

THE IMPACT OF OBESITY ON RESPIRATORY MUSCLE STRENGTH IN YOUNG ADULTS

Yohanna Ribeiro Ferreira¹

Paula Rocha Granado²

Orientadora: Viviane Soares³

Universidade Evangélica de Goiás – UniEVANGÉLICA¹²³

RESUMO

ABSTRACT

Introduction: Obesity, characterized by excess body fat, affects all age groups and is currently a public health problem. This condition is identified through anthropometric measures such as Body Mass Index (BMI) and waist-to-hip ratio. In addition to increasing the risk of chronic diseases, it contributes to changes in the musculoskeletal system. The global rise in obesity among adolescents and young adults suggests potential impairments in pulmonary function in 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 consisted of 70 medical students from UniEVANGÉLICA, selected according to inclusion and exclusion criteria. Body Mass Index (BMI) and respiratory muscle strength were evaluated through maximum inspiratory pressure (MIP) and maximum expiratory pressure (MEP). **Results:** Overweight young adults showed significantly higher values for MIP and predicted %MIP compared to eutrophic participants, indicating that obesity is associated with greater respiratory muscle strength. **Conclusion:** In this study, young adults with excess weight presented better MIP values, mostly within expected ranges. Obesity, a global health problem, increases the risk of respiratory and cardiovascular diseases, and these results contribute to developing health strategies to mitigate such risks.

Keywords: Young Adults; Obesity; Respiratory Muscle Strength

INTRODUCTION

Obesity is a multifactorial disorder characterized by the accumulation of body fat, affecting all age groups, with adolescence being a critical period for acquiring and maintaining excess weight into adulthood (OLIVEIRA et al., 2020). This condition can be identified through anthropometric measures such as Body Mass Index (BMI) (OLIVEIRA et al., 2020). Anthropometric indicators have been shown to predict the risk of chronic diseases, such as systemic arterial hypertension, and their potential complications in adulthood (WHO, 2000). Moreover, in addition to systemic effects, the body overload due to excess adipose tissue contributes to musculoskeletal and respiratory system alterations (SANTOS et al., 2019). The prevalence of overweight and obesity among adolescents has increased worldwide between 1975 and 2016 (ANTUNES et al., 2022). Obesity in adults can limit thoracic mobility, reduce diaphragmatic excursion, and consequently reduce lung volumes and capacities

(BATISTA et al., 2019). Therefore, it is important to assess the presence of obesity and its impact on respiratory muscle strength in young adults.

METHODOLOGY

Sample

This is a cross-sectional observational study. The study population consisted of medical students from UniEVANGÉLICA. A convenience sample of 70 young adults who agreed to participate was recruited. Inclusion criteria were students aged 18–25 years, enrolled from the 1st to the 8th semester, with BMI <25 or ≥30 kg/m², and who provided informed consent. Exclusion criteria included incomplete questionnaires and the presence of chronic cardiometabolic or respiratory comorbidities, as well as systemic diseases (hypertension, diabetes mellitus, thyroid disorders) identified at the time of the questionnaire application. The study was approved by the UniEVANGÉLICA Research Ethics Committee (Approval No. 6.215.903/2023).

Evaluation Protocols:

BMI was calculated using body weight and height. Ideal BMI was considered <25 kg/m² and obesity ≥30 kg/m² (WHO, 1998). Respiratory muscle strength was estimated through static pressures: maximum inspiratory pressure (MIP) and maximum expiratory pressure (MEP), measured from residual volume (RV) and total lung capacity (TLC), respectively (NEDER et al., 1999). Measurements were performed with participants seated using a manovacuometer (Globalmed-MVD300, Porto Alegre, Brazil). Reference values were derived from two regression equations for the Brazilian adult population (NEDER et al., 1999):

MEN

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

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

WOMEN

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

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

The results were described as mean, standard deviation, frequencies, and percentages. To assess data normality, the Kolmogorov-Smirnov test was used. Comparisons between groups were performed using the independent-samples t-test (for normally distributed data) or the Mann-Whitney test (for non-normal distributions). The delta variation (Δ) was calculated between means. Associations between categorical variables were tested using the Chi-square test. A p-value <0.05 was considered statistically significant, and data were analyzed using the Statistical Package for the Social Sciences (SPSS, version 23, IBM, Armonk, NY).

RESULTS

Table 1 presents the sample characteristics. Body mass ($\Delta=21.55$ kg, $p<0.001$) and BMI ($\Delta=7.53$ kg/m², $p<0.001$) were higher in young adults with overweight. When comparing respiratory muscle strength variables, overweight individuals showed higher maximal inspiratory pressure ($P_{im\acute{a}x}$) ($\Delta=17.42$ cmH₂O, $p=0.009$) and predicted % $P_{im\acute{a}x}$ ($\Delta=16.65\%$, $p=0.002$) (Table 2).

Tabela 1. Caracterização da amostra e força muscular respiratória (n=70).

| Variáveis | Eutrófico (n=43) | Excesso de peso (n=27) | p* |
|--------------------------|------------------|------------------------|--------|
| Sexo | n (%) | n (%) | |
| Masculino | 24 (55,8) | 14 (51,9) | 0,746 |
| Feminino | 19 (44,2) | 13 (48,1) | |
| | Média±dp | Média±dp | |
| Idade (anos) | 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 |
| $P_{im\acute{a}x}$ | 88,91±26,71 | 106,33±25,51 | 0,009 |
| % $P_{im\acute{a}x}$ | 73,90±20,60 | 90,55±19,91 | 0,001 |
| $P_{em\acute{a}x}$ | 112,68±33,77 | 113,12±34,08 | 0,959 |
| % $P_{em\acute{a}x}$ | 88,92±22,42 | 91,54±24,43 | 0,647 |

$P_{im\acute{a}x}$: pressão inspiratória máxima; $P_{em\acute{a}x}$: pressão expiratória máxima. *Dados para $p<0,05$. Fonte: Elaborada pelos autores (2024)

Overweight young adults (66.7%, $p=0.043$) had a higher proportion of $P_{im\acute{a}x}$ values within the predicted range.

Tabela 2. Associação do IMC com a força muscular respiratória (n=70).

| Variáveis | Total (n=70) n (%) | Eutrófico (n=43) n (%) | Excesso de peso (n=27) n (%) | p* |
|--------------------------------------|-----------------------|------------------------|------------------------------|-------|
| $P_{im\acute{a}x}$ | | | | |
| Normal | 36 (51,4) | 18 (41,9) | 18 (66,7) | 0,043 |
| Abaixo do previsto | 34 (48,6) | 25 (58,1) | 9 (33,3) | |

| Pe_{máx} | | | | |
|-------------------------|-----------|-----------|---------|-------|
| Normal | 43 (61,4) | 26 (60,5) | 17 (63) | 0,834 |
| Abaixo do previsto | 27 (38,4) | 17 (39,5) | 10 (37) | |

P_{imáx}: pressão inspiratória máxima; Pe_{máx}: pressão expiratória máxima. *Dados para p<0,05. Fonte: Elaborada pelos autores (2024)

CONCLUSION

In the present study, overweight young adults showed higher P_{imáx} values, with most of them within the predicted range. It is important to note that obesity is a global health problem caused by excessive body fat accumulation, which significantly increases the risk of respiratory, metabolic, and cardiovascular diseases. The results of this study help inform health promotion strategies aimed at minimizing the impact of obesity on respiratory health.

REFERENCES

- ANTUNES, Nelma Maria Neves *et al.* Diagnostic performance of anthropometric indicators used to assess excess body fat in adolescence. **Revista Paulista de Pediatria**, v. 41, 2022.*
- OLIVEIRA, Matheus Felipe Costa *et al.* Prevalência de obesidade em adolescentes e jovens. **RBONE-Revista Brasileira de Obesidade, Nutrição e Emagrecimento**, v. 14, n. 88, p. 811-820, 2020.
- NEDER, J.A. *et al.* Reference values for lung function tests: II. Maximal respiratory pressures and voluntary ventilation. **Brazilian Journal of Medical and Biological Research**, v. 32, n. 6, p. 719-727, 1999.
- SANTOS, Patrícia Clara Pereira dos. **Alinhamento do tronco, mobilidade do músculo diafragma, força e função pulmonar em adolescentes e adultos jovens obesos**. Tese apresentada ao Programa de Pós Graduação em Saúde da Criança e do Adolescente da Universidade Federal de Pernambuco. Recife, p. 80. 2019.
- BATISTA, F. C. S; *et al.* (2019). Força muscular respiratória em adolescentes obesos e não-obesos. **Revista Movimenta**, v.12 (3), p. 274-280, 2019.

World Health Organisation (WHO). WHO | **Waist Circumference and Waist–Hip Ratio. Report of a WHO Expert Consultation.** Geneva, 8-11 December 2008. 2008;(December):8–11.

WORLD HEALTH ORGANIZATION. Obesity: preventing and managing the global epidemic. 2000.