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Correlation between pulmonary function test and body composition in young adult

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Abstract:

Background: Understanding the relationship between PFTs and body composition in young adults is crucial for the early detection and management of respiratory diseases, which can have significant impacts on overall health and quality of life.

Aim: The aim of this study is to investigate the correlation between PFTs and body composition in young adults and identify potential predictors of respiratory health.

Hypothesis: We hypothesize that there is a significant correlation between PFTs and body composition in young adults, and that certain body composition measures may serve as predictors of respiratory health outcomes.

Materials & methods: After obtaining permission from the Institutional Ethics Committee, the present study was initiated. This cross-sectional survey was conducted on the attendants of patients who visited FM Medical College in Balasore, Odisha. This investigation comprised fifty-one females and one hundred forty-two males.

Statistical Analysis: The relationship between body composition and various PFT parameters was investigated using the univariate correlation coefficient (Pearson).

Results: In males, there was a substantial negative correlation between body mass index and FEV1 ($r=-0.198$, $p < 0.05$) and PIFR ($r=- 0.183$, $p=0.0023$). FEV1 exhibited a substantial negative correlation with fat percentage ($r=- 0.201$, $p=0.011$). PIFR and fat free mass index exhibited a substantial negative correlation ($r=-0.169$, $p=0.028$). A substantial positive correlation was observed between FVC and fat free mass in females. ($r=0.41$, $p=0.002$). The correlation between the other parameters was not statistically significant.

Conclusion: The findings of this investigation indicate that there is a substantial correlation between body composition and pulmonary function tests in young adults. The potential for personalized treatment plans based on individual test results, as well as the long-term effects of pulmonary function and body composition on overall health and well-being in young adults, could be a focus of future research in this field.

Key words: Pulmonary Function tests; Body composition; Young adults; Correlation; Respiratory system; Respiratory diseases.

Introduction:

Pulmonary function tests (PFTs) and body composition assessments are important tools in the evaluation of respiratory health in young adults [1-3].Understanding the relationship between PFTs and body composition in young adults is crucial for the early detection and management of respiratory diseases, which can have significant impacts on overall health and quality of life. Previous studies have shown that body composition and PFTs are closely related, but there is limited research on the specific correlations between these measures in young adults [4-8].The current study aims to address the knowledge gap by examining the relationship between PFTs and body composition in young adults, with a focus on identifying potential predictors of respiratory health.The rationale for this study is to provide a better understanding of the relationship between PFTs and body composition in young adults, which can inform the development of targeted interventions to improve respiratory health. The research question is what is the correlation between PFTs and body composition in young adults, and how do these measures relate to respiratory health outcomes?Hence, the aim of this study is to investigate the correlation between PFTs and body composition in young adults and identify potential predictors of respiratory health.We hypothesize that there is a significant correlation between PFTs and body composition in young adults, and that certain body composition measures may serve as predictors of respiratory health outcomes.

Materials & methods:

This cross-sectional study was conducted on the attendants of patients who visited FM Medical College in Balasor, Odisha. The study included participants aged 18 to 30. The sample size was 93, with 42 males and 51 females. A general and systemic examination was conducted, followed by an assessment of body composition and pulmonary function. All subjects were provided with comprehensive information regarding the study and the procedure they would be required to go through. The written informed assent was obtained from all subjects. The study excluded subjects with a history of smoking, chronic respiratory disease, cardiac disease, diabetes, drug intake known to affect respiratory function, examination findings suggestive of preexisting respiratory or cardiac disease, chest and abdominal pain for any cause, and oral or facial pain exacerbated by mouthpiece.

The ndd Large TrueFlow (EasyOne) spirometer was employed for the pulmonary function test. The pulmonary function measurement was documented. The subjects were questioned regarding their history of any strenuous activities that should be avoided prior to the lung function testing. All of the participants were acquainted with the instrument and the test-taking process. The subject's name, age, height, weight, sex, date of the test, atmospheric temperature, and humidity were recorded. The digital temperature and humidity meter (HTC-1) was employed to measure the temperature and humidity.

The examinations were conducted in a seated position. The subjects were instructed to inhale fully, followed by a rapid and vigorous exhalation through the mouthpiece. Three successive readings were recorded, and the most effective reading was chosen.

PFT parameters were deemed appropriate if they met the criteria for manoeuvre acceptability. The American Thoracic Society (ATS) and the European Respiratory Society (ERS) jointly issued statements regarding lung function testing, which were implemented [1,2].

Statistical analysis:

Microsoft Excel was employed to conduct statistical analysis. The relationship between body composition and various PFT parameters was investigated using the univariate correlation coefficient (Pearson).

Results:

This cross-sectional survey was conducted on the attendants of patients who visited FM Medical College in Balasore, Odisha. This investigation comprised fifty-one females and one hundred forty-two males. Tables 1 and figure 1 illustrate the subject's general characteristics, body composition, and pulmonary function parameters.

Table 1: Body composition parameters and general characteristics of the subjects

	18 – 22 years		23 – 26 years		27 – 30 Years	
	Males	Females	Males	Females	Males	Females
Age(yrs)	21.2 ± 1.5	20.2± 2.9	25.4 ± 3.1	32.57±2.174	43.8±2.631	44.07±3.518
Height(cm)	1.7±0.09	1.6±0.08	1.69±0.07	1.5±0.08	1.7±0.2	1.6±0.05
Weight(kg)	64.5±10.1	57.08±10.2	63.1±9.1	58.4±8.2	69.3±12.1	62.2±13.1
BMI(kg/m2)	21.3±3.6	21.5±2.7	22.3±1.9	23.8±4.1	23.6±6.1	25.6±5.1
BSA(m2)	1.8±0.1	1.6±0.2	1.7±0.14	1.6±0.3	1.8±0.3	1.6±0.3
Fatmass(kg)	9.4±4.1	12.2±2.9	10.9±2.5	14.1±3.3	14.3±4.9	17.23±4.9
%Fat	14.1±3.1	21.6±2.1	17.3±1.6	24.5±2.1	20.4±4.1	27.5±3
Fatfreemass(kg)	55.1±12.1	44.1±7.1	52.1±7.2	44.7±6.1	55.1±10.2	45.1±8.2
Fatfreemassindex	21.2±4.1	17.4±3.3	19.4±2.7	19.4±3.1	22.4±12.4	18.8±3.1

Table 2: Pulmonary function test parameters of the subjects

	18 – 22 years		23 – 26 years		27 – 30 Years	
	Males	Females	Males	Females	Males	Females
FVC(l)	3.1±0.6	2.8±0.5	3.6±0.8	2.4±0.5	3.5±0.7	2.3±0.5
FEV1(l)	3.2±0.5	2.4±0.5	2.9±0.6	2.01±0.4	2.8±0.5	1.8±0.5
FEV1(%)	0.9±0.08	1.01±1.2	1.1±1.3	0.9±0.07	0.8±0.07	0.8±0.08
PEFR(l/sec)	7.1±2	4.8±1.8	6.3±2.0	5.1±1.8	7.2±1.9	4.1±1.7
PIFR(l/sec)	4.6±2	2.9±1.5	4.7±1.7	2.9±1.2	4.9±2.1	2.5±1.4

The relationship between males and females' body composition parameters and PFT parameters were analysed. In males, there was a substantial negative correlation between body mass index and FEV1 ($r=-0.198$, $p < 0.05$) and PIFR ($r=- 0.183$, $p=0.0023$). FEV1 exhibited a substantial negative correlation with fat percentage ($r=- 0.201$, $p=0.011$). The parameters of the PFT exhibited a non-significant negative correlation and a non-significant positive correlation with fat mass and fat-free mass, respectively. PIFR and fat free mass index exhibited a substantial negative correlation ($r=-0.169$, $p=0.028$). Height exhibited a substantial positive correlation with all PFT parameters, with the exception of FEV1/FVC. Height exhibited a substantial positive correlation with all PFT parameters in females, apart from FEV1/FVC and PIFR. A substantial positive correlation was observed between FVC and fat free mass in females. (r=0.41, p=0.002). The correlation between the other parameters was not statistically significant.

Discussion:

The research question is what is the correlation between PFTs and body composition in young adults, and how do these measures relate to respiratory health outcomes? The aim of this study is to investigate the correlation between PFTs and body composition in young adults and identify potential predictors of respiratory health. We hypothesized that there is a significant correlation between PFTs and body composition in young adults, and that certain body composition measures may serve as predictors of respiratory health outcomes.

In the current investigation, a substantial negative correlation was observed between certain PFT parameters and BMI fat percentage and fat free mass. The majority of the PFT parameters exhibited a non-significant positive correlation with fat free mass. In males, we obtained these results; however, in females, we only observed a significant correlation between FVC and fat free mass. The relationship between the PFT parameters and the height was also investigated, as we had incorporated BMI and fat-free mass index, which have height as the denominator. A significant positive correlation between the two was observed. Consequently, our hypothesis was partially validated.

Some authors achieved results that were comparable to ours, while others obtained results that were contradictory to ours in certain parameters [2-4]. One common discovery that the majority of authors obtained was that BMI and fat percentage were negatively correlated with the majority of PFT parameters, despite the fact that the results were distinct between male and female subjects [5,6,8,9,12]. Another discovery we made was that the fat-free mass index was negatively correlated with FEV1 and PIFR in males. The results of our study were in direct opposition to those of all other studies, which either found no correlation or found a significant correlation.

There is a substantial positive correlation [2-4, 9-11]. This necessitated an examination of the correlation between height and PFT parameters. We anticipated a positive correlation in this instance, and we were able to establish a robust positive correlation with the majority of the PFT parameters. The fat-free mass index is determined by dividing the fat-free mass by height, where the height is included in the denominator. The present study's negative correlation was caused by a strong positive correlation with height. Adipose-free mass and adipose mass comprise the majority of body weight or body mass. Organ cell mass and non-fatty tissues, such as bone, skeletal muscle, tendons, and ligaments, comprise fat-free mass. Therefore, there is a possibility that the body weight may increase as a result of the increase in fat-free mass that occurs during exercise. Additionally, obesity can lead to an increase in body mass, as it occurs when fat mass increases. Consequently, the body mass index will be elevated in both rotund individuals and athletes. Thus, a high BMI results in an inaccurate assessment of obesity in individuals who are slender and have an excessive amount of muscle mass due to genetics or exercise training [11]. Therefore, in addition to the other variables, we considered fat mass and fat-free mass. A study [10] proposed that FM and FFM are independent factors that affect ventilatory function in adults. In adults, ventilatory function is positively correlated with FFM, which is a reflection of muscle mass, while FM is negatively correlated with it. Skeletal muscle, tendons, ligaments, and bones comprise FFM. Spirometry is a physiological test that quantifies the volume of air inhaled or exhaled by an individual as a function of time. Therefore, the muscle's power is a significant factor in PFT, and the increased fat-free mass will be correlated with the enhanced PFT parameters. It is well-established that consistent physical activity or exercise results in an increase in fat-free mass. In addition, the composition of the organism varies with age [8,9]. Obesity is characterized by an excessive accumulation of adipose tissue mass. A variety of pulmonary abnormalities may be present in conjunction with obesity. This encompasses diminished compliance with the chest wall, an increase in work of breathing, an increase in minute ventilation as a result of an increased metabolic rate, and a decrease in functional residual capacity and total lung capacity. Pulmonary function may be significantly enhanced by weight loss and additionally, lung function has been demonstrated to be influenced by fat distribution [12,13].

Conclusion:

In summary, the findings of this investigation indicate that there is a substantial correlation between body composition and pulmonary function tests in young adults. This finding has significant implications for the diagnosis and treatment of metabolic and respiratory disorders. The potential for personalized treatment plans based on individual test results, as well as the long-term effects of pulmonary function and body composition on overall health and well-being in young adults, could be a focus of future research in this field.

Conflict of interest:

There is no conflict of interest among the present study authors.

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