

HANDGRIP STRENGTH VARIATIONS IN NORTH INDIAN MALE AND FEMALE MEDICAL STUDENTS

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Abstract

Background: Handgrip strength (HGS) is the maximum force produced during maximal voluntary contraction (MVC). It can be measured by pulling and squeezing a dynamometer with one's hand to determine the amount of static force created. The handgrip dynamometer is used to exercise upper limb muscles, particularly the forearm and hand muscles. Handgrip strength is often considered an objective measure of upper extremity functional integrity. HGS is a physiological characteristic influenced by various parameters such as gender, age, and body size. The purpose of this study was to compare men's and women's maximal handgrip strength. The current study was designed to fill a gap in knowledge on the normative levels of handgrip strength in boys and females in the Jammu region. This can offer baseline data/handgrip reference values in medical students between the ages of 17 and 20.

Aims and Objectives: To assess and compare Handgrip strength in healthy first-phase male and female medical subjects.

Materials and Methods: A cross-sectional study including 250 healthy first-phase medical students aged 17-20 years (125 male and 125 female) was conducted in the research lab of GMC Jammu's Physiology department. Students with a history of upper limb injury/nerve damage, a significant illness, a musculoskeletal problem, or a history of medicines altering motor function were barred from participating in the study. The investigation was approved by the Institutional Ethics Committee. A handgrip dynamometer determined maximum handgrip strength (Apex International, Amritsar; Punjab; India). The grip strength of the dominant hand was tested three times at minute intervals according to the American Society of

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Hand Therapists (ASHT) standard testing technique, with the more excellent reading (in kg) reflecting the maximal handgrip strength for each.

Results: SPSS version 26.0 and an unpaired t-test were used to examine the data. Handgrip strength in male subjects (Mean: 41.85 kg) was statistically significant when compared to female subjects (Mean: 31.87 kg) ($p < 0.001$).

Conclusion: Male individuals had stronger grips than female subjects. This study aims to provide a baseline of normative data (control values) among a sample cohort of GMC Jammu medical students. Our study, however, was limited to medical students between 17 and 20. We believe that diverse age groups should be studied.

Keywords: Dynamometer; Female; Handgrip strength; Male; Medical Students.

I. INTRODUCTION

The human hand is a necessary organ. Its function ranges from fine to significant motor actions. Many daily activities and sporting events necessitate a great deal of hand activity. Grip strength is determined by the strength of the forearm and hand muscles. Nerve and muscle function are directly related to human motor performance.¹ Grip strength is essential in various sports such as cricket, hockey, tennis, football, basketball, and baseball, as well as everyday activities such as carrying groceries, turning a doorknob, and opening a jar. Handgrip strength is the highest force produced during voluntary contraction under unspecified conditions.² It is the amount of static power and muscle strength that a person can generate with their hands, and it is quantifiable.

It is the amount of muscle power and force that a person can generate with their hands, and it may be tested by pulling and squeezing a person's hand around a dynamometer.³ In sports, muscle strength and function testing are especially significant. It is widely used as a measure of overall physical strength. Handgrip strength has historically been used in various occupations involving human movement. Handgrip strength (HGS) is a biomarker for many physiological systems. Increasing it may be a realistic approach to improving general health and lowering the chance of developing several chronic illnesses resulting in premature mortality.⁴ Handgrip strength can be measured when examining and monitoring people with neuromuscular disorders.⁵ It can also be used to determine nutritional status.⁶ Grip strength is widely accepted as an accurate predictor of upper extremity functional integrity.⁷ It was recently introduced to first-phase MBBS students in India, according to Competency-Based MCI Curriculum-2019.^{8,9}

Aims and Objectives: To assess and compare Handgrip strength in healthy first-phase male and female medical subjects.

II. MATERIALS AND METHODS

This is a cross-sectional study conducted at GMC Jammu, Bakshinager, in the Physiology department's research lab. Our study comprised 250 healthy participants between 17 and 20 from our institute's first-year student group (125 males and 125 females). Students with a history of upper limb injury/nerve damage, a significant illness, a musculoskeletal problem, or a history of medicines altering motor function were barred from participating in the study. The Institutional Ethical Committee authorized this study on April 15, 2021, with the code IEC/GMC/Cat C/2021/503.

From the start, all participants were informed of the study's purpose and protocol. All of the individuals provided written informed consent. The measurements were obtained in the afternoon in a natural setting (between 3 PM To 4:30 PM). The trial was two months long. The patient was asked to throw a tennis ball to assess hand dominance so that it may be employed in the exercise to acquire the best grip possible. Maximum handgrip strength was tested using an adjustable handgrip dynamometer, CAMRY Brand, Model No.EH101 (North America), with a division of 0.1 kg in the range of 0 to 90 kg (Marketed by Apex International, Amritsar; Punjab; India). The most common and straightforward method for

assessing grip strength is to use a portable dynamometer. The handgrip device was used to measure the subjects' grip strength while sitting in the chair. The individual should be seated upright against the back of a chair that is flat on the floor, according to the American Society of Hand Therapists (ASHT). The elbow should be flexed 90 degrees, the forearm neutral, and the wrist should be extended between 0 and 30 degrees.¹⁰ A handgrip dynamometer was calibrated before each evaluation. The grip size was chosen to make the subject feel at ease when squeezing it. With closed eyes (The traditional approach), the maximal handgrip strength of the dominant hand was measured.¹¹ To avoid tiredness, it was tested three times with a one-minute interval between trials, and the higher value was chosen as the maximal HGS in this study. In the statistical analysis, the unpaired t-test was employed with SPSS software. 26.0. A p-value of 0.05 was considered statistically significant, while 0.001 was considered extremely significant.

III. RESULTS

Two hundred fifty healthy first-year medical students took part in this investigation. Within the cohort, there were 125 male and 125 female subjects. All subjects recorded age and physical characteristics such as height (cm) and weight (kg) etc. Tables (Tables 1-4 & Fig.1) infra display the analyzed data.

Table 1: Gender-wise distribution of subjects studied

Gender	Frequency	Per cent
Males	125	50.0
Females	125	50.0
Total	250	100.0

Table 2: Distribution of demographic parameters of subjects studied

Parameter	Number	Mean	SD	Minimum	Maximum
Age (years)	250	18.0080	0.69416	17.00	20.00
Weight (Kg)	250	55.7680	6.20809	45.00	74.00
Height (cm)	250	165.0840	10.75078	145.00	178.00
BMI (Kg/m ²)	250	20.4492	1.68523	16.20	25.40

Table 3: Comparison of demographic parameters between male and female subjects

Parameter	Gender	Number	Mean	SD	Significance	
					t-value	p-value
Age	Males	125	17.8320	0.63164	-4.137	0.097
	Females	125	18.1040	0.71147		
Weight	Males	125	60.8320	4.50580	22.341	< 0.0001
	Females	125	50.7040	2.32110		
Height	Males	125	170.0000	4.24644	38.110	< 0.0001
	Females	125	155.1680	3.97723		
BMI	Males	125	19.8568	1.77529	-5.927	< 0.0001
	Females	125	21.0417	1.35779		

Table 4: Comparison of handgrip strength between male and female subjects

Parameter	Gender	Number	Mean (Kg)	SD (Kg)	Significance	
					t-value	p-value
Handgrip	Males	125	41.8528	1.67397	49.931	< 0.001
	Females	125	31.8712	1.48094		

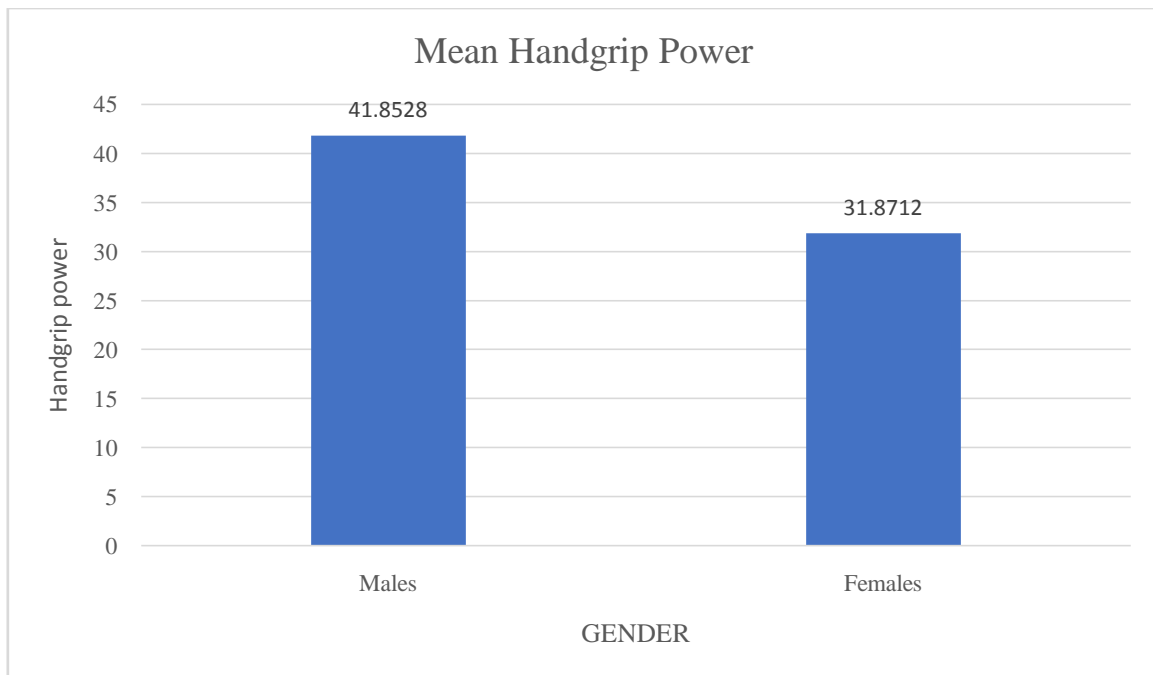


Figure 1: Comparison of Handgrip power (Kg) in male and female medical subjects

Although there was no statistically significant difference in mean age between men and women, there was a statistically significant difference in height, weight, and BMI ($p < 0.0001$).

IV. DISCUSSION

Handgrip strength (HGS) is a crucial indicator of athletic performance or sports efficiency and one of the most commonly used tests for measuring muscle fitness in adults. HGS is helpful in investigating, following up, and rehabilitating individuals with neuromuscular problems. HGS is a quick, straightforward, low-cost approach to assessing muscular strength. Few experts have proposed integrating HGS in regular admission initial assessment since it predicts hospital stay duration, patient outcome, and mortality. The clinical significance of HGS is the risk prediction of cardiovascular events and its involvement in cardiovascular health. The current study examined the HGS of 125 female and 125 male medical students. Medical students between the ages of 17 and 20 can provide baseline data/handgrip reference values. In our study, HGS was found to be statistically

significant in male students in contrast to female students (Table 4 & Fig.1). According to Christine, females aged 16 and above have almost two-thirds less muscular strength than boys of the same age. Gender differences in muscle strength may be explained by differences in daily physical activity.

Furthermore, a gender difference in maximal handgrip strength was identified attributable to sex differences in muscle mass. According to Leyk D et al.¹², men have more considerable mean maximal handgrip strength than women. Because men have more muscle mass than women, Heyward VH et al. discovered that gender disparities in power are more pronounced in the upper body.¹³ Shah et al. found that healthy adult males have stronger handgrips than females.¹⁴ Similarly, Shyamal Koley and Shrikant Goud discovered that males have greater grip strength than females.¹⁵ However, our study was limited to medical students between 17 and 20. In the future, it will be essential to explore a variety of age groups.

Limitation of the study: The study did not include exercise or physical activity, which has been proven in prior studies to affect HGS. Physical activities should be explored in relation to gender, age, and other anthropometric measurements. Because the position of the shoulder, elbow, and wrist may influence the results, they should be standardized. Other factors to consider are posture, arm support, nutritional state, age, the time factor, hand circumference, psychological factor, temperature, altitude, oxygen, weariness, smoking, and alcohol.¹⁶

V. CONCLUSION

We concluded that male individuals had better handgrip strength (HGS) than female subjects. HGS in males may have increased in this study due to differences in physiological maturation found in muscle growth, most likely due to Masculinizing agents (e.g., Testosterone), greater upper body muscle mass, and greater participation of boys in extra-curricular activities and sports requiring upper-body strength. This study creates a baseline of normative data (Control values) in a sample cohort of GMC Jammu medical participants. However, our study was limited to medical students between the ages of 17 and 20. As a result, different age groups must be explored.

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