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ORIGINAL ARTICLE

SPIROMETRIC EVALUATION OF LUNG FUNCTIONS IN MIDDLE-AGED OBESE HYPERTENSIVE AND NON-HYPERTENSIVE SUBJECTS

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ABSTRACT

Introduction: Obesity is becoming a major health hazard in developed and developing countries. It is proved to be a co-morbid condition in various metabolic and cardiovascular disorders. Obesity is commonly associated with hypertension. Obesity can offer mechanical obstruction to different movements of the body including that of the respiratory system. Hence, it is reasonable to hypothesize that obesity could adversely affect the lung functions. This study was undertaken to evaluate the influence of obesity and hypertension on pulmonary functions. **Aim of the Study**: To evaluate the influence of obesity with or without hypertension on lung functions (FVC, FEV_1, $FEV_{1\%}$) in middle-aged subjects. **Materials and Methods:** Pulmonary functions like FVC, FEV_1, FEV_1% were evaluated in 20 obese normotensives (BMI of 33.19 ± 2.59), 20 obese hypertensives (BMI of 32.89 ± 2.58) and 20 normal (BMI of 22.36 ± 1.54) male subjects in the age group of 40 to 60 by using computerized spirometer in sitting position. After giving sufficient trial to familiarize with the instrument, three recordings of pulmonary function were performed. Best of the three readings were computed. Percentage deviations of observed value from the predicted value in the normal and obese groups were compared by using students 't' test. **Results:** FVC, FEV_1, FEV_1% in obese normotensive subjects were 84.45 ± 15,75 %, 89.35 ± 16.48 %, 101.47 ± 20.50 %, in obese hypertensives 76.60 ±13.38 %, 78.65 ± 17.62 %, 102.10 ± 12.76 % and the corresponding values for the normal subjects were 94.82 ± 13.07 %, 95.62 ± 15.19 %101.48 ± 7.36 % . There was a statistically significant decline in FVC, FEV_1, in obese normotensive and hypertensives subjects when compared to the normal individuals ($p<0.001$). However there was no significant difference between obese normotensive and hypertensives subjects. **Conclusion:** It can be concluded that obesity adversely affects the pulmonary functions by posing mechanical restriction to respiratory movements. Obesity is also associated with hyper responsiveness of airway resulting in the alteration of size. In obese hypertensives there is varying degrees of left ventricular dysfunction, pulmonary hypertension, thickening of sub mucosa in the respiratory passages contributing to airway obstruction. Decline in pulmonary functions suggest a predominant restrictive and mild obstructive effect.

Keywords: Lung functions; Body Mass Index; Middle-aged men; Arterial Hypertension.

1.INTRODUCTION

In the recent past, the most serious nutritional problem in the world and the source of multiple co-morbid conditions in metabolic and cardiopulmonary disorders is obesity. Certainly for pulmonary function this assumption would be appropriate, even though most obese persons exhibit anatomically intact pulmonary structures. There are no direct correlations between excessive energy or lipid intake and damage to trachea, bronchi or alveoli. Subjects with excessive body weight tend to be chronically hypo ventilated and have reduced cardiopulmonary ability(Faintuch et al., 2004) Respiratory muscle strength and lung functions are closely associated with body weight and lean body mass(Rassian et al., 2004; Zerah et al., 1993). A central pattern of fat distribution is negatively associated with lung function in healthy adults(Hancox and Whyte, 2003). Obesity can affect diaphragm, thoracic and abdominal muscles. Increased respiratory effort and impairment of gas transport system can

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result in altered respiratory function even though the lungs are normal(Gudmundsson et al., 1997). Obesity may also cause hyper tonicity in the abdominal muscles and may also impair the respiratory function dependent diaphragmatic activity. Studies of otherwise healthy obese individuals have suggested that pulmonary and chest wall compliance was reduced due to fat deposition in the chest wall and abdomen(Koenig and Steven,2001). This results in elastic retraction and decreased distensibility of extra pulmonary structures, leading to manifestation of dyspnoea, sleep apnoea and obesity hypoventilation syndrome(Harik-Khan et al., 2001). All these factors are associated with substantial morbidity and increased mortality, particularly in obese hypertensives compared to non-obese normotensive middle-aged individuals.

AIM OF THE STUDY:

To evaluate the influence of obesity with or without hypertension on lung functions (FVC, FEV_1, FEV_1%) in middle-aged subjects.

2.MATERIALS AND METHODS:

This hospital based prospective descriptive study was conducted in Raja Muthiah Medical College and Hospital, Annamalainagar with during the period November 2014 to august 2016. Sample size of the study was around 60 middle aged patients. 20 obese hypertensive individuals and 20 obese normotensive individuals were recruited from those attending outpatient departments, 20 age matched normal male individuals from the general population were taken as controls.

STUDY TYPE:

Descriptive study

Inclusion criteria:

a. Males in the age group of 40-60 years with body mass index (BMI) $\geq$30kg/m^2 (10 in thesis) with essential hypertension (BP $\geq$140/90 mm of Hg) and without essential hypertension.
b. Normal middle-aged men with BMI 18.5-24.99 kg/m^2.

Exclusion criteria:

a. Subjects with history of coronary heart disease.
b. History of respiratory diseases like moderate or severe chronic obstructive pulmonary disease (C.O.P.D), pulmonary tuberculosis, Cystic fibrosis etc.
c. Subjects presently smoking or history of smoking, any surgery within the last 6 months and any skeletal abnormality likely to affect lung functions.
d.

Method of collection of data:

Subjects were middle-aged men in the age group of 40-60 years who satisfied the inclusion and exclusion criteria. Medical information obtained through a standardized questionnaire, which included subjects' medical history, dietary history, use of drugs, personal habits such as cigarette smoking and were screened for general physical health. The obesity was categorized as per the WHO recommendations. Subjects were also be screened for essential hypertension as per seventh report of the joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure guidelines. Subjects were assigned to three different groups. Informed written consent was obtained from all subjects for spirometric evaluation of lung function by using SCHULLER computerized spirometry.

Functional Parameters Studied

1. Forced vital capacity (FVC in Liters &FVC %)
2. Forced expiratory volume (FEV1 in Liters & FEV1%)
3. FEV_1 %

Statistical Analysis:

The Statistical software namely SPSS 11.0, Stata 8.0, Systat 11.0 and Effect Size calculator were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables, etc.

3.RESULTS:

60 subjects in the age group of 40-60 years were considered for study Subjects were divided into three groups, group A, group B and group C.

Group A: Consisted of 20 normal subjects, Group B: Consisted of 20 obese normotensive subjects, Group C: Consisted of 20 obese hypertensive subjects.

Table 1: Comparison of FVC in three groups of subjects studied Results are presented in Mean ± SD (Min-Max)

FVC (L)	Group A	Group B	Group C	P value
Observed	3.15±0.62 (2.20-4.14)	3.01±.0.79 (1.62-4.42)	2.64±0.73 (0.97-3.72)	0.072+
Predicted	3.32±0.61 (2.12-4.32)	3.61±0.59 (2.01-4.54)	3.43±0.54 (2.54-4.44)	0.271
Percentage change	94.82±13.07 (76-127)	84.45±15.75 (43-106)	76.60±13.38 (45-95)	0.001**
P value (Ob-Pred)	0.070+	0.001**	<0.001**	-

Table 2: Comparison of FEV_1 in three groups of subjects studied Results are presented in Mean ± SD (Min-Max)

FEV_1 (L)	Group A	Group B	Group C	P value
Observed	2.62±0.51 (1.72-3.30)	2.63±0.69 (1.31-3.88)	2.21±0.67 (0.88-3.08)	0.061+
Predicted	2.74±0.50 (1.69-3.58)	2.95±0.48 (1.67-3.71)	2.49±0.46 (2.14-3.69)	0.369
Percentage change	95.62±15.19 (74.0-132.5)	89.35±16.48 (46.0-14.0)	78.65±17.62 (31.0-101.0)	0.013*
P value (Ob-Pred)	0.155	0.015*	<0.001**	-

Table 3: Comparison of FEV_1% in three groups of subjects studied Results are presented in Mean ± SD (Min-Max)

FEV_1%	Group A	Group B	Group C	P value
Observed	83.31±6.11 (69.60-93.60)	86.03±4.95 (78.20-94.37)	83.89±10.35 (48.097.0)	0.401
Predicted	81.99±1.81 (78.10-86.50)	81.22±1.32 (79.083.40)	81.66±1.77 (75.5-84.2)	0.183
Percentage change	101.48±7.36 (89.0-116.0)	101.47±20.50 (18.50-117.0)	102.10±12.76 (59.0-121.0)	0.319
P value (Ob-Pred)	0.336	0.001**	0.330	-

4.DISCUSSION:

Our data show that body composition and fat distribution are associated with lung function in middle-aged men, in that a central pattern of fat distribution is associated with a decrease in lung functions namely (FVC, FEV_1). Our finding of a significant inverse relationship between adiposity indices (BMI, WHR) and to lung functions like FVC, FEV_1 expand on and complement the findings of previous report. The altered lung function is suggestive of an obstructive and restrictive type of airway dysfunction. The amount of body fat and a central pattern of fat distribution might be related to lung function by several mechanisms. Mechanical effects of diaphragm to impeding its descent. Reduction in compliance of chest wall, work of breathing and elastic recoil of lungs(Jone et al, 2006).Adiposity and visceral fat tend to increase with age. Our findings are in line with those of Alexander et al. 2001) who observed an association between increase in fat mass and reduction in FVC and FEV_1. The reduction in pulmonary function is due to deposition of fat in abdominal cavity and thoracic cage(Alexanderet al., 2001). This may diminish rib cage movement and thoracic compliance, both of which lead to restrictive respiratory movement. Other mechanism suggested that abdominal fat deposition leads to a redistribution of blood to the thoracic compartment that reduces vital capacity. The association of hypertension with altered pulmonary function is not a new observation, but the mechanism remains obscure. Hypertension is associated with increase in systemic and pulmonary vascular resistance and increased vessel stiffness(Lazarus et al., 1997).

It is postulated that the increased blood volume resulting from obesity results in increased pulmonary blood volume, and this may be responsible for airflow limitation in obese hypertensive patients. Pulmonary vascular engorgement may lead to airway sub mucosal thickening, which in turn decreases the calibre of small airways(Sparrow et al., 1988).

CONCLUSION:

- 5.Both obesity and aging are important pathophysiologic changes contributing for altered lung functions in middle-aged subjects.
- Obesity adversely affects lung functions.
- Obese normotensives and hypertensives exhibit a significant decline in lung functions like FVC, FEV_1 when compared to normal subjects.
- There was no significant difference in lung functions between normotensive and hypertensive obese subjects.

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Conflict of interest – none

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