respiratory function tests of the study and control groups are given in Table-2. The FVC, FEV1, %FEV1 and PEFR results of the overweight group were 2.97 ± 0.12, 2.36 ± 0.46, 0.77 ± 0.16 and 6.06 ± 2.43 respectively. In normal weight group the results were 3.21 ± 0.5, 2.84 ± 0.24, 0.82 ± 0.02 and 7.06 ± 2.32 respectively.

Table-1 shows the Anthropometric Characteristics of Subjects in the Cases and Control Groups

Parameters	Cases (n=40) Mean±SD	Controls (n=40) Mean±SD	P-Value
Age in Years	21.06±2.14	20.16±4.01	0.17
Height	168.02 ± 4.16	166.2 ± 6.31	0.001
Weight	78.9 ± 6.52	62.02 ±8.06	0.001
BMI	28.45 ± 2.41	22.31 ± 1.03	0.001

*Statistically Significant (P<0.05)

When compared between normal and overweight individuals, significant difference is observed in height, weight and BMI with p-values <0.05 and the mean+sd for age, they did not show statistically significant with a p value (0.17 >0.05). The spirometry parameters of the Cases and Control groups were compared in Table-2 When compared between Cases and Control individuals, significant difference is observed in all the four parameters (Forced vital capacity (FVC), forced expiratory volume in first second (FEV1), %FEV1, peak expiratory flow rate (PEFR)) as shown in table 2; with p value <0.05. In this study, significant difference is observed in all the four parameters (FVC, FEV1, %FEV1& PEFR), which were used to compare the lung function in overweight and normal healthy individuals. Similar results has been observed in a study conducted by researchers during 2008, which showed a significant decrease in FVC, FEV1 and %FEV with p value <0.05. And these two factors are considered as the most common lung functions inversely related to BMI.[11] A study conducted by Rubinstein also proved the same finding as mentioned above.[12]

Table-2 shows the Pulmonary functions test of the Cases and Control Groups :

Parameters	Cases (n=40) Mean±SD	Controls (n=40) Mean±SD	P-Value
FVC	2.97 ± 0.12	3.21 ± 0.5	0.001
FEV1	2.36 ± 0.46	2.84 ± 0.24	0.001
%FEV1	0.77 ± 0.16	0.82 ± 0.02	0.001
PEFR	6.06 ± 2.43	7.06 ± 2.32	0.001

*Statistically Significant (P<0.05)

A recent research conducted by Arkanshu et al in Chennai during 2014 demonstrated the negative correlation existing between BMI and FEV1/FVC ratio.[13] And this study results supports our study findings with significant statistical difference. Our result is also supported by another study conducted by Donna Rinnie during 2007, which also has proved the inverse relationship between FEV1/FVC ratio and BMI in overweight and obese individuals.[14] Many other researchers including Lazarus et al[15], Biring et al[16] and Paralikar et al[17] have also shown decrease in FEV1/FVC in overweight and proved the strong negative correlation existing between FEV1/FVC and BMI. Even though many studies supported the inverse relationship between FVC, FEV1 & FEV1/FVC ratio, research conducted by Emel et al had shown no statistical differences in FEV1, FVC, or FEV1/FVC ratio. In the same research conducted by Emel et al, PEF is reduced in overweight with significant statistical difference supporting our result.[18] Results of another study conducted by Mohammed also had reduction in PEFR, in accordance with our study result. But there was no significant reduction in other three parameters (FVC, FEV1 and FEV1/FVC).[19]

Reason for reduction in these parameters of lung functions may be due to deposition of fat around the chest wall leading to decrease in the compliance of chest wall[14] and lowered respiratory muscle endurance with increased work of breathing, airway resistance[20] and gas transport.[21] Defective descent of diaphragm due to mechanical hindrance caused by deposition of fat around the chest wall also plays an important role in altered lung functions.[22,23] Another reason has also been reported by many researchers, mentioning the role of adipose tissue in altered lung functions. Adipocytokines are released by adipose tissue as a result of hypoxemia induced by obesity. These adipocytokines affects systemic inflammation, leading to increase in inflammatory markers. Increased level of interleukins (ILs) 6 and 8, tumor necrosis factor α (TNF-α), CRP, leptin, and lower levels of adiponectin, which helps in regulating insulin sensitivity have all observed in individuals with increased BMIA.[24.25] All these factors act mutually in altering the lung functions with increased BMI above normal range. In this study, many of the individuals in overweight group have decreased lung function when compared to the normal healthy group.

Conclusion

These findings serve as a reaffirmation, for the proven fact that increasing BMI leads to defective lung functions. All the four parameters were found to have statistical significance, which proves overweight to be a major risk factor for defective lung functions. Therefore, factors which influence the increase in BMI like genetics, ethnicity, nutrition, physical activity and lifestyle can also influence the pulmonary functions.

Acknowledgements

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Abbreviations Used

BMI: Body mass index, FVC: Forced vital capacity, FEV1: Forced expiratory volume in one second, PEFR: Peak expiratory flow rate, ILs: Interleukins and TNF-α: Tumor necrosis factor α

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