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Research Article

CORRELATION BETWEEN BODY MASS INDEX, WAIST-HIP RATIO, AND PULMONARY FUNCTION TESTS IN HEALTHY YOUNG ADULTS

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ABSTRACT

Background: Obesity and abnormal body fat distribution have emerged as important determinants of respiratory health. Body Mass Index (BMI) and Waist-Hip Ratio (WHR) are commonly used anthropometric indicators that may influence pulmonary function by altering chest wall mechanics and lung compliance.

Objective: To evaluate the correlation between BMI, WHR, and pulmonary function test (PFT) parameters among healthy young adults.

Materials and Methods: A cross-sectional study was conducted among 120 healthy young adults aged 18–25 years. Anthropometric measurements including height, weight, waist circumference, and hip circumference were recorded. BMI and WHR were calculated using standard methods. Pulmonary function parameters such as Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV1), FEV1/FVC ratio, Peak Expiratory Flow Rate (PEFR), and Forced Expiratory Flow 25–75% (FEF25–75%) were assessed using computerized spirometry. Statistical analysis was performed using Pearson correlation and Student's t-test.

Results: BMI demonstrated a significant negative correlation with FVC ($r = -0.32$, $p = 0.001$), FEV1 ($r = -0.29$, $p = 0.002$), and PEFR ($r = -0.26$, $p = 0.006$). WHR also showed a significant inverse relationship with FVC ($r = -0.35$, $p < 0.001$), FEV1 ($r = -0.31$, $p = 0.001$), and PEFR ($r = -0.28$, $p =$

0.004). Participants with higher BMI and WHR exhibited reduced pulmonary function indices.

Conclusion: Increased BMI and WHR were associated with decreased pulmonary function in healthy young adults. Central obesity measured by WHR appeared to exert a greater adverse effect on respiratory function than generalized obesity.

Keywords: Body Mass Index, Waist-Hip Ratio, Pulmonary Function Test, Spirometry, Obesity, Young Adults, Lung Function.

INTRODUCTION

Obesity has become a major public health challenge worldwide and is associated with several metabolic, cardiovascular, and respiratory disorders. Excess body fat can adversely affect respiratory physiology by reducing chest wall compliance, increasing airway resistance, and limiting diaphragmatic movement. These alterations may lead to measurable changes in pulmonary function even in apparently healthy individuals [1].

Body Mass Index (BMI) is widely used as an indicator of overall adiposity, while Waist-Hip Ratio (WHR) reflects central or abdominal fat distribution. Evidence suggests that central obesity may have a stronger influence on respiratory mechanics than generalized obesity because abdominal fat directly restricts diaphragmatic excursion and lung expansion [2,3].

Pulmonary Function Tests (PFTs) provide an objective assessment of respiratory performance and are useful in detecting early functional impairment. Parameters such as Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV1), and Peak Expiratory Flow Rate (PEFR) are commonly used to evaluate lung function [4]. Several studies have demonstrated an inverse relationship between obesity indices and pulmonary function; however, findings vary across populations due to differences in age, ethnicity, lifestyle, and body composition [5]. Young adulthood represents a critical period during which preventive measures can be implemented to reduce future respiratory morbidity.

Limited data are available regarding the combined influence of BMI and WHR on pulmonary function among healthy young adults in the Indian population. Therefore, the present study was undertaken to assess the correlation between BMI, WHR, and pulmonary function parameters in healthy young adults.

Aim of the study: The present study aimed to assess the relationship between Body Mass Index (BMI), Waist-Hip Ratio (WHR), and

pulmonary function test parameters in healthy young adults.

MATERIALS AND METHODS

A cross-sectional observational study was conducted over a period of six months in the Department of Physiology in collaboration with the Pulmonary Function Laboratory of a tertiary care teaching hospital. The study included 120 healthy young adults aged between 18 and 25 years who were selected through convenient sampling after obtaining informed consent. Anthropometric measurements and pulmonary function tests were performed according to standard protocols to evaluate the relationship between Body Mass Index (BMI), Waist-Hip Ratio (WHR), and pulmonary function parameters among the study participants.

Inclusion Criteria

- Age between 18 and 25 years.
- Apparently healthy individuals.
- Non-smokers.
- Individuals willing to provide written informed consent.

Exclusion Criteria

- History of asthma, COPD, tuberculosis, or chronic respiratory disease.
- Acute respiratory infection within the preceding four weeks.
- Known cardiovascular disease.
- Pregnancy.
- Smokers and tobacco users.
- Individuals with chest wall deformities.

Data Collection

Height and weight were measured using standard anthropometric techniques. BMI was calculated as:

$BMI = \text{Weight (kg)}/\text{Height}^2\ (m^2)$

Waist and hip circumferences were measured using a non-stretchable measuring tape. WHR was calculated as:

WHR = Waist Circumference / Hip Circumference

Pulmonary function tests were performed using computerized spirometry according to ATS/ERS guidelines.

Parameters recorded:

- FVC (L)
- FEV1 (L)
- FEV1/FVC (%)
- PEFR (L/min)
- FEF25–75% (L/s)

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation. Pearson correlation coefficient was used to determine the relationship between BMI, WHR, and pulmonary function parameters. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 120 healthy young adults aged 18–25 years were included in the study. Anthropometric measurements and pulmonary function test parameters were assessed to evaluate the relationship between obesity indices and respiratory function. The findings are presented in the following tables and figures.

Table 1: Demographic and Anthropometric Characteristics of Study Participants (n=120)

Variable|	Mean ± SD
Age (years)	21.2 ± 2.1
Height (cm)	166.5 ± 8.7
Weight (kg)	65.8 ± 12.4
BMI (kg/m²)	23.7 ± 4.3
Waist Circumference (cm)	82.1 ± 9.2
Hip Circumference (cm)	95.6 ± 8.5
WHR	0.86 ± 0.07

The study population consisted predominantly of healthy young adults with a mean BMI within the normal to overweight range. (Table 1)

Table 2: Pulmonary Function Test Parameters

Parameter	Mean ± SD
FVC (L)	3.81 ± 0.67
FEV1 (L)	3.24 ± 0.58
FEV1/FVC (%)	85.0 ± 4.8
PEFR (L/min)	445.8 ± 72.3
FEF25–75% (L/s)	3.72 ± 0.81

Pulmonary function parameters were within normal physiological limits for the study population. (Table 2)

Table 3: Correlation of BMI with Pulmonary Function Parameters

Parameter	r-value	p-value
FVC	-0.32	0.001
FEV1	-0.29	0.002
FEV1/FVC	0.08	0.361

PEFR	-0.26	0.006
FEF25–75%	-0.18	0.052

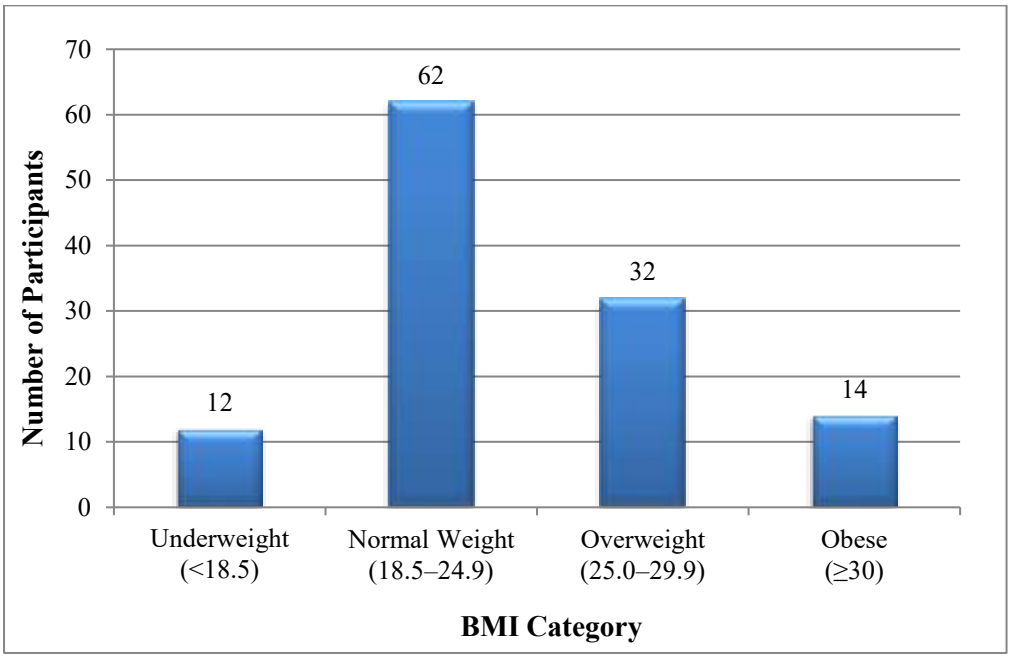
BMI showed significant negative correlations with FVC, FEV1, and PEFR, indicating reduced lung function with increasing body mass. (Table 3)

Table 4: Correlation of WHR with Pulmonary Function Parameters

Parameter	r-value	p-value
FVC	-0.35	<0.001
FEV1	-0.31	0.001
FEV1/FVC	0.06	0.448
PEFR	-0.28	0.004
FEF25–75%	-0.20	0.084

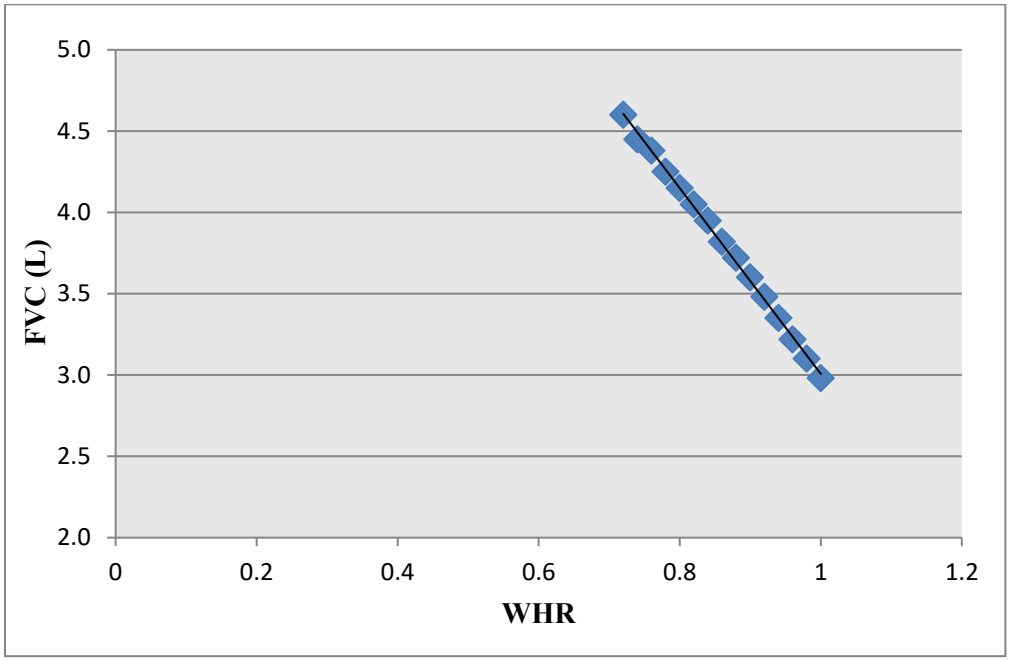
WHR exhibited stronger inverse correlations with pulmonary function parameters than BMI, suggesting a greater adverse effect of central obesity on respiratory function. (Table 4)

Figure 1: Distribution of BMI Categories among Study Participants



The majority of participants (51.7%) belonged to the normal BMI category, while 26.7% were overweight and 11.7% were obese. Only 10% of participants were underweight. (Figure 1)

Figure 2: Scatter Plot Showing Correlation between WHR and FVC



The scatter plot demonstrates a negative relationship between WHR and FVC. As WHR increases, FVC tends to decrease, indicating that central obesity may adversely affect lung function. (Figure 2)

DISCUSSION

The present study demonstrated significant negative associations between BMI, WHR, and pulmonary function parameters, particularly FVC, FEV1, and PEFR. These findings suggest that increasing body mass may adversely affect respiratory mechanics even among apparently healthy young adults [6].

Wu T et al. reported that increased visceral adiposity was associated with adverse respiratory outcomes and reduced pulmonary function in both children and adults [7]. Excess adipose tissue around the thorax and abdomen can restrict chest wall movement and reduce lung compliance, leading to diminished pulmonary function.

The present study also revealed that WHR exhibited a stronger inverse correlation with pulmonary function indices than BMI. Similar observations have been reported in studies evaluating central adiposity and pulmonary function, suggesting that abdominal fat accumulation exerts greater mechanical constraints on diaphragmatic excursion and lung expansion than generalized obesity [8,9].

The absence of a significant correlation between BMI, WHR, and FEV1/FVC ratio indicates that obesity predominantly affects lung volumes rather than airway obstruction. These findings support previous studies demonstrating a restrictive rather than

obstructive pattern in overweight and obese individuals [10].

The observed reduction in PEFR among participants with higher BMI and WHR may be attributed to increased airway resistance and reduced respiratory muscle efficiency [11]. Early identification of such alterations is important because respiratory impairment beginning in young adulthood may contribute to future pulmonary morbidity.

CONCLUSION

The present study demonstrated a significant inverse relationship between BMI, WHR, and pulmonary function parameters among healthy young adults. Increased adiposity, particularly central obesity as measured by WHR, was associated with reduced lung volumes and expiratory flow rates. These findings emphasize the importance of maintaining healthy body composition and preventing abdominal obesity to preserve optimal respiratory function. Routine assessment of anthropometric indices along with pulmonary function testing may aid in the early identification of individuals at risk for future respiratory impairment.

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