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Original Research Article

IMPACT OF HAND DOMINANCE AND BODY MASS INDEX ON HAND GRIP STRENGTH IN YOUNG ADULTS

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ABSTRACT

Background: Hand grip strength (HGS) is a practical marker of upper-limb muscle function and overall neuromuscular performance. Hand dominance and body mass index (BMI) can influence HGS through differences in habitual use, muscle mass, and body composition. **Objectives:** To evaluate the influence of hand dominance and BMI on HGS in young adults and to examine sex-based differences.

Materials and Methods: A cross-sectional observational study was conducted among 50 healthy adults aged 18–25 years. BMI was calculated from measured height and weight and participants were grouped as underweight, normal, overweight, or obese. HGS was recorded using a standard hand dynamometer for both dominant and non-dominant hands, taking the higher of two maximal efforts for each hand. Group comparisons were performed using appropriate parametric tests, and statistical significance was considered at $p < 0.05$.

Results: The cohort had a mean age of 21.3 ± 2.1 years and a mean BMI of 22.8 ± 3.7 kg/m². Dominant-hand HGS (34.8 ± 8.6 kg) exceeded non-dominant HGS (31.9 ± 8.1 kg), with a significant mean difference of 2.9 ± 1.7 kg. Dominant-hand HGS differed significantly across BMI categories, being lowest in underweight participants and highest in the overweight group. Across BMI categories, males showed higher HGS than females, with a steeper increment in strength from underweight to overweight.

Conclusion: In young adults, HGS is consistently higher in the dominant hand. BMI category is associated with HGS, with reduced strength in underweight individuals and comparatively higher values in overweight participants. Sex modifies the BMI–HGS pattern, with more pronounced changes in males.

Keywords: Handgrip strength; hand dominance; body mass index; young adults; sex differences; dynamometry.

INTRODUCTION

Hand grip strength (HGS) is a simple, non-invasive indicator of muscle function that integrates peripheral muscle mass, motor unit recruitment, and neural drive. Because it is quick to measure and interpretable across settings, HGS has been proposed as a practical biomarker of health and functional reserve.[1] Lower HGS is associated with poorer nutritional status and adverse clinical trajectories,[2] and it predicts important outcomes such as disability and mortality in older and vulnerable adults.[3]

HGS estimates are sensitive to measurement protocol. Variations in dynamometer type, posture, hand used, and whether the maximum or mean of trials is recorded can change reported values. A standardized approach improves comparability across studies.[4] Classical work demonstrates high reliability and validity of grip measurements when standardized positioning and instructions are followed,[5] and additional studies provide stable reference values and inter-rater agreement for hand-held dynamometry.[6]

Young adulthood is a period of near-peak neuromuscular performance and provides an

informative window to examine physiological correlates of strength. Normative datasets consistently show higher grip strength in males than females.[7] Hand dominance is another determinant because habitual use alters neuromuscular coordination and loading. Evidence demonstrates a dominant-hand advantage, although patterns can vary in left-handed individuals.[8] In young adults, laterality has been linked with absolute HGS and anthropometric characteristics, supporting routine documentation of dominance during testing.[9]

Body mass index (BMI) is widely used to classify underweight, normal weight, overweight, and obesity at the population level, and Asian BMI guidance emphasizes that cardiometabolic risk occurs at lower BMI values than in Western populations.[10] Although BMI does not separate fat and lean components, it often tracks with body size and, in early adulthood, can correlate with absolute strength. Studies in younger populations report lower grip strength in underweight groups and higher values up to the overweight range, with attenuation at higher fat levels.[11,12] Strength capacity is also relevant to metabolic risk: adequate HGS can attenuate overweight-associated cardiometabolic risk markers in collegiate populations,[13] and low HGS has been identified as a risk indicator for type 2 diabetes in cohort evidence syntheses.[14]

Against this background, understanding how dominance and BMI relate to grip strength can improve interpretation of HGS in fitness screening and preventive physiology. The present study quantified dominant versus non-dominant HGS and examined variation across BMI categories in healthy young adults. Objectives of the study were: (i) to compare HGS between dominant and non-dominant hands; (ii) to compare HGS across BMI categories; and (iii) to assess sex differences in the BMI–HGS relationship.

MATERIALS AND METHODS

Study design and setting: This cross-sectional observational study was carried out in the Department of Physiology, Government Medical College, Siddipet, Telangana, India. Data collection was completed over a three-month period, and each participant underwent a single assessment session.

Participants and sample size: A total of 50 healthy young adults aged 18–25 years were enrolled using convenience sampling from the institutional population and surrounding community. All participants provided written informed consent prior to study procedures.

Eligibility criteria: Inclusion criteria were: (1) willingness to participate and (2) age between 18 and 25 years. Exclusion criteria were: unwillingness to participate; history of neuromuscular disorders; known cardiovascular disease or peripheral vascular disease; smoking or chronic alcohol use; and any other significant previous illness that could influence neuromuscular performance.

Anthropometry and BMI classification: Height was measured to the nearest 0.1 cm using a stadiometer and weight to the nearest 0.1 kg using a calibrated weighing scale, with participants in light clothing and without shoes. BMI was calculated as weight (kg) divided by height squared (m^2). Participants were categorized as underweight (<18.5 kg/m^2), normal (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2), or obese (≥30 kg/m^2). Asian BMI guidance was considered when interpreting public health relevance.[10]

Hand grip strength measurement: Hand dominance (right/left) was recorded by self-report based on the preferred hand used for writing and daily tasks. HGS was measured using a standard handgrip dynamometer. To align with standardized recommendations, participants were seated with the shoulder adducted and neutrally rotated, the elbow flexed at 90°, the forearm in neutral position, and the wrist maintained in neutral to slight extension. After a brief familiarization, participants were instructed to hold the dynamometer with a full grip and squeeze with maximal effort for 3–5 seconds. Two maximal trials were obtained for each hand with a one-minute rest interval between trials; the higher value was recorded as the maximal grip strength for that hand. This approach is supported by evidence on protocol standardization and reliability of dynamometer-based grip strength measurement.[4-6]

Data management and statistical analysis: Data were entered into Microsoft Excel and analyzed using SPSS version 27.0. Continuous variables were summarized as mean ± standard deviation and categorical variables as frequency and percentage. Dominant versus non-dominant HGS comparisons were conducted using paired analyses. Differences in HGS across BMI categories were assessed using one-way analysis of variance (ANOVA), and sex-stratified comparisons were similarly examined. A p value <0.05 was considered statistically significant.

Ethical considerations: The study protocol adhered to the principles of the Declaration of Helsinki. Participant confidentiality was maintained by de-identifying data, and participation was voluntary with the option to withdraw at any time without affecting routine services.

RESULTS

Fifty young adults aged 18–25 years were studied (mean age 21.3 ± 2.1 years). Males constituted 56% (n=28) and females 44% (n=22). The overall mean BMI was 22.8 ± 3.7 kg/m^2, and right-hand dominance was present in 92% of participants. Baseline anthropometric characteristics and BMI distribution are summarized in Table 1.

Table 1: Baseline Characteristics of Study Participants (N = 50)

Parameter	Value
Age (years), mean ± SD	21.3 ± 2.1
Height (cm), mean ± SD	166.8 ± 8.9
Weight (kg), mean ± SD	63.4 ± 11.6
BMI (kg/m²), mean ± SD	22.8 ± 3.7
Gender, n (%)	
Males	28 (56%)
Females	22 (44%)
BMI Categories, n (%)	
Underweight (<18.5)	6 (12%)
Normal (18.5–24.9)	28 (56%)
Overweight (25–29.9)	12 (24%)
Obese (≥30)	4 (8%)
Hand Dominance, n (%)	
Right-handed	46 (92%)
Left-handed	4 (8%)

Dominant-hand HGS for the overall cohort was 34.8 ± 8.6 kg compared with 31.9 ± 8.1 kg for the non-dominant hand. The mean dominant–non-dominant difference was 2.9 ± 1.7 kg and was statistically significant (p = 0.001). When stratified by sex, males demonstrated higher HGS values than females in both hands, and the dominant-hand advantage remained significant in each sex group. [Table 2]

Table 2: Comparison of Dominant and Non-Dominant Hand Grip Strength

Group	Dominant HGS (kg) Mean ± SD	Non-Dominant HGS (kg) Mean ± SD	Mean Difference (kg)	p-value
Overall (N=50)	34.8 ± 8.6	31.9 ± 8.1	2.9 ± 1.7	0.001
Males (n=28)	40.6 ± 6.5	37.2 ± 6.2	3.4 ± 1.5	<0.001
Females (n=22)	27.5 ± 4.3	25.1 ± 4.0	2.4 ± 1.3	0.002

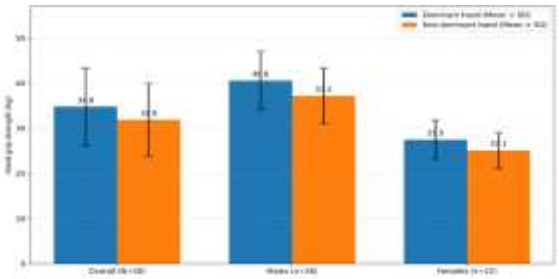

Figure 1: Comparison of Dominant and Non-Dominant Hand Grip Strength

Across BMI categories, dominant-hand HGS was lowest in underweight participants (26.8 ± 4.9 kg) and highest in the overweight group (38.6 ± 7.1 kg), with a modest decline in the obese category (36.1 ± 6.4 kg). Between-category differences for dominant-hand HGS were significant (ANOVA p = 0.004). A similar pattern was observed for non-dominant HGS, with underweight participants recording the lowest values. [Table 3]

Table 3: Hand Grip Strength According to BMI Categories

BMI Category	Dominant HGS (kg) Mean ± SD	Non-Dominant HGS (kg) Mean ± SD
Underweight (n=6)	26.8 ± 4.9	24.3 ± 4.6
Normal (n=28)	34.2 ± 6.8	31.5 ± 6.3
Overweight (n=12)	38.6 ± 7.1	35.8 ± 6.7
Obese (n=4)	36.1 ± 6.4	33.4 ± 5.9
ANOVA p-value (Dominant HGS)	0.004	

Gender-stratified analysis showed progressive increases in dominant-hand HGS from underweight to overweight in both sexes, with a mild reduction among obese participants. The increment across BMI categories was more pronounced in males (ANOVA p = 0.002) than in females (ANOVA p = 0.01), as presented in Table 4.

Table 4: Gender-wise Dominant Hand Grip Strength Across BMI Categories

BMI Category	Males (kg) Mean ± SD	Females (kg) Mean ± SD
Underweight	32.4 ± 3.8	21.3 ± 2.9
Normal	39.8 ± 5.7	26.8 ± 3.5
Overweight	44.2 ± 5.1	30.4 ± 3.6
Obese	42.8 ± 4.9	29.1 ± 3.2
ANOVA p-value	0.002	0.01

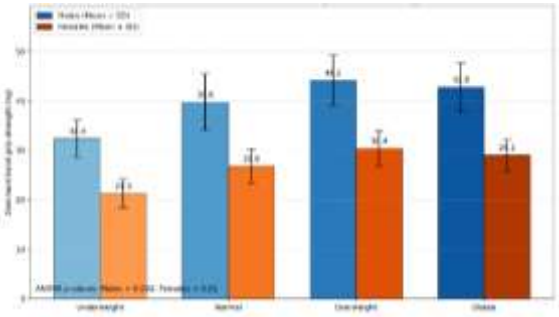

Figure 2: Gender-wise Dominant Hand Grip Strength Across BMI Categories

DISCUSSION

This study evaluated the combined influence of hand dominance and BMI on hand grip strength in healthy young adults, a life stage characterized by high neuromuscular potential. Dominant-hand grip strength exceeded non-dominant values in the overall cohort, and this pattern persisted after sex stratification. A dominant-hand advantage is consistent with laterality-related adaptations in muscle recruitment and habitual loading, which are more evident in right-handed individuals.[8] Young-adult cohorts also demonstrate measurable associations between laterality and absolute grip strength, supporting the need to record dominance in routine strength profiling.[9]

Sex differences were marked: males demonstrated higher grip strength than females across both hands. This aligns with well-established normative patterns in adult populations, reflecting differences in lean mass, forearm cross-sectional area, and hormonal milieu that influence muscle strength.[7] From a measurement perspective, protocol standardization remains critical when interpreting sex-specific estimates. Grip strength values can vary with posture, dynamometer characteristics, and the number of trials recorded; therefore, adopting consistent testing conditions improves interpretability and supports reproducibility across studies.[4] Evidence also indicates high reliability of dynamometer-based grip strength measurement when standardized instructions are applied, although summary measures (mean versus maximum) affect test–retest performance.[5,6]

Across BMI categories, underweight participants showed the lowest grip strength, while overweight participants displayed the highest values, with a slight reduction in the obese group. This pattern is biologically plausible. Underweight status can reflect lower muscle mass and reduced substrate availability for force generation, resulting in diminished maximal strength. Up to the overweight range, higher body size frequently coexists with greater absolute lean mass, which can increase absolute grip strength; however, excessive adiposity can reduce muscle quality and functional efficiency, contributing to a plateau or decline at higher BMI levels.[11,12] Because BMI does not differentiate fat and lean components, the observed obese-category attenuation likely reflects heterogeneity in body composition within a small subgroup.

The sex-stratified findings indicated a steeper BMI-related increment in grip strength among males. This suggests that changes in body size across BMI strata translate into larger differences in absolute muscle mass and strength capacity in males compared with females, which is consistent with population-based strength datasets.[12] Beyond musculoskeletal implications, higher strength capacity has relevance to metabolic health. In collegiate cohorts, adequate grip strength—used as a proxy of overall strength capacity has been shown to attenuate overweight-related cardiometabolic risk profiles.[13] Longitudinal evidence syntheses further support handgrip strength as an indicator of type 2 diabetes risk,[14] and emerging reviews highlight its potential role as a 'new vital sign' across the lifespan. Within this context, the present results support the utility of grip strength testing in young adults as a simple physiological marker that captures laterality and body-size related differences in neuromuscular performance.

Limitations

The study included a small sample from a single institution, which restricts generalizability. Participants were recruited by convenience sampling and physical activity, occupational hand use, and dietary intake were not quantified. BMI served as the sole body-size indicator and does not separate fat mass from lean mass. The obese subgroup was small, limiting precision of category comparisons. Cross-sectional design precludes causal inference.

CONCLUSION

Hand grip strength in young adults is higher in the dominant hand than in the non-dominant hand, confirming a consistent laterality effect. Grip strength also varies across BMI categories, with reduced values in underweight individuals and higher values in the overweight category, followed by a slight attenuation in obesity. Males exhibit higher grip strength than females across BMI strata, and the BMI–strength gradient is more pronounced in males. Routine assessment of grip strength, together with documentation of hand dominance and BMI, provides a rapid and informative profile of neuromuscular performance in young adults.

REFERENCES

1. Vaishya R, Misra A, Vaish A, Ursino N, D'Ambrosi R. Hand grip strength as a proposed new vital sign of health: a narrative review of evidences. J Health Popul Nutr. 2024 Jan 9;43(1):7. doi:10.1186/s41043-024-00500-y. PMID:38195493.
2. Norman K, Stobäus N, Gonzalez MC, Schulzke JD, Pirlich M. Hand grip strength: outcome predictor and marker of nutritional status. Clin Nutr. 2011 Apr;30(2):135-142. doi:10.1016/j.clnu.2010.09.010. PMID:21035927.
3. Bohannon RW. Hand-grip dynamometry predicts future outcomes in aging adults. J Geriatr Phys Ther. 2008;31(1):3-

10. doi:10.1519/00139143-200831010-00002. PMID:18489802.
4. Roberts HC, Denison HJ, Martin HJ, Patel HP, Syddall H, Cooper C, Sayer AA. A review of the measurement of grip strength in clinical and epidemiological studies: towards a standardised approach. Age Ageing. 2011 Jul;40(4):423-429. doi:10.1093/ageing/afr051. PMID:21624928.
5. Mathiowetz V, Weber K, Volland G, Kashman N. Reliability and validity of grip and pinch strength evaluations. J Hand Surg Am. 1984 Mar;9(2):222-226. doi:10.1016/S0363-5023(84)80146-X. PMID:6715829.
6. Peolsson A, Hedlund R, Öberg B. Intra- and inter-tester reliability and reference values for hand strength. J Rehabil Med. 2001 Jan;33(1):36-41. doi:10.1080/165019701300006524. PMID:11480468.
7. Mathiowetz V, Kashman N, Volland G, Weber K, Dowe M, Rogers S. Grip and pinch strength: normative data for adults. Arch Phys Med Rehabil. 1985 Feb;66(2):69-74. PMID:3970660.
8. Incel NA, Ceceli E, Durukan PB, Erdem HR, Yorgancioglu ZR. Grip strength: effect of hand dominance. Singapore Med J. 2002 May;43(5):234-237. PMID:12188074.
9. Zaccagni L, Toselli S, Bramanti B, Gualdi-Russo E, Mongillo J, Rinaldo N. Handgrip strength in young adults: association with anthropometric variables and laterality. Int J Environ Res Public Health. 2020 Jun 15;17(12):4273. doi:10.3390/ijerph17124273. PMID:32549283.
10. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004 Jan 10;363(9403):157-163. doi:10.1016/S0140-6736(03)15268-3. PMID:14726171.
11. Lad UP, Satyanarayana P, Shisode-Lad S, Siri CC, Kumari NR. A study on the correlation between the body mass index (BMI), the body fat percentage, the handgrip strength and the handgrip endurance in underweight, normal weight and overweight adolescents. J Clin Diagn Res. 2013 Jan;7(1):51-54. doi:10.7860/JCDR/2012/5026.2668. PMID:23450189.
12. Massy-Westropp NM, Gill TK, Taylor AW, Bohannon RW, Hill CL. Hand grip strength: age and gender stratified normative data in a population-based study. BMC Res Notes. 2011 Apr 14;4:127. doi:10.1186/1756-0500-4-127. PMID:21492469.
13. Garcia-Hermoso A, Tordecilla-Sanders A, Correa-Bautista JE, Peterson MD, Izquierdo M, Prieto-Benavides D, Sandoval-Cuellar C, González-Ruíz K, Ramírez-Vélez R. Handgrip strength attenuates the adverse effects of overweight on cardiometabolic risk factors among collegiate students but not in individuals with higher fat levels. Sci Rep. 2019 May 6;9(1):6986. doi:10.1038/s41598-019-43471-5. PMID:31061449.
14. Kunutsor SK, Isiozor NM, Khan H, Laukkanen JA. Handgrip strength-a risk indicator for type 2 diabetes: systematic review and meta-analysis of observational cohort studies. Diabetes Metab Res Rev. 2021 Feb;37(2):e3365. doi:10.1002/dmrr.3365. PMID:32543028.