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Correlation of The Abdominal Circumference with Pulmonary Functions in Young Adults

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Abstract

***Background**: Obesity is a global health risk that has been related to several metabolic issues, including dyslipidemia, type II diabetes, and heart and circulatory illnesses, as well as having a detrimental effect on pulmonary function. The best indicator of adiposity in connection to dynamic pulmonary function is yet unknown, and the mechanism behind this association is still under discussion. **Methods**: We investigated the relationship between respiratory variables and body mass index (BMI), waist circumference (WC), and waist-hip ratio (WHR), which are each indicators of relative and abdominal obese adiposity. Tests of pulmonary function were conducted by a spirometer with a computer (Med Spiror). 5–10 minutes of break and a briefing for the method FVC (maximum inhale, followed by a sustained maximum exhale) Until instructed to breathe in again, the test was carried out in a calm, private space, holding the nose clip while standing situated on the nose. The volume, and flow Timed graphs were recorded spirometric parameters were used for the analysis of Forced Vital Capacity (FVC): (L/sec) FEV1 stands for forced expiratory volume in one in (L/sec). **Conclusion:** This study found a Negative correlation between pulmonary functions and abdominal fat in males from those who don't suffer from extreme fat people. Obesity in the abdomen is a significant indicator of impaired pulmonary function and is more important than significant than measures of overall adiposity that included weight and BMI.*

***Keywords**: Obesity, pulmonary functions, abdominal circumference, Waste circumference*

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Introduction

It is widely acknowledged that obesity poses a health risk due to its high correlation with many metabolic problems such as dyslipidemia, diabetes mellitus, hypertension, and heart attacks. [1] Obesity has been linked in numerous studies to respiratory issues like obesity hypoventilation syndrome, obstructive sleep apnea, and asthma in children and adults. [2] It is also thought to diminish lung volumes. Poor respiratory health also predicts death from pulmonary disorders, cardiovascular diseases, and stroke. [3] Although this connection may simply be the result of smoking, obesity is also linked to morbidity and mortality. [4] According to numerous research, there is an antagonistic relationship between various measures of obesity or fat distribution and respiratory performance. These indices include measurements of general adiposity like weight or body mass index (weight (kg)/height (m^2), as well as indicators of fat distribution such as waist circumference (WC), percentage of fat mass, and skin fold thickness. [5] The pulmonary functions are typically impacted by differences in male and female fat distribution. [6] Asians who are more prone to abdominal obesity may display a different regional variability pattern. Body mass index (BMI) or one of its variants has been utilized in the majority of earlier reports as a proxy for overall obesity. Although this well-known measure has a lot to recommend for epidemiologic purposes, it does not indicate fat distribution. [7] Additionally, height and weight, which serve as substitutes for measurements of body size, are predictors of the results of the pulmonary function test. The relationship between adiposity markers and pulmonary functions may be impacted by gender differences in the accumulation of fat that is "apple vs. pear" shaped. For men and underweight individuals, a unit of body weight and BMI is likely to contain less fat mass than for women and overweight individuals. Compared to overall adiposity, which may compress the chest wall, abdominal adiposity measures like the Waist Hip Ratio (WHR) and WC may affect pulmonary function through a process that may inhibit the descent of the diaphragm and limit lung expansion. [8] Clinical research has examined the connection between WHR, WC, and impaired respiratory performance in both slightly and morbidly obese individuals. [9] The striking variability of illness patterns in obese patients frequently confounds doctors. Because of this, determining the level of obesity at which a disease result is more likely to occur is important for patient care and treatment. According to research, abdominal adiposity is a more accurate index of visceral fat, the metabolically active fat deposit linked to several metabolic disorders. [10] In this study, non-obese and obese young people's total body and abdominal adiposity are examined in relation to FEV1 and FVC.

Materials and Methods

Inclusion criteria

1. Aged 20 – 30 years
2. Healthy male adults
3. Without any history of respiratory disorders
4. Non-smokers
5. Voluntarily willing to participate

Exclusion criteria

1. History of respiratory disorders
2. Not as per the inclusion criteria

Subjects were questioned about whether they met the criteria for inclusion after taking a very thorough history that included their whole medical, family, and personal backgrounds. They were also assessed for their resting pulse rate and blood pressure, according to the subject proforma. To avoid diurnal changes, the volunteers were instructed to refrain from drinking tea, coffee, and other stimulants and to arrive at the department of physiology in the morning with a light breakfast. To help them become familiar with the method, they were informed about it, made aware of it, and instructed to perform the necessary tests on themselves. The included subjects were asked if they had any acute respiratory issues and underwent anthropometry using the established methods and tools. Age was calculated nearest to the year. The BMI was calculated with a measuring tape mounted on a wall, standing height was measured to the nearest five millimeters (mm) and five millimeters (mm), respectively. Weight was measured using a Krups weighing scale with a minimum count of 100 grams while wearing light clothing and no shoes. Weight in kilograms and height in meters were used to compute body mass index. Weight in kilograms divided by height in meters squared is the BMI. Based on BMI values n=30 cases were non-obese and n=20 cases were classified as obese.

With feet 25 to 30 cm apart and weight evenly distributed, the waist circumference is measured at the level of the umbilicus without skin compression using a tailor's measuring tape in a plane perpendicular to the long body axis. Abdominal obesity is defined as WC >/=90 cm in men according to WHO Asia Pacific perspective guidelines. The greater trochanter diameter is measured with the legs and feet together using a measuring tape without squeezing the skin fold while wearing light, minimum clothing. The measurement of the central pattern of fat distribution is the waist-hip ratio, which is determined as the ratio of WC and HC. (Male >0.9). Tests of pulmonary function were conducted by a spirometer with a computer (Med Spiror). 5–10 minutes of break and a briefing for the method FVC (maximum inhale, followed by a sustained maximum exhale) Until instructed to breathe in again, the test was carried out in a calm, private space, holding the nose clip while standing situated on the nose. The volume, and flow Timed graphs were recorded spirometric parameters were used for the analysis of Forced Vital Capacity (FVC):

(L/sec) FEV1 stands for forced expiratory volume in one in (L/sec). All the obtained values were uploaded on MS Excel Spreadsheet and analyzed by SPSS version 19 on windows format. For continuous variables mean, standard deviations and percentages were used and categorical variables were estimated by Fischer's extract test p values of <0.05 was considered as significant.

Results

When age and height were compared between people who were obese and those who were not, neither gender in Table 1 showed any significant differences, indicating that the group under study was homogeneous in character. As anticipated, the control and obese groups had significantly different weight and adiposity measures such as BMI, WC, and WHR.

Table 1: Measurement of variables in the subjects of study

Variable	*Male (n=50)*		*P value*
	Non-obese	*Obese*	
Age (years)	23.5 ± 5.5	22.9 ± 4.8	0.136
Height (m)	1.67 ± 1.23	1.66 ± 2.17	0.335
Weight (Kg)	66.78 ± 8.59	82.15 ± 7.5	0.041*
BMI (Kg/m^2)	23.19 ± 1.59	30.24 ± 2.71	0.032*
WHR	0.90 ±0.06	1.25 ± 0.087	0.013*
WC (cm)	95.62 ±10.94	113.73 ±11.30	0.011*

* Significant

Table 2 displays the relationship between the adiposity markers BMI, WC, and WHR and the trend of pulmonary functions in both men. Female obese patients had significantly lower FVC and FEV1 readings than male obese patients. A substantial inverse trend in the pulmonary parameters was seen in males, except for stratification by BMI. The WC revealed that in obese females, the FVC and FEV1 levels had fallen significantly. However, among male patients who are not obese and those who are obese, the WHR shows the greatest difference in pulmonary parameters.

Table 2: Comparison of spirometric values FVC and FEV 1 with obesity parameter

Spirometer measurement	*Variable*	*Non-obese*	*Obese*	*P value*
FVC (L/s)	BMI (Kg/m^2)	3.62 ± 0.27	3.53 ± 0.31	0.298
	WC (cm)	3.77 ± 0.12	3.54 ± 0.36	0.019*
	WHR	3.60 ± 0.29	3.51 ± 0.29	0.034*
FEV1 (L/s)	BMI (Kg/m^2)	3.25 ± 0.24	3.79 ± 0.33	0.364
	WC (cm)	3.44 ± 0.09	3.33 ± 0.31	0.062
	WHR	3.31 ± 0.26	3.21 ± 0.30	0.041*

There was a substantial negative association between the FVC and FEV1 in both males and females, according to Pearson's partial correlation matrix made up of several measurements of adiposity indicators. Despite showing a less than substantial connection with FEV1, WHR and BMI did so. The partial correlation coefficient between obesity characteristics and spirometric variables corrected for age and height revealed a significant link in both males and females, as shown in Tables III. The FVC and FEV1 significantly inversely correlated with each other, according to Pearson's correlation with several measures of adiposity markers WC and WHR, in both males and females. There was a weak negative connection between WHR and BMI and FEV1. Compared to other metrics, WC exhibited the highest connection with both the dynamic parameters FVC and FEV1.

Table 3: Correlation coefficient among the various parameters

	Weight (Kg)	*BMI (Kg/m^2)*	*WC (cm)*	*WHR*	*FVC (L/s)*	*FEV1 (L/s)*
Weight (Kg)	1	0.875*	0.798 *	0.443*	-0.412*	-0.398*
BMI (Kg/m^2)	-	1	0.782 *	0.401*	-0.419*	-0.392*
WHR	-	-	1	0.599*	-0.553*	-0.414*
WC (cm)	-	-	-	1	-0.377*	-0.301*
FVC (L/s)	-	-	-	-	1	-0.917*
FEV1 (L/s)	-	-	-	-	-	1

* Significant

Discussion

In a population-based cross-sectional investigation, we looked into the relationship between several adiposity indicators and pulmonary function. Both obese (BMI ≥ 30 kg/m ^{2}) sexes had lower mean values of the dynamic pulmonary parameters than normal. Men showed an inverse relationship between BMI, WHR, waist circumference, and pulmonary function. It is more difficult to determine how pulmonary function and total weight are related. Changes in age and height may help partially explain the inverse correlation with adiposity markers. Since abdominal adiposity markers (such as WHR and waist circumference) have better explanatory power than total body adiposity measured as BMI, according to the p-value significance an analysis of trends of pulmonary function stratified with abdominal adiposity markers and the association of abdominal adiposity and pulmonary function adjusted for age and height, support the hypothesis. [11] The findings of this study are particularly significant since, among all the adiposity indicators, WC, a specialized marker for visceral adiposity, explained the most variation in pulmonary function. Interleukin-6 and cytokines are influenced by visceral adipose tissue levels in the bloodstream, which may cause systemic inflammation and impair pulmonary function. Insulin resistance may consequently have a deleterious effect on pulmonary function as a result of WC. [12-14] Other researchers have discovered an inverse relationship between serum leptin levels and FEV1 as well as greater levels of C-reactive protein, leukocytes, and fibrinogens, which are additional markers of inflammation. generalized inflammation. [15] A mechanical restriction on chest expansion during the FVC maneuver is another potential reason underlying the relationship between abdominal obesity and pulmonary performance. Increased abdominal bulk may prevent the diaphragm from descending and raise thoracic pressure. [16] By compressing the lungs and diaphragm, abdominal adiposity is anticipated to decrease expiratory reserve volume which will lead to lower FVC readings, which is exactly what we saw from the strong inverse correlation between every adiposity marker and FVC in males. [17] The finding that the lowest WC had slightly higher pulmonary function than the lowest WHR and BMI lends credence to the idea that having a lower WC may be a better indicator of general health in men than having a low BMI because people with low BMIs may have varying degrees of abdominal adiposity depending on gender. This confirms our theory that, even in people who are classed as non-obese using conventional measures of obesity (i.e., BMI, 30 Kg/m^{2}), abdominal adiposity may nevertheless have a deleterious impact on pulmonary function. The findings are in line with Y Chen et al., [18] Scottish cross-sectional survey of men and women aged 25 to 64 years, which found that WC was negatively correlated with FVC and FEV1 in both men and women. D Canoy et al., [19] examined the relationship between WHR and FVC and FEV 1 in both men and women in a British cohort study of 9674 men and 11876 women aged 45–79 years and discovered a strong inverse relationship. After adjusting for potential confounding variables like age, height, and BMI, the relationships remained. The recent study also suggested that the relationship between WC and FEV1 would be stronger after BMI adjustments are solely made for females. Our findings are in line with those of Canoy et al. on the relationship between waist/hip ratio and pulmonary function, but only in females did WC reveal an adverse link that remained significant after adjusting for BMI. In their study on the relationship between waist/hip ratio and pulmonary function, Harik-Khan et al., [19] found an unfavorable relationship between FEV1 and waist/hip ratio in males exclusively, which is supported by our findings for both genders. In their study of volunteers aged 40 to 50, Koziel et al. discovered that there was no correlation between WHR and FVC or FEV1 in women, but in men, FVC was negatively correlated with WHR and positively correlated with BMI, and FEV1 was inversely correlated with both BMI and WHR. [20]

Conclusion

Within the limitations of the current study, it was found that a Negative correlation between pulmonary functions and abdominal fat in males among those who don't suffer from extreme fat people. Obesity in the abdomen is a significant indicator of impaired pulmonary function and is more important than significant than measures of overall adiposity that included weight and BMI.

***Conflict of Interest*: None**
***Source of support*: Nil**
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