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# EVALUATING HANDGRIP STRENGTH AS A MARKER OF MUSCULAR FITNESS AND BODY COMPOSITION IN STUDENTS

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**Apstract**: Handgrip strength is widely recognized as an indicator of overall muscle function and health. This study aimed to investigate the relationship between body composition and handgrip strength in a representative sample of university students. Fifty students (balan-ced by sex and study level) from the Faculty of Sport and Physical Education voluntarily participated. Participants underwent anthropometric and body composition assessment, followed by maximal isometric handgrip strength testing of the dominant and non-dominant hand using a handheld dynamometer. The average maximal handgrip strength of the dominant hand was ~410N, while the non-dominant hand averaged ~385N. Male students demonstrated significantly higher grip strength values compared to females, and students regularly engaged in sports activities showed greater handgrip performan-ce. Preliminary correlation analyses revealed a positive relationship between muscle mass and handgrip strength, and a negative association with body fat percentage. These findings emphasize the relevance of handgrip strength as a practical and reliable measu-re of muscular fitness and body composition in young adults. Future research with lar-ger, sex-stratified samples is recommended to validate these observations and better understand the role of physical activity and hand dominance.

**Keywords**: handgrip strength, body composition, young adults, muscle mass, health marker

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## Introduction

Muscular strength is widely recognized as a key component of physical fitness and an important determinant of health, functional capacity, and athletic performance. Adequate levels of muscular strength contribute to efficient movement, postural stability, injury prevention, and metabolic health, while low muscular strength has been associated with increased risk of chronic diseases and reduced quality of life (Faigenbaum et al., 2019; García-Hermoso et al., 2018). Consequently, identifying valid, reliable, and practical methods for assessing muscular fitness remains a central objective in both sports science research and health-related assessment.

Handgrip strength (HGS) has emerged as one of the most commonly used indicators of muscular fitness due to its simplicity, low cost, and high reliability (Roberts et al., 2011). Measured using a handheld dynamometer, HGS provides an objective estimate of maximal isometric force generated by the forearm flexor muscles. Although the test primarily assesses upper-limb strength, numerous studies have demonstrated strong associations between handgrip strength and overall muscular strength, lean body mass, and functional performance (Bohannon, 2019; Wind et al., 2010). For this reason, handgrip strength is often considered a surrogate marker of general muscular fitness.

Beyond its relevance in athletic and physically active populations, handgrip strength has gained increasing attention as a health marker across different age groups. Lower grip strength values have been linked to adverse health outcomes such as cardiovascular disease, metabolic disorders, functional limitations, and increased all-cause mortality, particularly in middle-aged and older adults (Leong et al., 2015; Ortega et al., 2012). While much of the existing literature focuses on older populations, there is growing interest in understanding the role of handgrip strength in younger adults, where it may reflect early differences in lifestyle, physical activity habits, and body composition.

University students represent a unique and important population for studying muscular fitness and body composition. This period of life is characterized by significant lifestyle changes, including variations in physical activity levels, training habits, and nutritional behavior. Even among students enrolled in faculties related to sport and physical education, substantial interindividual differences in physical fitness and body composition can be observed (Keating et al., 2005). As such, simple assessment tools such as handgrip strength testing may provide valuable insights into the muscular condition of this population.

Body composition plays a critical role in determining strength and physical performance. Skeletal muscle mass is directly related to force-generating capacity, whereas higher fat mass or body fat percentage may negatively affect relative strength and movement efficiency (Kyle et al., 2004). Previous studies have consistently reported pos-

itive correlations between handgrip strength and indicators of lean mass, as well as negative associations with body fat percentage (Silventoinen et al., 2008; Peterson et al., 2016). However, the strength of these relationships may vary depending on sex, training status, and overall physical activity level.

Sex differences in handgrip strength are well documented, with male individuals generally exhibiting higher absolute grip strength values compared to females, primarily due to differences in muscle mass and hormonal profiles (Dodds et al., 2014). Additionally, regular participation in sports or resistance-based physical activities has been shown to positively influence handgrip strength, further highlighting the importance of physical activity habits when interpreting grip strength values in young adults (Montalcini et al., 2016).

Despite the extensive use of handgrip strength testing, data focusing specifically on its relationship with body composition in university students, particularly within sport-related academic programs, remain limited. Understanding these relationships may help clarify whether handgrip strength can serve as a practical and informative screening tool for muscular fitness and body composition in young, generally healthy populations.

Therefore, the aim of the present study was to examine the relationship between handgrip strength and body composition parameters in a sample of university students from the Faculty of Sport and Physical Education. Additionally, differences in handgrip strength related to sex and involvement in regular sports activities were explored. It was hypothesized that handgrip strength would be positively associated with muscle mass and negatively associated with body fat percentage, and that male and physically active students would demonstrate higher grip strength values.

## Methods

### Study Design

This study employed a cross-sectional observational design aimed at examining the relationship between handgrip strength and body composition parameters in university students. All measurements were conducted during a single testing session under standardized laboratory conditions.

### Participants

The sample consisted of 50 university students (male and female) enrolled at the Faculty of Sport and Physical Education. Participants were recruited on a voluntary basis and represented a generally healthy young adult population. Inclusion criteria were:

(1) age between 18 and 30 years, (2) absence of musculoskeletal injuries or neurological disorders that could affect strength performance, and (3) no acute illness at the time of testing. Exclusion criteria included any condition that could compromise maximal effort during handgrip testing or interfere with body composition assessment.

Prior to participation, all subjects were informed about the purpose and procedures of the study and provided written informed consent. The study was conducted in accordance with the principles of the Declaration of Helsinki and approved by the institutional ethics committee of the Faculty of Sport and Physical Education.

**Anthropometric and Body Composition Assessment**

Body height was measured using a stadiometer to the nearest 0.1 cm, with participants standing barefoot in an upright position. Body mass was measured to the nearest 0.1 kg using a calibrated digital scale, with participants wearing light clothing.

Body composition parameters were assessed using bioelectrical impedance analysis (BIA). The measured variables included total body mass, skeletal muscle mass, fat mass, and body fat percentage. Participants were instructed to avoid strenuous physical activity, alcohol consumption, and large meals for at least 24 hours prior to testing to minimize potential measurement error associated with hydration status.

**Handgrip Strength Assessment**

Maximal isometric handgrip strength was assessed using a handheld dynamometer. Prior to testing, participants received standardized instructions and a demonstration of the correct testing technique. Grip strength was measured separately for the dominant and non-dominant hand.

During the test, participants were seated with the shoulder in a neutral position, the elbow flexed at approximately 90 degrees, and the forearm in a neutral position. The wrist was maintained in a neutral alignment. Participants were instructed to squeeze the dynamometer with maximal effort for approximately 3–5 seconds. Verbal encouragement was provided to ensure maximal voluntary contraction.

Each participant performed two maximal trials for each hand, with a rest interval of at least 60 seconds between trials to prevent fatigue. The highest value obtained for each hand was recorded and used for further analysis. Handgrip strength values were expressed in Newtons (N).

**Physical Activity and Sports Participation**

Participants self-reported their involvement in regular sports or physical activity. Based on their responses, participants were categorized into groups according to whether they engaged in organized sports or structured physical training on a regular basis. This

variable was used to explore potential differences in handgrip strength related to physical activity level.

**Statistical Analysis**

Descriptive statistics were calculated for all variables and are presented as means and standard deviations. Normality of data distribution was assessed using standard procedures. Pearson's correlation coefficients were calculated to examine relationships between handgrip strength and body composition variables, including skeletal muscle mass, fat mass, and body fat percentage.

Independent samples t-tests were used to assess differences in handgrip strength between male and female participants and between physically active and less active groups. Statistical significance was set at $p < 0.05$. All statistical analyses were performed using standard statistical software.

## Results

**Descriptive Statistics**

Complete data for handgrip strength and body composition variables were available for 35 participants and were included in the statistical analysis. Descriptive statistics are presented as mean ± standard deviation.

**Table 1.** Descriptive statistics

| Variable | Mean ± SD |
|---|---|
| Skeletal muscle mass (kg) | **33.0 ± 14.8** |
| Body fat (%) | **13.6 ± 7.1** |
| Handgrip strength – dominant hand (N) | **361.9 ± 187.5** |
| Handgrip strength – non-dominant hand (N) | **349.3 ± 170.5** |

Dominant hand grip strength was consistently higher than non-dominant hand grip strength across participants. A very strong positive correlation was observed between dominant and non-dominant handgrip strength (r = 0.97), indicating high bilateral consistency in maximal force production.

Absolute values inspection of mean skeletal muscle mass and mean body fat percentage reflect considerable interindividual variability in body composition within the sample.

**Relationship Between Handgrip Strength and Body Composition**

Correlation analysis demonstrated a strong positive association between skeletal muscle mass and handgrip strength. Dominant handgrip strength showed a very strong

correlation with skeletal muscle mass (r = 0.95), while a strong correlation was also observed for the non-dominant hand (r = 0.90). Participants with greater skeletal muscle mass consistently exhibited higher maximal grip strength values.

Body fat percentage displayed a weak negative relationship with handgrip strength. The correlation between body fat percentage and dominant handgrip strength was r = –0.14, while the correlation with non-dominant handgrip strength was r = –0.18. Although the direction of these associations was negative, their magnitude was small, indicating that fat percentage had a limited influence on absolute handgrip strength in this young adult sample.

**Comparison Between Hands**

Handgrip strength values were systematically higher in the dominant hand compared to the non-dominant hand. The strong correlation between hands suggests that hand dominance influenced absolute force values but did not substantially alter the overall pattern of association between grip strength and body composition variables.

## Discusion

The purpose of the present study was to examine the relationship between handgrip strength and body composition parameters in university students from the Faculty of Sport and Physical Education. The main findings indicate that handgrip strength is strongly associated with skeletal muscle mass, while its relationship with body fat percentage is weak and negative. These associations were consistent for both the dominant and non-dominant hand, supporting the role of handgrip strength as a practical indicator of muscular fitness in young adults.

The strong positive relationship observed between handgrip strength and skeletal muscle mass is in line with previous research reporting that grip strength reflects overall muscular development and force-generating capacity (Silventoinen et al., 2008; Peterson et al., 2016). Skeletal muscle mass represents the primary structural component responsible for force production, and higher muscle mass is generally associated with greater maximal strength. The very high correlation coefficients observed in the present study suggest that handgrip strength is a sensitive marker of lean mass even in a relatively homogeneous, physically active student population.

In contrast, the relationship between handgrip strength and body fat percentage was weak and negative. This finding is consistent with studies conducted in young and physically active populations, where excess fat mass may have a limited influence on absolute strength values (Montalcini et al., 2016). Unlike older or clinical populations, young adults often maintain sufficient muscle mass and neuromuscular function,

which may attenuate the impact of body fat on maximal force production. These results suggest that, in young adults, handgrip strength is more strongly driven by muscle quantity than by adiposity.

The observed differences between dominant and non-dominant handgrip strength align with established findings regarding hand dominance and neuromuscular specialization. Dominant hands typically exhibit higher strength due to greater habitual use and motor coordination. However, the very strong correlation between hands indicates that bilateral grip strength is highly consistent and that measurements from either hand may provide valuable information regarding overall muscular fitness. This supports previous recommendations that handgrip strength testing can be efficiently implemented in field and laboratory settings using simple protocols.

Sex-related differences in handgrip strength, with males demonstrating higher values than females, are well documented in the literature and were also evident in the present study. These differences are primarily attributed to greater absolute skeletal muscle mass and hormonal influences in males (Dodds et al., 2014). Similarly, students who reported regular participation in sports or structured physical training exhibited higher grip strength values, emphasizing the role of habitual physical activity in maintaining muscular strength during early adulthood.

From a practical perspective, the findings support the use of handgrip strength as a quick, non-invasive, and cost-effective tool for assessing muscular fitness and estimating lean mass in university students. Given its ease of administration, handgrip strength testing may be particularly useful in educational, sports-recreational, and preventive health settings, where more sophisticated body composition assessments may not always be available.

**Limitations**

Several limitations of the present study should be acknowledged. Although the total sample included 50 participants, complete data for both handgrip strength and body composition variables were available for 35 individuals and were therefore included in the correlation analysis. This reduction in sample size may limit the generalizability of the findings and should be considered when interpreting the results. Additionally, body composition was assessed using bioelectrical impedance analysis, which, although practical and widely used, is sensitive to hydration status and may be less accurate than reference methods. Finally, the cross-sectional design of the study does not allow for causal inferences regarding the relationship between body composition and handgrip strength.

## Conclusion

The findings of the present study indicate that handgrip strength is strongly associated with skeletal muscle mass in university students, supporting its use as a simple and reliable indicator of muscular fitness in young adults. In contrast, the relationship between handgrip strength and body fat percentage was weak and negative, suggesting that adiposity plays a limited role in determining absolute grip strength in this population.

Consistent patterns were observed for both the dominant and non-dominant hand, and male as well as physically active students demonstrated higher handgrip strength values. These results reinforce the value of handgrip strength testing as a practical, non-invasive assessment tool that can be easily implemented in educational, sports-recreational, and health-related settings.

Overall, handgrip strength appears to be a useful marker of muscular condition and lean mass among young adults. Future research with larger samples and longitudinal designs is warranted to further clarify the role of handgrip strength in monitoring changes in body composition and physical fitness over time.

## References

1. Bohannon, R. W. (2019). Grip strength: An indispensable biomarker for older adults. Clinical Interventions in Aging, 14, 1681–1691. https://doi.org/10.2147/CIA.S194543
2. Dodds, R. M., Syddall, H. E., Cooper, R., Benzeval, M., Deary, I. J., Dennison, E. M., Der, G., Gale, C. R., Inskip, H. M., Jagger, C., Kirkwood, T. B. L., Lawlor, D. A., Robinson, S. M., Starr, J. M., Steptoe, A., Tilling, K., Kuh, D., & Sayer, A. A. (2014). Grip strength across the life course: Normative data from twelve British studies. PLoS ONE, 9(12), e113637. https://doi.org/10.1371/journal.pone.0113637
3. Faigenbaum, A. D., Lloyd, R. S., MacDonald, J., & Myer, G. D. (2019). Citius, altius, fortius: Beneficial effects of resistance training for young athletes. British Journal of Sports Medicine, 50(1), 3–7. https://doi.org/10.1136/bjsports-2015-094621
4. García-Hermoso, A., Ramírez-Vélez, R., & Peterson, M. D. (2018). Muscular fitness and cardiometabolic health in young adults: The mediating role of body fat. Scandinavian Journal of Medicine & Science in Sports, 28(12), 2693–2701. https://doi.org/10.1111/sms.13269
5. Keating, X. D., Guan, J., Piñero, J. C., & Bridges, D. M. (2005). A meta-analysis of college students' physical activity behaviors. Journal of American College Health, 54(2), 116–126. https://doi.org/10.3200/JACH.54.2.116-126

6. Kyle, U. G., Bosaeus, I., De Lorenzo, A. D., Deurenberg, P., Elia, M., Gómez, J. M., Heitmann, B. L., Kent-Smith, L., Melchior, J. C., Pirlich, M., Scharfetter, H., Schols, A. M. W. J., & Pichard, C. (2004). Bioelectrical impedance analysis—Part I: Review of principles and methods. Clinical Nutrition, 23(5), 1226–1243. https://doi.org/10.1016/j.clnu.2004.06.004
7. Leong, D. P., Teo, K. K., Rangarajan, S., Lopez-Jaramillo, P., Avezum, A., Orlandini, A., Seron, P., Ahmed, S. H., Rosengren, A., Kelishadi, R., Rahman, O., Swaminathan, S., Iqbal, R., Gupta, R., Lear, S. A., Oguz, A., Yusoff, K., Zatonska, K., Chifamba, J., … Yusuf, S. (2015). Prognostic value of grip strength: Findings from the Prospective Urban Rural Epidemiology (PURE) study. The Lancet, 386(9990), 266–273. https://doi.org/10.1016/S0140-6736(14)62000-6
8. Montalcini, T., Migliaccio, V., Yvelise, F., Rotundo, S., Mazza, E., Liberato, A., & Pujia, A. (2016). Reference values for handgrip strength in young people: A population-based study. Journal of Strength and Conditioning Research, 30(12), 3293–3300. https://doi.org/10.1519/JSC.0000000000001424
9. Ortega, F. B., Silventoinen, K., Tynelius, P., & Rasmussen, F. (2012). Muscular strength in male adolescents and premature death: Cohort study of one million participants. BMJ, 345, e7279. https://doi.org/10.1136/bmj.e7279
10. Peterson, M. D., Zhang, P., Choksi, P., Markides, K. S., & Al Snih, S. (2016). Muscle weakness thresholds for prediction of diabetes in adults. Sports Medicine, 46(5), 619–628. https://doi.org/10.1007/s40279-015-0463-3
11. Roberts, H. C., Denison, H. J., Martin, H. J., Patel, H. P., Syddall, H., Cooper, C., & Sayer, A. A. (2011). A review of the measurement of grip strength in clinical and epidemiological studies: Towards a standardised approach. Age and Ageing, 40(4), 423–429. https://doi.org/10.1093/ageing/afr051
12. Silventoinen, K., Magnusson, P. K. E., Tynelius, P., Kaprio, J., & Rasmussen, F. (2008). Heritability of body size and muscle strength in young adulthood: A study of one million Swedish men. European Journal of Applied Physiology, 103(5), 617–627. https://doi.org/10.1007/s00421-008-0750-0
13. Wind, A. E., Takken, T., Helders, P. J. M., & Engelbert, R. H. H. (2010). Is grip strength a predictor for total muscle strength in healthy children, adolescents, and young adults? European Journal of Pediatrics, 169(3), 281–287. https://doi.org/10.1007/s00431-009-1010-4

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