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RELATION BETWEEN THE BODY COMPOSITION AND STRENGTH OF RESPIRATORY MUSCLES

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Abstract:
Lung function and respiratory muscle strength are thought to be affected by body composition. The relationships between the components of body weight and the markers of lung function, however, are generating more and more interest. There has not been much research done on how body composition factors, like lean and fat masses and their distribution, affect breathing capacity. Researchers have been studying the connection between pulmonary functions and body composition since the middle of the 1950s. There has been research on the relationship between pulmonary function and body composition, but the findings have been inconsistent. The aim of this study was to examine the correlation between the body composition and respiratory muscle strength of football players. For this purpose, 12 healthy athletes participated in our study. The measurements of the participants were performed in the laboratory. Body composition measurement was carried out using a body composition analyzer with Tanita (Bioelectrical Impedance Analysis). Respiratory muscle strength measurement was performed with a respiratory pressure meter. When the data were analyzed; there were no significant differences between the parameters of the participants' body composition and respiratory muscle strength parameters ($p>0.05$). In conclusion, it could be said that there is no significant correlation between body composition and respiratory muscle strength.

Keywords: human body, respiratory, correlation

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1. Introduction

According to the literature, information about a person's body composition is crucial for determining nutritional status, which has been verified to be particularly related to lung function (Maiolo *et al.*, 2003). Nevertheless, the majority of cross-sectional studies that have examined lung function have employed additive linear models that only take into account a person's age and height, not weight or other body composition parameters (Quanjer *et al.*, 1993). Increased muscular growth and improved muscle strength are two frequently mentioned outcomes of long-term resistance training. According to the training principle of specificity, these adaptations will happen to the muscles that are actively used in the movements being trained. In addition to the muscles used to exert direct force on an external object, the stabiliser muscles, which help maintain posture, will also be more actively activated (Martuscello *et al.*, 2013). It also seems that lung function and respiratory muscle strength are influenced by body composition. In young adult males and females in good health, Ro *et al.* (2015) demonstrated a relationship between MIP and the skeletal muscle index (in relation to body mass). More recently, a large cross-sectional study of healthy persons aged 18–89 years revealed that decreased skeletal muscle mass index was linked with reduced forced vital capacity (FVC) and forced expiratory volume in 1 second (FEV1) (Park *et al.*, 2018).

Given that decreased skeletal muscle mass can raise inflammation-related chemicals and impair lung elasticity and expansion, it appears likely that body composition could have an impact on lung function throughout a wider age range (Byun *et al.*, 2017). However, there is growing curiosity about the connections between the elements of body weight and the indicators of lung function. The effect of body composition parameters (such as lean and fat masses and their distribution) on respiratory performance has not been extensively studied (Maiolo *et al.*, 2003). Since the mid-1950s, researchers have been examining the relationship between body composition and pulmonary functions. The association between pulmonary function and body composition has been studied, although the results have varied (Park *et al.*, 2012). Therefore, this study aimed to examine the relationship between body composition and respiratory muscle strength.

2. Method

2.1. Experimental Design and Participants

This study was designed for the relational screening model. Respiratory muscle strength and body composition measurements were carried out of the volunteers participating in the study. 12 healthy athletes participated in the study. G Power analysis was used to determine the number of subjects. Volunteers visited the laboratory twice. In the first visit, information was given about the study and body composition was measured. In the second and last visit, respiratory muscle strength measurements were performed.

Table 2.1: Descriptive characteristics of participants about body composition and respiratory muscle strength

	Mean	Std. Deviation
Fat mass (kg)	1,15	0,47
FFM (kg)	10,36	3,34
Fat percentage (%)	9,57	2,79
MIP (cmH_2O)	107,25	33,00
MEP (cmH_2O)	135,17	22,34

2.2. Respiratory Muscle Strength Measurement

An electronic respiratory pressure meter (Pocket Spiro MPM-100, Medical Electronic Construction R&D, Brussels, Belgium) was used for MIP and MEP calculation according to the 2002 guidelines of the American Thoracic Society and European Respiratory Society. For MIP measurement, participants performed maximal expiration, immediately following which they were asked to perform maximal inspiration for 1– 3 s. For MEP measurement, the participants performed maximal inspiration, following which they were immediately asked to perform maximal expiration for 1–3 s. The measurements were repeated until the difference between the best two measurements was 5 cmH2O, and the best result was recorded in terms of cmH2O (Hautmann *et al.*, 2000).

2.3. Body Composition Measurement

Measurements were carried out with a Tanita (Bioelectrical Impedance Analysis) body composition analyzer, the validity of which was tested for the calculation of the body compositions of the volunteers.

2.4. Statistical Analysis

SPSS 20.0 program was used to analyze the data. Pearson correlation analysis was used to determine the relationship between respiratory muscle strength and body composition parameters. The data obtained were presented as the mean and standard deviation, and the significance was examined at $p<0.05$.

3. Results

Table 3.1 shows the analysis of the correlation between the respiratory muscle strength and body composition of the participants. When the data were examined, no significant differences could be found between fat-free mass, fat mass, and fat percentages belonging to body composition and MIP and MEP, which are respiratory muscle strength parameters ($p>0.05$).

Table 3.1. Examination of the relationship between the participants' body composition and respiratory muscle strength

		MIP	MEP
Fat mass (Fat Mass)	r	-0,013	-0,033
	p	0,484	0,459
FFM (Fat Free Mass)	r	0,021	-0,336
	p	0,474	0,143
Fat percentage	r	-0,075	0,137
	p	0,409	0,335

4. Discussion

The aim of this study was to examine the correlation between body composition and respiratory muscle strength of healthy athletes. For this purpose, measurements were made with 12 healthy athlete individuals. When the obtained data were analyzed; there were no significant differences between the parameters of the participants' body composition and respiratory muscle strength parameters. When the studies examined in the literature, there are many studies that revealed that respiratory muscle strength may have a positive correlation between body structure and muscle ratios (Tsubaki *et al.*, 2009). If the muscle ratios in the body are high, it is expected that the respiratory muscles will be stronger. At the same time, the lower the body fat percentage, the more significant force production in the respiratory muscles could be in question (Hughes *et al.*, 2018). Apart from these, there are many studies in which the strength and functions of the respiratory muscles are affected. These studies revealed the structure of respiratory muscles, the conditions in which they are affected and their correlation with other parts of the body (Ro *et al.*, 2015; Park *et al.*, 2018; Akınoğlu *et al.*, 2019). In our study, no significant difference was found between respiratory muscle strength and body composition.

5. Conclusion

As a result, it could be said that there is no significant correlation between body composition and respiratory muscle strength. With the studies to be carried out, meaningful results can be obtained with a larger sample group and different participants.

Authors' Contributions

Conceptualization, MTA, MHM; investigation and data collection, MHM; writing of original draft preparation, MTA, MHM; writing, review and editing, MTA, MHM; visualization, MTA, MHM; supervision.

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The authors declare no conflict of interest.

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