

## PULMONARY FUNCTION TEST IN RELATION TO ABDOMINAL OBESITY IN ADULT MALES IN AGE GROUP OF 18-21 YEARS IN AND AROUND RAICHUR CITY

Mohammed Jeelani<sup>1</sup>, Mohammad Muzammil Ahmed<sup>2</sup>

### HOW TO CITE THIS ARTICLE:

Mohammed Jeelani, Mohammad Muzammil Ahmed. "Pulmonary Function Test in Relation to Abdominal Obesity in Adult Males in Age Group of 18-21 Years in and Around Raichur City". Journal of Evidence based Medicine and Healthcare; Volume 2, Issue 18, May 04, 2015; Page: 2746-2751.

**ABSTRACT: INTRODUCTION:** Impaired respiratory function is associated with morbidity and mortality. Poor respiratory function predicts overall mortality, as well as death due to cancer, pulmonary disease, cardiovascular disease and stroke. Obesity is also associated with morbidity and mortality. It is global health hazard and has been linked to numerous metabolic complications such as dyslipidemia, type II diabetes and cardio vascular diseases and is negatively associated to the pulmonary function. The mechanism for this association is still debated and the best marker of adiposity in relation to dynamic pulmonary function is still not clear. Therefore the purpose of the study is to determine pulmonary test in relation to abdominal obesity in adult males. Aims and **OBJECTIVE:** To determine the predictability of Body mass index (BMI), Waist- hip ratio (WHR), and Body fat percentage for pulmonary functions in adult males with and without excess body weight. **MATERIALS AND METHODS:** The Study consists of 100 males in age group of 18 -21 years with body mass index (BMI) 18.5 to 29.9 kg/m<sup>2</sup>, physically healthy, without any symptoms. Their height, weight, body mass index (BMI) and waist to hip ratio (WHR) were measured. The percentage of body fat was estimated by measuring skin fold thickness at four sites (4SFT-biceps, triceps, subscapular and suprailiac) with the help of Harpenden's calliper. The pulmonary functions were assessed using Power lab 8/30 series with dual bio Amp/stimulator, manufactured by AD instruments, Australia. All data was presented as a mean  $\pm$  SD for each of the parameter. The two groups were compared by applying unpaired 't' test and P value of less than 0.05 was considered as significant. Correlation of ventilatory lung function tests with body fat percentage was done by using Pearson's correlation coefficient test. **RESULTS:** body fat % showed negative correlation with expiratory reserve volume (ERV), forced vital capacity (FVC), maximum ventilatory volume (MVV), peak expiratory flow rate (PEFR) and forced expiratory volume at the end of first second (FEV1). **CONCLUSION:** These results indicate that increase in percentage of body fat and central pattern of fat distribution may affect the pulmonary function tests.

**KEYWORDS:** body mass index, pulmonary function tests, body fat percentage, skin fold thickness

**INTRODUCTION:** The magnitude of the upswing in overweight and obesity prevalence has been truly astonishing.<sup>1</sup> It has now become an important health problem in developing countries particularly in India.<sup>2</sup> The consequences of industrialization and urbanization, which lead to decrease in physical activity, together with substantial dietary changes and overall pattern of life style, promote weight gain. Although all risks associated with increasing weight are aggravated in

# ORIGINAL ARTICLE

---

persons with body mass index (BMI) > 40 kg/m<sup>2</sup>, a BMI between 25 and 30 kg/m<sup>2</sup> should be viewed as medically significant and worthy of therapeutic intervention especially in the presence of risk factors. The influence of increased percentage of body fat (body fat >35%) and central obesity on blood pressure and glucose intolerance has been well documented.<sup>3,4</sup> Few studies have considered the percentage of body fat and the pattern of fat distribution which also can affect the pulmonary function. Thus, the purpose of this study was to evaluate the association of pulmonary functions (static and dynamic) with the percentage of body fat in young male students.

**MATERIALS AND METHODS:** The study was conducted in 100 male subjects in and around Raichur City in the age group of 18–21 years with body mass index (BMI) 18.5 to 29.9 kg/m<sup>2</sup>. All the subjects were males, physically healthy, without any symptoms. They were evaluated as per standard proforma which included a questionnaire. The experimental protocol was explained to all the student volunteers and written informed consent was obtained from them. Subjects with preexisting lung diseases, chronic history of smoking and alcohol, cardiac disease, family history of respiratory disorders like asthma, allergies and history of contact with open tuberculosis were excluded in the study. All anthropometric measurements were obtained in the volunteers wearing light- weight clothing, and barefoot. All measurement procedures were as per the protocol described in Helsinki Declaration. Standing height was measured to the nearest 0.1 cm. Body weight was recorded in kilograms on an empty bladder and before lunch on a standardized weighing scale. The weight measurement was recorded to the nearest 0.1 kg. The waist circumference (cm) was measured at a point midway between the lower rib and iliac crest, in a horizontal plane. The hip circumference (cm) was measured at the widest girth of the hip. The measurements were recorded to the nearest 0.1 cm. Body mass index was calculated by Quetelet's Index.<sup>5</sup> The study was undertaken in two groups. Subjects having BMI 18.5 to 24.9 kg/m<sup>2</sup> formed the control groups (50 males) and Subjects having BMI 25 to 29.9 kg/m<sup>2</sup> formed the overweight groups (50 males) respectively.

The percentage of body fat was estimated by using the method of Durnin and Womersley<sup>6</sup>. For measuring the skin fold thickness at four different sites on the left side of the body, skin fold caliper was used. Extremity skinfolds were measured at the triceps and biceps and trunk skinfolds were measured at the suprailiac and subscapular areas.<sup>6,7</sup> The skin fold was picked up between the thumb and the forefinger and the readings were taken 5 seconds after the caliper was applied. Three consecutive readings were taken and recorded at each site. The difference was not more than 2 mm between them. The average of the three readings at each site was calculated and the sum of these values was entered into the table given by Durnin and Womersley.<sup>6</sup> The pulmonary function test was carried out using Power lab 8/30 series with dual bio Amp/stimulator, manufactured by AD instruments, Australia. Marketed by Comtek scientific instruments Bangalore with model no. ML870. The recorded parameters were compared with the inbuilt pulmonary function norms for the Indian population depending upon the age, sex, height, and weight. Recording of static and dynamic pulmonary function tests was conducted on motivated young healthy volunteers in standing position.<sup>8</sup> These tests were recorded at noon before lunch, as expiratory flow rates are highest at noon.<sup>9</sup> For each volunteer three satisfactory

# ORIGINAL ARTICLE

efforts were recorded according to the norms given by American Thoracic Society.<sup>10</sup> The essential parameters obtained were, tidal volume (VT), expiratory reserve volume (ERV), inspiratory capacity (IC), forced vital capacity (FVC), timed vital capacity (FEV1), maximum ventilator volume (MVV) and peak expiratory flow rate (PEFR). All the records i. e., anthropometric measurements, skin fold measurements and recording of pulmonary function tests were conducted in one sitting on the same day.

**Statistical Analysis of Data:** The ventilatory lung function tests is compared in both the normal and overweight groups by the 'unpaired t' test. Data is expressed as Mean±SD. Statistical significance was indicated by 'P' value <0.05. Correlation of ventilatory lung function tests with body fat percentage was noted by using Pearson's correlation coefficient test. The non-zero values of 'r' between - 1 to 0 indicate negative correlation.

**RESULTS:** The anthropometric parameters of the subjects are given in Table I. In the present study age and height of the subjects were homogenous. There was significant difference in the waist to hip ratio and percentage body fat. The observed values of various lung function parameters are provided in Table II. In overweight groups expiratory reserve volume (ERV), forced vital capacity (FVC), and maximum ventilator volume (MVV) were decreased significantly (P<0.05). It was observed that body fat % had no correlation with tidal volume (VT) and inspiratory capacity (IC). Interestingly body fat % showed significant negative correlation with ERV (r = -0.72) FVC (r = -0.47), MVV (r = -0.62), PEFR (r = -0.49), and FEV1 (r = -0.68).

Parameters (n)	Males	
	Control (50)	Overweight (50)
Age (years)	19.12±3.31	19.67±3.12
Height (cm)	170.40±6.43	171.05±5.13
Weight (kg)	66.68±5.44	77.34±6.13
BMI	22.10±1.44	27.28±1.31
WHR	0.81±0.11	0.94±0.12*
<b>Skin fold thickness (mm)</b>		
Biceps	10.54±4.11	13.43±6.72
Triceps	12.87±4.67	20.02±6.38
Subscapular	18.41±5.32	28.31±7.19
Suprailiac	22.43±6.12	30.77±7.67
Body fat %	23.31±2.89	28.73±2.86*

\*P<0.05 unpaired 't' test; Body Fat % – calculated by Durnin and Womersley method

TABLE I: Comparison of Mean±SD values of anthropometric parameters of two groups of the subjects

Parameters	Males	
	Control	Overweight
VT (L)	0.47±0.12	0.45±0.14
ERV (L)	0.82±0.37	0.73±0.19*
IC (L)	3.13±0.53	3.08±0.65
FVC (L)	3.98±0.44	3.71±0.23*
FEV1/FVC	0.80±0.11	0.80±0.32
MVV (L/min)	128.64±22.12	116.23±17.44*
PEFR (L/min)	459.33±120.31	425.11±117.32
*P<0.05 Student 't' test; unpaired observations.		
TABLE II: Comparison of Mean±SD values of pulmonary function tests amongst the control and overweight subjects.		

**DISCUSSION:** Present study demonstrated the relationship of pulmonary functions with body fat percentage in male subjects. A significant negative correlation of ERV with body fat % was observed indicating that ERV diminishes in inverse proportion of percentage body fat. The reduced values of ERV were due to the increased fat percentage. It is an established fact that ERV contributes to the amount of FRC, VC and TLC. In this study, FVC correlated inversely with body fat %. The observed values of decreased FVC suggested displacement of air by fat within the thorax and abdomen.

In our study, FEV1 showed negative correlation with body fat %. Both FEV1 and FVC are the lung functions most closely related to body composition and fat distribution. It has been also stated that increase in adult body mass is a predictor of FEV1 decline.<sup>11</sup> The normal FEV1/FVC ratio in our study indicates that the inspiratory and expiratory muscle strength is normal<sup>12</sup>. The present data shows that increased body fat % have negative correlation with ERV and FVC (static tests) and MVV (dynamic tests). The negative correlation of increased percentage of body fat and FEV1 was observed and similar results were reported earlier.<sup>13,14,15</sup>

Body fat usually constitutes 15 to 20% of body mass in healthy men. In this study although BMI of the control group subjects was within normal range the observed body fat percentage was on the higher side.<sup>16</sup>

Waist to hip ratio (WHR) is highly correlated with abdominal fat mass and is therefore; often used as a surrogate marker for abdominal or upper body obesity. The predicted normal WHR in men is 0.93. In our study central pattern of fat distribution was observed and all the ventilatory function parameters per se in each group were within the predicted normal range. The amount of body fat and a central pattern of fat distribution might be related to lung function via several mechanisms, such as mechanical effects on the diaphragm and on the chest wall primarily due to the changes in compliance and in the work of breathing and the elastic recoil.<sup>17</sup>

**CONCLUSION:** The study suggests that increase in body fat % and central fat distribution is associated with a modest decrease in the static (ERV, FVC) and dynamic (MVV, FEV1) tests in overweight individuals. Although the magnitude of the effect is relatively small from a public

# ORIGINAL ARTICLE

---

health perspective, our findings in the present study indicate the consequence of increased body fat % on lung function.

## REFERENCES:

1. Haslam DW, James WP. Obesity. *Lancet* 2005; 366 (9492): 1197–1209.
2. Mohan V, Deepa R. Obesity and abdominal obesity in Asian Indians. *Indian J Medical Res* 2006; 123: 593–596.
3. Pi Sunyer Fx. 'The epidemiology of central fat distribution in relation to disease. *Nutritional Reviews* 2004; 62 (7): 120–126.
4. Pi-Sunyer Fx/Medical hazards of obesity. *Ann Intern Med* 1993; 119: 655–660.
5. Garrow JS, Webster J. Quetelet's index as a measure of fatness. *Int J Obes* 1985; 9 (2): 147–153.
6. Durnin JV, Womersley J. Body fat assessed from the body density and its estimation from skinfold thickness measurements on 481 men and women aged 16 to 72 years. *Br J Nutr* 1974; 32: 77–97.
7. Kumar B, De AK. Assessment of body fat in young Indian males and females by two and four skin fold methods. *Biomedical Research* 2003; 14 (2): 133–137.
8. Townsend MC. Spirometric forced expiratory volumes measured in standing verses sitting posture. *Am Rev Respir Dis* 1984; 130 (1): 123– 124.
9. Hetzel MR. The pulmonary clock. *Thorax* 1981; 36: 481–486.
10. American thoracic society. Standardization of spirometry. 1994 update *Am J Respir & Crit Care Med* 1995; 152: 1107–1136.
11. IM Carey, DG Cook, DP Strachan. The effect of adiposity and weight change on forced expiratory volume decline in a longitudinal study in adults. *Int J Obes Relat Metab Disord* 1999; 23 (9): 979–985.
12. Sahebhami H, Gartside PS. Pulmonary function in obese subjects with a normal FEV1/FVC ratio. *Chest* 1996; 110 (6): 1425–1428.
13. Delorey DS, Wyrick BL, Babb TG. Mild to moderate obesity: Implications for respiratory mechanics at rest and during exercise in young men. *Int J Obes* 2005; 29: 1039–1047.
14. Cotes JE, Chinn DJ, Reed JW. Body mass, fat % & fat free mass as a reference variable for lung function. *Thorax* 2002; 1: 411–416.
15. Collins LC, Hoberty PD, Walker JF, Fletcher EC. The effect of body fat distribution on pulmonary function tests. *Chest* 1995; 107: 1298–1302.
16. Lohman TG. The use of skinfolds to estimate body fatness in children and youth. *J of Physical Education and Recreation* 1988; 58 (9); 98–102.
17. Luce JM. Respiratory complications of obesity. *Chest* 1980; 78: 626–631.

# ORIGINAL ARTICLE

---

**AUTHORS:**

1. Mohammed Jeelani
2. Mohammad Muzammil Ahmed

**PARTICULARS OF CONTRIBUTORS:**

1. Tutor, Department of Physiology,  
Employees State Insurance Corporation  
Medical College, Gulbarga.
2. Assistant Professor, Department of  
Anatomy, Navodaya Medical College,  
Raichur.

**NAME ADDRESS EMAIL ID OF THE  
CORRESPONDING AUTHOR:**

Dr. Mohammed Jeelani,  
# 5-470/1-5, Near Masjid Al-Farooq,  
6<sup>th</sup> Cross, Islamabad Colony,  
Gulbarga-585104, Karnataka.  
E-mail: drjeelani24@gmail.com

Date of Submission: 24/04/2015.  
Date of Peer Review: 25/04/2015.  
Date of Acceptance: 01/05/2015.  
Date of Publishing: 04/05/2015.