**ORIGINAL ARTICLE**

# Evaluation of Normative Grip Strength in Students of Vikhe Patil Institute of Medical Sciences, Ahmednagar, Maharashtra

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## ABSTRACT

**Introduction:** It is widely acknowledged that grip strength provides a goal index of the functional reliability of the upper extremity. Many management protocols compare the strength of the injured limb with that of uninjured limb or evaluate with normative data of same group persons. Assessment of hand strength is of great significance for identifying impairments, establishing goals, and for information on the efficiency of interventions for patients with hand or upper extremity injuries or disabilities. Differences exist in the text over the association between hand grip strength (HGS) and body mass index (BMI). Many researchers claim a positive correlation between grip strength and BMI in both genders and all ages, while other researchers found no correlation.

**Materials and methods:** Ethical committee clearance was obtained. Grip strength was measured for 200 students from the Vikhe Patil Institute of Medical Sciences in the age group of 18 to 25 years satisfying the inclusion and exclusion criteria of the study. Grip strength was measured using a handheld dynamometer. The BMI was calculated following the measurement of each participant's weight and height.

**Results:** Our study shows that the normative values of hand grip are 27.83 kg on the right hand and 26.74 kg on left hand of male, and normative values of hand grip of female are 19.14 kg on the right hand and 18.23 kg on the left hand. There was positive correlation of BMI with HGS.

**Conclusion:** We conclude that the HGS of male is greater than that of female. The BMI shows a positive correlation with HGS in this study.

**Keywords:** Body mass index, Grip strength, Handheld dynamometer.

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## INTRODUCTION

Muscle power is the most essential predictor of function, mobility, independence, and activities of daily living. Evaluation of muscle strength in medical settings is usually quantified by manual muscle testing. The hand major functions involve gripping, manipulation, and expression.[1] Grip strength is one of the primary determinants of hand function. Over the years, grip strength has been assessed by health care professionals using many others unlike instruments together with various types of strain gages, sphygmomanometers, and dynamometers (bulb, spring, hydraulic, and digital). The Jamar dynamometer is at present the most universally used instrument for measuring grip strength in treatment.[2]

It was introduced by Bechtol in 1954 which today is used by many clinicians as the "Gold standard" instrument for measuring grip strength and suggested by the California Medical association in 1956 as the most suitable and accurate instrument for measuring grip strength. Physical strength of a person is measured by assessing the useful muscle contraction. Muscle contraction depends on cross-sectional area of muscle and its intensity of recruitment. Individuals with type II fibers have larger physical endurance. The strength ability examination is done by asking the person to carry out a particular task like pushing or lifting an object. The observations are compared with capabilities of a part of population.[2]

Muscular strength can be calculated by nonmotorized dynamometry (handgrip dynamometer), motorized dynamometry, with free weights, and exercise machines.[3] Hand grip strength can be quantified by measuring the amount of static force that the hand can apply on a dynamometer. This eliminates the partiality of different assessors or with different brands of dynamometers.[3] Reliable and valid assessment of hand strength is of importance in determining successfully different management strategies or effects of different measures. It is widely established that grip strength provides an objective index of the functional reliability of the upper extremity. The Jamar dynamometer has been found to give the most exact and acceptable measures of grip strength.[4]

The increasing prevalence of obesity in the younger adult population of every country is an absolute concern;

hence, the vitality of assessing the body fat has been a renaissance of importance in the evaluation of different body composition approaches. The World Health Organization (WHO) expresses overweight and obesity on body mass index (BMI) at >25 and <30 kg/h(m)$^2$ correspondingly in younger adult populations WHO. However, there is increasing confirmation that these cut-off values are not of use for all populations as the relation between BMI and body fat percentage fluctuates between population groups.[5] It is also necessary for any sport in which the hands are used for catching and throwing. Hand strength depends on a patient's age, sex, and hand dominance.[6] Thus, the purpose of my study was to find out the normative values of grip strength in students of Vikhe Patil Institute of Medical Sciences and their correlation with the BMI.

## MATERIALS AND METHODS

A cross-sectional observational descriptive type of study was conducted in Vikhe Patil Institute of Medical Sciences for 1 year from June 2015 to June 2016. A total of 200 students were randomly selected based on the inclusion and exclusion criteria.

### Criteria

*Inclusion*

- Age 18 to 25 years
- Willing to participate in study

*Exclusion*

- Any recent trauma or surgery.
- Restriction of movements of upper limb.
- Any history of inflammatory joint diseases of upper extremity.
- Any neurological disorder.
- Any injury to upper extremity.

### Procedure

Ethical clearance was obtained for the study. Written informed consent was obtained from all the students of Vikhe Patil Institute of Medical Sciences fitting in the inclusion criteria. Initially, the demographic data, i.e., height, weight, and BMI were checked. The outcome measure was HGS of right and left.

### Measurement of HGS

Before data collection, a practice trial was given to make known the subjects of the dynamometer. Prior to testing, the examiner explained as to how to hold the handle of the dynamometer. The same commands were given for each trial. The HGS of both the hands was measured using a hand dynamometer with participants seated, their elbow by their side and flexed to right angles, and a neutral wrist position. After the subject was positioned with the dynamometer, the examiner instructed the subject to "squeeze as hard as possible harder, harder." The maximal force was maintained for a period of 2 to 3 seconds. To manage the effects of fatigue, the subjects were asked to rest for 2 minutes. Calculation of the mean of three trials of grip strength for each hand was well documented as reliable. The participants' HGS data were displayed as left or right despite hand dominance. Participant's BMI was calculated following the measurement of each participant's weight and height.

### Body Mass Index

The height was recorded during inspiration using a stadiometer to the nearest 0.1 cm, and weight was measured by digital standing scales to the nearest 0.1 kg with the subjects wearing light indoor clothes and without shoes. The BMI was then calculated using the formula weight (in kg)/height (m).$^2$

### RESULTS

Statistical analysis performed by using GraphPad InStat software version 3 and Microsoft Excel. Descriptive analysis was used to find out mean and standard deviations for outcome measures.
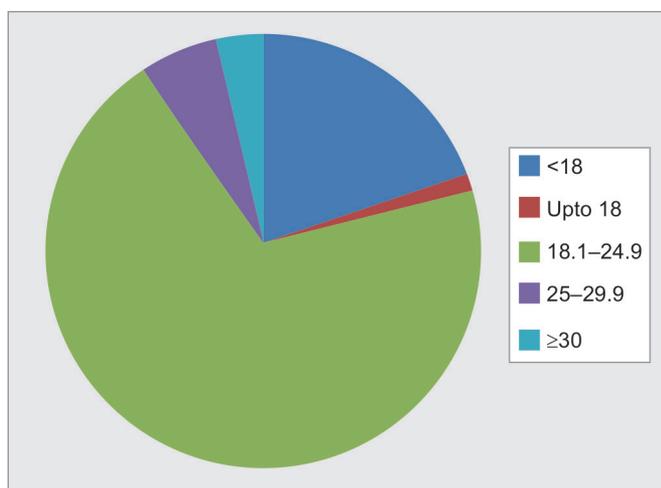
Graph 1 shows distribution of subjects according to BMI in which 20% were underweight, 69.5% were within the normal range, 6% belonged to preobese category, and 3.5% belonged to the obese category.

Graph 2 show mean grip strength of male and female in which for male right side mean is 27.83 and 26.74 for left side. For female, right side mean is 19.14 and 18.23 for left side.

All the data except the height, BMI, and weight was nonparametric. Table 1 shows coefficient correlation of BMI and handgrip which was found r value 0.159 for right hand of male and for left hand 0.0784. For female r value 0.2473 for right hand and 0.2235 for left hand which shows positive result (Table 1).

The result of paired sample t-test shows that the comparison between the handgrip strength in male (Rt hand) and female (Rt hand) is very highly significant (t = 9.059 and p = <0.001). It proves that there is very high significant between handgrip strength of the male (Rt hand) and female (Rt hand) (Table 2).

The result of paired sample t-test shows that the comparison between the handgrip strength in male (Lt hand) and female (Lt hand) is very highly significant (t = 6.893 and p = <0.001). It proves that there is very high significant between handgrip strength of the male (Lt hand) and female (Lt hand) (Table 3).

**Graph 1:** Distribution of subjects according to BMI
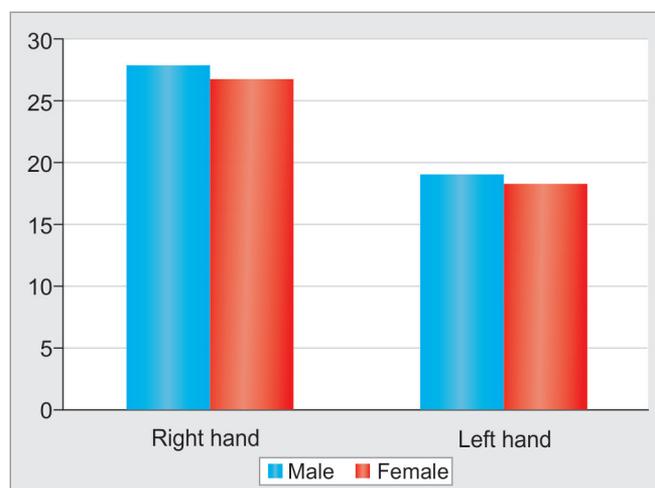


**Graph 2:** Mean grip strength of males and females

**Table 1:** Coefficient correlation of BMI and handgrip

|  | *Right r-value* | *Left r-value* | *Result* |
|---|---|---|---|
| Male | 0.159 | 0.0784 | Positive |
| Female | 0.2473 | 0.2235 | Positive |

**Table 2:** Comparison of grip strength between right hand of male and right hand of female

| | *Mean + SD* | |
|---|---|---|
| Male (right) | 27.83 ± 8.433 | t-value – 9.059 |
| Female (right) | 19.14 ± 4.643 | p-value – <0.0001 |
| | | Result – Extremely significant |

SD: Standard deviation

**Table 3:** Comparison of grip strength between left hand of male and left hand of female

| | *Mean+SD* | |
|---|---|---|
| Male (left) | 26.68 ± 8.699 | t-value – 6.893 |
| Female (left) | 18.23 ± 4.461 | p-value – <0.0001 |
| | | Result – Extremely significant |

SD: Standard deviation

## DISCUSSION

The current study investigated the normative values of hand grip and its correlation with BMI.

In our study, the normative values of hand grip were 27.83 and 26.74 kg on the right and left sides in males and the normative values of hand grip were 19.14 and 18.23 kg on right and left sides in females respectively. We also found that there was a positive correlation between HGS of males and females. Our study also supports the finding by Hemberal et al[3] that there was a positive correlation between all anthropometric data and the maximal grip strength (MGS) in both males and females. The hand circumference had the strongest correlation with MGS in both males and females for right hand. However, the correlation was observed only in females for the left hand.

Out of 200 subjects, 20% were underweight, 69.5% were within the normal range, 6% belonged to preobese category, and 3.5% belonged to the obese category. We also found that there was a positive correlation between BMI and hand grip <0.0001, which is extremely significant. Our study also has a positive correlation with the study done by Rafique et al,[6] who found out that the correlation of BMI and HGS is 0.001, which is significant at

the 0.05 level. For HGS, both the university performances were satisfactory.

## CONCLUSION

The purpose of our study here was to develop an attitude of self-health evaluation and consciousness/awareness in student's communities and assess their fitness status. The study originally was encouraging and the participant's attitude toward the health and fitness evaluation activities was positive. The research was mainly about health and fitness in order to generate an environment of common health measurement and classify the strengths and weaknesses. It is vital to improve each one's physical and physiological competencies and build an attitude to keep themselves healthy and active in their routine lifestyles.

## ACKNOWLEDGMENTS

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