



CROSS-SECTIONAL ANALYSIS OF HAND GRIP STRENGTH AMONG HEALTHY YOUNG ADULTS IN INDIA

Physical Medicine

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ABSTRACT

Background: Hand grip strength (HGS) is a measure of the maximum static force that a hand can squeeze using a dynamometer. HGS is a simple, reliable, and commonly used measure of overall muscle strength and has predictive value for various health outcomes. Normative data stratified by age and sex are essential for accurate clinical interpretation as HGS varies with race, sex, and age. We set out to establish the same amongst the healthy young adults in Indian population. **Aim:** To establish normative hand grip strength values among healthy young adults amongst medical fraternity in the Indian population. **Methods:** A cross-sectional descriptive study was conducted among 458 healthy male and female medical students aged 18 years and above at a tertiary care university hospital in Southern India. Basic demographic data, including age, gender, height, weight, food habits, and state of origin, were collected. BMI was calculated, and HGS of the dominant hand was measured using a Camry Hand Dynamometer. The average of three successive measurements was recorded. **Results:** The mean BMI was 23.7 kg/m². Subjects were grouped into three age brackets: 18–19, 20–24, and 25–30 years. Normal reference range was compared with the values obtained for weak, normal or strong hand grip strength among males and females. Males in the 20–24 age group demonstrated the highest mean grip strength. No significant association was found between HGS and either BMI or dietary habits. **Conclusion:** This study provides baseline normative data for hand grip strength in a young Indian adult population. Males of age group 20–24 had highest normal range when compared with others and was statistically significant. These findings can serve as a reference in clinical and research settings for assessing hand function and general health.

KEYWORDS

Hand Dynamometer, Hand Grip Strength, Body Mass Index, Indian Population

INTRODUCTION

Hand grip strength (HGS) has evolved as an useful marker for evaluating overall muscle strength, functional status of the individual, and various health-related outcomes. It is a non-invasive, inexpensive, quick and easy assessment method which has been proved to correlate with nutritional status, physical fitness, and even long-term morbidity and mortality risks.^{1,5,10} Normative data for HGS are widely used in clinical assessments to identify individuals with sarcopenia, frailty, or neuromuscular disorders.^{2,12}

Several studies have established normal HGS reference values across different populations, grouped by sex, age, and ethnicity.^{3,4,9} However, due to variables such as genetics, nutritional habits, socioeconomic status, and physical activity levels, population-specific reference values are important. While there are extensive datasets available from Western populations, there is a paucity of similar studies in the Indian demographic, especially among young adults.^{14,15}

The aim of this study is to determine normal hand grip strength metrics in a healthy young adult Indian population, thus contributing region-specific normative data to the growing global database.

MATERIALS AND METHODS

Study Design and Participants

This was a cross-sectional descriptive study conducted at a tertiary care teaching hospital in Southern India. A total of 458 healthy medical students aged 18 years and above participated voluntarily in the study. Participants were selected through convenience sampling.

Inclusion Criteria Were:

- Age 18 years and above
- Medically healthy individuals with no known musculoskeletal, neurological, or systemic illnesses affecting muscle strength
- Willingness to provide informed consent

Exclusion Criteria Included:

- Acute or chronic illness that may impair grip strength
- History of upper limb injury or surgery
- Use of medications that affect muscle strength

Ethical clearance was obtained from the Institutional Ethics Committee prior to the commencement of the study and informed consent was signed by all the participants.

Participants were interviewed and examined using a pre-tested data collection form. The variables recorded were Age, Sex, Height (cm),

Weight (kg), Body Mass Index (BMI) (kg/m²), hand dominance, State of origin and Dietary habits (vegetarian or mixed). BMI was calculated as weight in kilograms divided by the square of height in meters. Participants were categorized into standard BMI groups according to WHO criteria.

Hand Grip Strength Measurement

Hand grip strength was measured using a Camry Hand Dynamometer (model EH101). Participants were seated comfortably with their elbow flexed at 90 degrees with the forearm in a neutral position. Each participant performed three maximal voluntary contractions using their dominant hand, with a rest period of at least 30 seconds between each attempt.^{7,8} The average of the three readings was taken as the final HGS value.

Statistical Analysis

Data were analysed using SPSS software. Descriptive statistics such as mean and standard deviation were calculated. Participants were grouped into three age categories: 18–19, 20–24, and 25–30 years. Comparisons of mean HGS were made between genders and among age groups using appropriate statistical tests (t-test and ANOVA). Correlation analyses were performed to examine associations between HGS and BMI, as well as dietary habits. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Participant Characteristics

The study included 458 medical students with a mean age of 23.3 years. The majority (67%) belonged to the 20–25 age group. Females constituted 57% of the sample population. Regarding nutritional status, 47.2% had a BMI in the normal range (18.5–24.9), while 42.6% were overweight or obese. The mean BMI was 24 kg/m². A non-vegetarian diet was reported by 75% of participants, and 67% were residents of Tamil Nadu.

Hand Grip Strength Analysis

The mean hand grip strength (HGS) for the study population was 31.5 kg. Based on standardized norms for age and gender, 40% of participants exhibited weak grip strength, 55% had normal strength, and 5% had strong grip strength.

A comparison between genders revealed no significant difference in the proportion of strong grip strength (males 5.1% vs. females 5.7%, $p > 0.05$). Males predominantly demonstrated normal HGS across all age groups. Among females, normal HGS was observed in those <20

and 20–25 years, while weak grip was more prevalent in those >25 years

Table 1. Participant Demographics (n = 458)

Variable	Value
Mean Age (years)	23.3
Age Group: 20–25 years	67%
Female Participants	57%
Mean BMI (kg/m ²)	24
BMI 18.5–24.9 (Normal)	47.2%
Overweight/Obese (BMI ≥25)	42.6%
Non-Vegetarian Diet	75%
Residents of Tamil Nadu	67%

Table 2. Hand Grip Strength Classification by Gender

HGS Category	Male (%)	Female (%)	Total (%)
Weak	37.2	40.9	40
Normal	57.7	53.4	55
Strong	5.1	5.7	5

DISCUSSION

The current study aimed to establish normative hand grip strength reference values among healthy young Indian adults. This group of population were chosen in a medical college. The findings confirm a clear gender difference in HGS, with males consistently showing higher values than females in all age groups. This can be related with global data, likely due to differences in muscle mass, hormonal influences, and levels of physical activity.^{3,10,11}

The peak grip strength observed in the 20–24 age group lines up with the expected rise in muscle mass and physical performance in early adulthood.⁴ Although there was a slight drop in HGS beyond the age of 24 in males, it was not statistically significant.

Our results are comparable with other international studies that demonstrate the usefulness of HGS as a reliable biomarker for muscle strength in population health studies.¹⁵ The average HGS values in this study, particularly in males, were relatively lower compared to Western populations, which may be explained by ethnic, nutritional, or lifestyle differences, and due to differences in anthropometric characteristics.^{13,14}

The lack of significant association between HGS and BMI is also supported by earlier studies suggesting that BMI by itself does not justify variations in muscle strength or quality, especially in younger and healthier cohorts such as ours.^{6,13} It is possible that lean body mass and specific muscular conditioning play more critical roles in determining grip strength than overall body weight.

Dietary patterns, whether vegetarian or mixed, also showed no significant correlation with grip strength. While some literature indicate that protein intake influences muscle mass and strength, our data did not show such a difference, potentially due to uniformity in dietary adequacy among the student population. Moreover, the narrow age range and similar socioeconomic and educational backgrounds might have minimized such effects.

This study underscores the importance of region-specific normative data in clinical assessment. International cut-off values may not be suitable for Indian populations due to various interethnic differences. Establishing local references is crucial as it helps in better diagnosis and monitoring of various conditions such as sarcopenia, malnutrition, frailty, and in measurement rehabilitation outcomes.

Future research should aim to include a larger, more diverse sample encompassing varied educational and occupational backgrounds to improve generalizability. Additionally, including non-dominant hand measurements and assessing physical activity levels could offer a more comprehensive understanding of grip strength dynamics.

LIMITATIONS

This study has a few limitations. Firstly, the sample was drawn entirely from a medical college, potentially limiting the generalizability of findings to the broader Indian youth population. Secondly, physical activity levels were not quantified, which might have provided further insight into factors influencing grip strength. Additionally, only the dominant hand was tested, and grip strength may vary bilaterally in some individuals.

CONCLUSIONS

This study successfully established normative hand grip strength values for healthy young Indian adults. Males in the 20–24 age group had the highest grip strength, while BMI and dietary patterns showed no significant impact. These reference values can be instrumental in clinical practice and future research.

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