

THE IMPACT OF OBESITY ON RESPIRATORY MUSCLE STRENGTH IN YOUNG ADULTS

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SUMMARY

Introduction: Obesity, characterized by excess body fat, affects all ages and is now a public health problem. This condition is identified by anthropometric measures such as Body Mass Index (BMI) and the waist-to-hip ratio. In addition to posing risks for chronic diseases, it contributes to changes in the musculoskeletal system. The global increase in obesity among adolescents and young adults suggests possible impairments in the pulmonary function of these individuals. **Objectives:** To associate the presence of obesity with respiratory muscle strength in young adults. **Methodology:** This is a cross-sectional observational study. The study population consists of 70 students from the Medicine course at UniEVANGÉLICA, according to the inclusion and exclusion criteria. The following were evaluated: body mass index (BMI) and respiratory muscle strength, through maximum inspiratory pressure (MIP) and maximum expiratory pressure (MEP). Results: showed that overweight youth had significantly higher values for Pimáx and predicted %Pimáx compared to eutrophic individuals, indicating that obesity is associated with greater respiratory muscle strength. **Conclusion:** In the study, overweight youth showed better values for Pimáx, with most within the expected range. Obesity, a global problem, increases the risk of respiratory and cardiovascular diseases, and the results help develop health strategies to mitigate these risks.

Keywords: Young Adults; obesity; respiratory muscle strength.

Introduction

Obesity is a multifactorial disorder characterized by the accumulation of body fat that affects all age groups, with adolescence being one of the most critical periods for the acquisition and maintenance of excess weight in adulthood (OLIVEIRA et al., 2020). This condition can be identified through anthropometric measures such as the body mass index (BMI) (OLIVEIRA et al., 2020). In this sense, the ability of examinations and anthropometric indicators to predict the risk of chronic diseases, such as systemic arterial hypertension, and their possible complications in adulthood has been evidenced (WHO, 2000). That said, it is posited that, in addition to systemic impairment, the related bodily overload

the excess of adipose tissue contributes to the emergence of alterations in the musculoskeletal and respiratory systems (SANTOS et al., 2019).

With that, a relevant problem for the population is that the prevalence of overweight and obesity in adolescents has increased worldwide between 1975 and 2016 (ANTUNES et al., 2022). It is known that obesity in adults can limit the mobility of the thoracic cage, reduce diaphragmatic excursion, and consequently reduce lung volumes and capacities (BATISTA et al., 2019). Thus, it is important to assess the presence of obesity and its impact on the respiratory muscle strength of young adults. Thus, the objective of this study is to associate the presence of obesity with respiratory muscle strength in young adults.

Methodology

Sample

This is a cross-sectional observational study. The study population consists of students from the Medicine course at UniEVANGÉLICA. The sample was recruited for convenience, and 70 young people agreed to participate in the study. Students from the Medicine course at UniEVANGÉLICA from the 1st to the 8th

semester, aged between 18 to 25 years, with BMI (<25 or $\geq 30\text{Kg/m}^2$), who agreed to participate and signed the informed consent form, were included. Students who did not complete the questionnaire fully and those with chronic carbometabolic and respiratory comorbidities, as well as systemic diseases (hypertension, diabetes mellitus, and thyroid diseases) identified at the time of the questionnaire application, were excluded. The work was approved by the Research Ethics Committee of UniEVANGÉLICA with the number 6.215.903/2023.

Evaluation protocols

The body mass index (BMI) was calculated based on body mass and height. To be considered the ideal BMI, the values were $< 25\text{ kg/m}^2$ and obesity

$\geq 30\text{ kg/m}^2$ (WHO, 1998). To estimate respiratory muscle strength, static pressures were used: maximum inspiratory pressure ($P_{\text{imáx}}$) and maximum expiratory pressure ($P_{\text{emáx}}$), which are pressures obtained from residual volume (RV) and total lung capacity (TLC), respectively (NEDER et al., 1999). The maneuvers were performed with the participants seated and connected to the Manovacuumeter (Globalmed-MVD300, Porto Alegre, Brazil). The reference values were obtained at

starting from two regression equations for the Brazilian adult population (NEDER et al., 1999):

Homens

$$P_{\text{imáx}}: y = -0.80 (\text{age}) + 155.3, \text{ SEE} = 17.3 \text{ equação (1);}$$

$$P_{\text{emáx}}: y = -0.81 (\text{age}) + 165.3, \text{ SEE} = 15.6 \text{ equação (2);}$$

Women

$$P_{\text{imáx}}: y = -0.49 (\text{age}) + 110.4, \text{ SEE} = 9.1 \text{ equação (3);}$$

$$P_{\text{emáx}}: y = -0.61 (\text{age}) + 115.6, \text{ SEE} = 11.2 \text{ equação (4);}$$

The results were described as mean, standard deviation, frequencies, and percentages. To verify the normality of the data, the Kolmogorov-Smirnov test was used. The comparison between the groups was performed using the t-test for independent samples (normal distribution) or Mann-Whitney test (asymmetric distribution). The delta variation (Δ) was calculated between the means. The association between the categorical variables was tested using the Chi-square test. The p-value considered was <0.05 and the data were analyzed using the Statistical Package for Social Science (SPSS, version 23, IBM, Armonk, NY) software.

Results

In Table 1, the sample is characterized. Body mass ($\Delta=21.55$ kg, $p<0.001$) and BMI ($\Delta=7.53$ kg/m², $p<0.001$) were higher in overweight youth. When comparing the muscle strength variables, the overweight youth had higher P_{imáx} ($\Delta=17.42$ cmH₂O, $p=0.009$) and predicted %P_{imáx} ($\Delta=16.65\%$, $p=0.002$) (Table 2).

Table 1. Sample characterization and respiratory muscle strength (n=70).

Variables	Eutrophic (n=43)	Excess weight (n=27)	p*
Sex	n (%)	n (%)	
Male	24 (55,8)	14 (51,9)	0,746
Female	19 (44,2)	13 (48,1)	
	Média±dp	Média±dp	
Age (years)	22,21±2,05	23,70±2,64	0,01
Massa corporal (kg)	64,96±10,89	86,50±14,64	<0,001
Estatura (m)	1,70±0,09	1,70±0,07	0,948
IMC (kg/m ²)	22,10±1,98	29,63±4,35	<0,001
P _{imáx}	88,91±26,71	106,33±25,51	0,009
%P _{imáx}	73,90±20,60	90,55±19,91	0,001
P _{emáx}	112,68±33,77	113,12±34,08	0,959
%P _{emáx}	88,92±22,42	91,54±24,43	0,647

P_{imáx}: maximum inspiratory pressure; P_{emáx}: maximum expiratory pressure. * Data for $p<0.05$. Source: Prepared by the authors (2024)

Young people with excess weight (66.7%, $p=0.043$) had more $P_{imáx}$ within the expected range.

Table 2. Association of BMI with respiratory muscle strength (n=70).

Variables	Total (n=70) n (%)	Eutrophic (n=43) n (%)	Excess weight (n=27) n (%)	p^*
$P_{imáx}$				
Normal	36 (51,4)	18 (41,9)	18 (66,7)	0,043
Below expectations	34 (48,6)	25 (58,1)	9 (33,3)	
$P_{emáx}$				
Normal	43 (61,4)	26 (60,5)	17 (63)	0,834
Below expectations	27 (38,4)	17 (39,5)	10 (37)	

$P_{imáx}$: maximum inspiratory pressure; $P_{emáx}$: maximum expiratory pressure. * Data for $p<0.05$. Source: Prepared by the authors (2024)

Conclusion

In the present study, overweight young people had better values for $P_{imáx}$, and most of them had $P_{imáx}$ within the expected range. It is worth noting that obesity is a global health problem resulting from the excessive accumulation of body fat, which considerably increases the risk of respiratory, metabolic, and cardiovascular diseases. The results of this study assist in establishing health promotion strategies to minimize the risks of obesity on respiratory health.

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