



## Comparison of Hand Grip Strength among Health Care Workers and Students

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

**Background:** The information is gathered from a wide spectrum of health-care professionals, including medical students, nurses, and doctors. The study takes place at SMCH in Chennai. For students and health workers, the offered data is also utilized to compare handgrip strength between right and left handgrip. MATLAB software is used to analyze hand grip strength among health care personnel and students, and the results are far more efficient than traditional methods.

**Objective:** The objective of this study is to compare hand grip strength in South Indian health care workers and students under normal and sex impact situations.

**Methodology:** A grip strength test will almost certainly be performed if you consult an occupational or physical therapist for any problem involving weakness. A hand-held dynamometer is commonly used to assess grip strength. The patient squeezes the dynamometer three times with each hand, using all of their strength. The comparison of different types of data will be analyzed in the proposed method by using MATLAB software.

**Results:** This is the first study to develop models for evaluating the strength of different types of hand grips. Gender is the most important demographic variable to include when analyzing models. The comparison analysis resulting in images shows the value of each comparison. When compared to the non-dominant and left hands, the dominant and right hands demonstrated superior grip strength. Regular assessments of hand grip strength, hand anthropometric characteristics, and hand disability level are recommended as part of routine examinations in order to detect the amount of physical disability.

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**Conclusion:** Gender is the most important demographic variable in comparison of models. Although power grip strength is common in many sports, it may not be a strong predictor of thumb push and ball of thumb strength. The students and the health care workers are classified and their hand grip strength is calculated successfully. For convenience and time savings, there are two types of hand strength.

*Keywords: Hand grip strength; World Health Organization; bucket handle tear; international classification of functioning; disability and health.*

## 1. INTRODUCTION

As we become older, our grip strength deteriorates, which has an impact on our daily lives. Simple tasks like opening jars, carrying groceries, and turning doorknobs become more difficult or impossible depending on hand strength [1-5]. Grip strength tests are simple to calculate, yet they are sensitive enough to detect even the tiniest changes in hand strength, making them particularly valuable for assessing a patient's progress throughout physical therapy. It's also a good predictor of a higher risk of a heart attack or stroke. An 11-pound loss in grip strength is linked to a 17 percent increased risk of cardiovascular death, a 7% increased risk of heart attack, and a 9% increased risk of stroke, according to an international study.

Grip strength has been linked to a higher risk of death from any cause in older persons in multiple studies, and it is frequently used as a proxy for overall muscular strength. Surprisingly, the exact reason for the correlation between grip strength and longer life is unknown, though it could be tied to sarcopenia, or the decrease of muscular mass that occurs as people age. It's crucial to remember that inadequate grip strength isn't always a sign of bad health [4-9]. It's still unclear whether strengthening your grip may help you avoid age-related disorders like heart disease and cancer. Even 10 minutes of physical activity each day has been related to preventing disability, enhancing mobility, and living longer.

Data on handgrip strength (HGS) has been widely used in a variety of fields. The World Health Organization (WHO) recommends measuring grip strength for the International Classification of Functioning, Disability, and Health (ICFDH). Furthermore, certain sarcopenia cases have been detected by grip strength, according to physicians and ageing experts. Grip strength is often used by epidemiologists and clinicians in public health and preventative medicine to predict the death of the elderly. Grip strength is used by physical therapists and

scientists to assess the efficiency of rehabilitation. Handgrip strength tests were also utilised to see how treatments affected young athletes' strength levels. Furthermore, ergonomists, industrial engineers/designers, and industrial hygienists create and select appropriate hand equipment and goods depending on grip strength to ensure the safety of manual operations. As a result, researchers, physicians, physical therapists, and ergonomists have previously determined the general population's grip strength norm. Furthermore, two new studies that measure and mention handgrip strength in children and haemodialysis patients have been published.

## 2. METHODOLOGY AND STATISTICAL ANALYSIS

Hand grip value norms were established based on sex group classifications older than 20 years. The hand grip values on the right and left sides were compared, taking into consideration the dominance effect, in order to determine if norms should be created according to the side tested or the dominant side. A paired Student t-test and the staff tests by the given data were used to compare the values between the dominant and non-dominant sides in both right-handed and left-handed groups.

### 2.1 Comparison of Hand Grip Strength

It's hardly surprising that women's strength was much lower than men's, showing lower when comparing among the both hand motions. The analysis for the given data is performed using MATLAB 2021a. The main reason for comparison of Hand-grip strength (HGS) serves as a proxy measure for muscle function and physical health. Studies have shown that low HGS is associated with common age-related disorders including frailty and sarcopenia and other related diseases.

The figure below illustrates the left-hand grip of all male and female participants for the analysis.

Here the x Grip strength is the most frequent measurement used to evaluate the effectiveness of rehabilitation, predict mortality, and design tools and equipment. Furthermore, to reduce the duration of experiments and avoid having a large number of trials, which may result in muscle fatigue, we also evaluated the models using the measured grip strength with other demographic variables to predict another four types of hand exertion.

The left-hand grip of all male and female participants in the study is depicted in the diagram above. The most common measurement used to evaluate the efficiency of rehabilitation, forecast mortality, and build tools and equipment is the both hand grip strength. We then assessed the models utilising the observed grip strength with other demographic data to predict another type of hand exertion to shorten the duration of the studies and prevent having a large number of trials, which could lead to muscle fatigue.

The right-hand grip of both male and female members in relation to the body mass index is depicted in Fig. 2. Depending on the arm posture in which grip strength is tested, grip strength increases or decreases. When a person's arm is extended 90 degrees in front of their body, as opposed to the two extreme arm postures of resting at one's side or holding straight up above

one's head, their grip strength is usually the strongest. When one's arm is extended backwards beyond the resting posture at the body's sides, grip strength is compromised. It may be established that grip strength is influenced by the ability of certain arm muscles to contract.

Fig. 3 depicts the BMI index in relation to hand grip. The number of people is represented on the x axis, while the BMI and hand grip value are represented on the y axis. In males, but not in females, the underweight and overweight groups had lesser grip strength and endurance than the normal weight group. The association was minor, but it suggested that hand grip endurance decreased in both boys and females on both sides of the normal BMI.

Normal weight individuals had superior handgrip endurance, but underweight females had better handgrip endurance, however the difference was statistically insignificant. The handgrip endurance of both males and females was statistically significant, with the maximum grip endurance in the normal weight group and the minimum grip endurance in the overweight group. For males and females, the relationship between BMI, body fat percentage, and handgrip endurance was complex and varied.

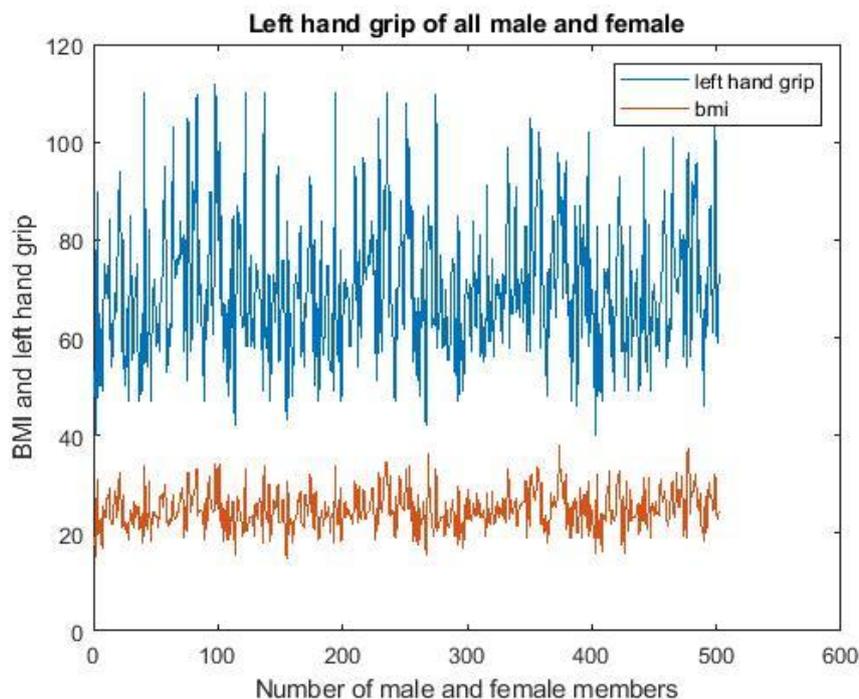


Fig. 1. Left hand grip of all male and female members

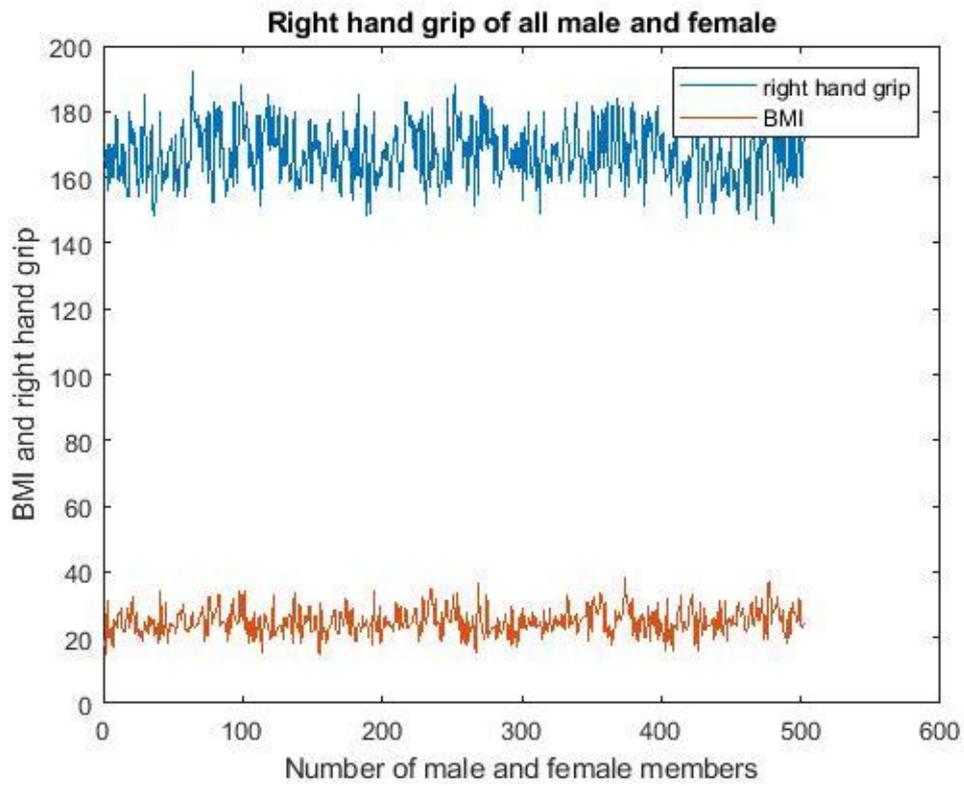


Fig. 2. Right hand grip of all male and female members

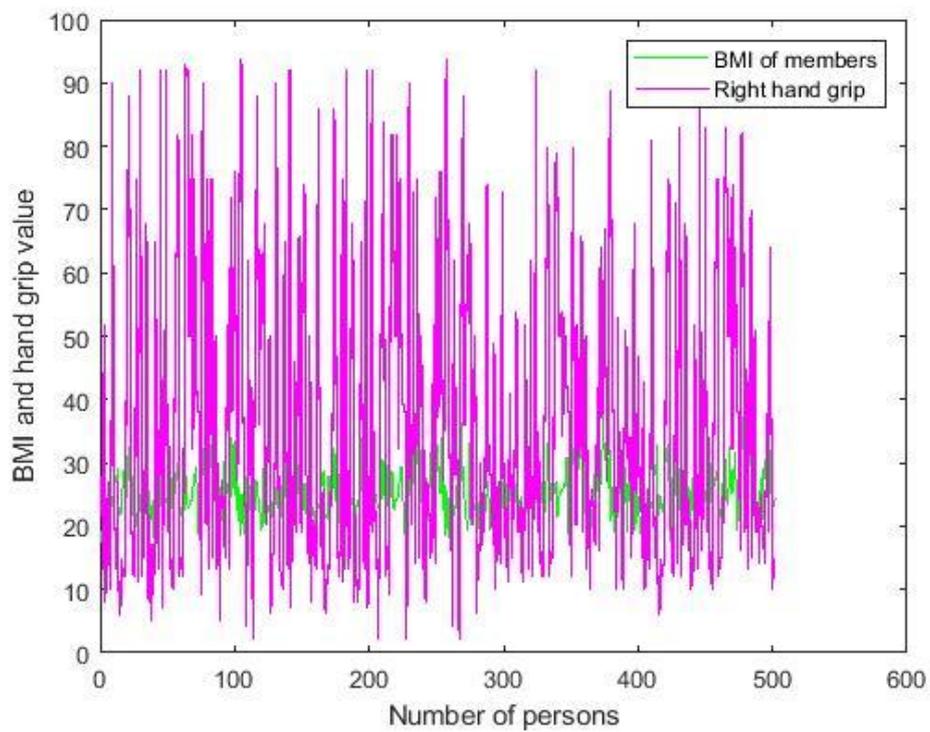


Fig. 3. BMI index related to the hand grip

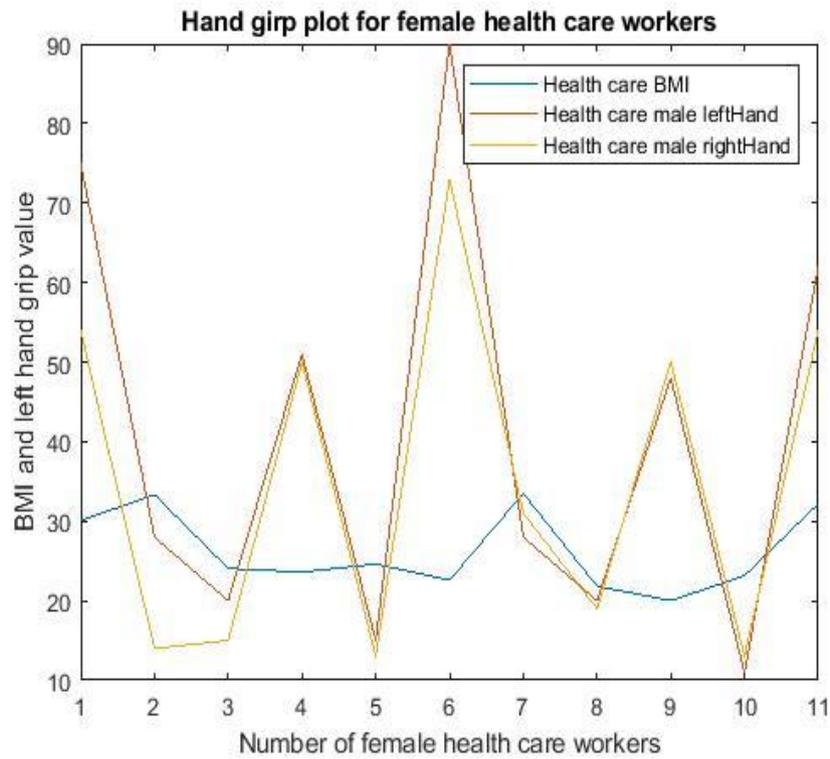


Fig. 4. Hand girp plot for female health care workers

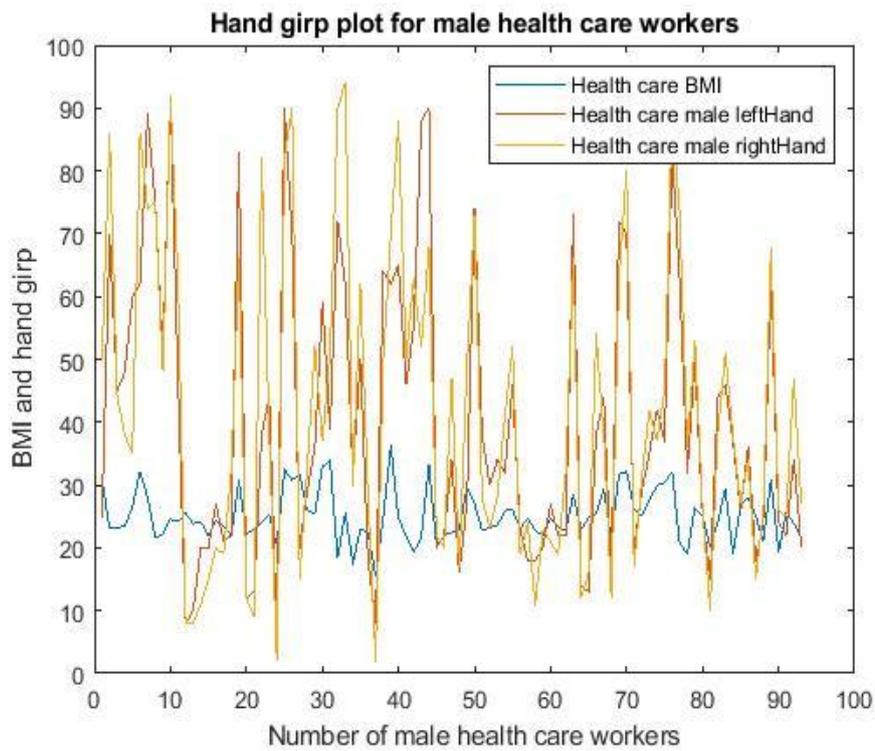


Fig. 5. Hand girp plot for male health care workers

The hand grip study of both male and female health care employees is shown in Figs. 5 and 6. Participants were medical, dental, physiotherapy, and nursing professionals working at Chennai hospitals.

There were more than 100 people in the sample. Subjects must be in good health, be over the age of 18, have been practising surgery for at least a year, and be willing to participate in the study.

It's unclear if handgrip strength supremacy is linked to forearm flexor muscle size. Fig. 6 depicts the students' biceps in relation to their left-hand grip. The link between forearm muscle thickness and side-by-side disparities in handgrip strength. The left hand of the left-handed group, on the other hand, was 7.8% stronger than the right hand. The relationship between handgrip strength and biceps muscle thickness, as well as handgrip strength and forearm-radius muscle thickness, when compared side by side.

Fig. 7 shows the pupils comparing their biceps with their right-hand grip. The total number of pupils is represented by the X axis in the graph. The hand grip values are represented on the Y

axis, which represents the biceps. The hand dominance of each individual was determined by asking which hand they used to accomplish well-learned activities such as writing. All participants who were right-handed preferred to utilise their right hand.

### 3. RESULTS AND DISCUSSION

It is common knowledge that the dominant hand has around 10% more strength than the nondominant hand. This is the first study to develop models for evaluating the strength of different types of hand grips. Gender is the most important demographic variable to include when analyzing models. When compared to the non-dominant and left hands, the dominant and right hands demonstrated superior grip strength. Regular assessments of hand grip strength, hand anthropometric characteristics, and hand disability level are recommended as part of routine examinations in order to detect the amount of physical disability and establish an appropriate rehabilitation regimen for people as they age. The comparison results in the figures provided in proposed methodology shows the analytical results for the proposed method.

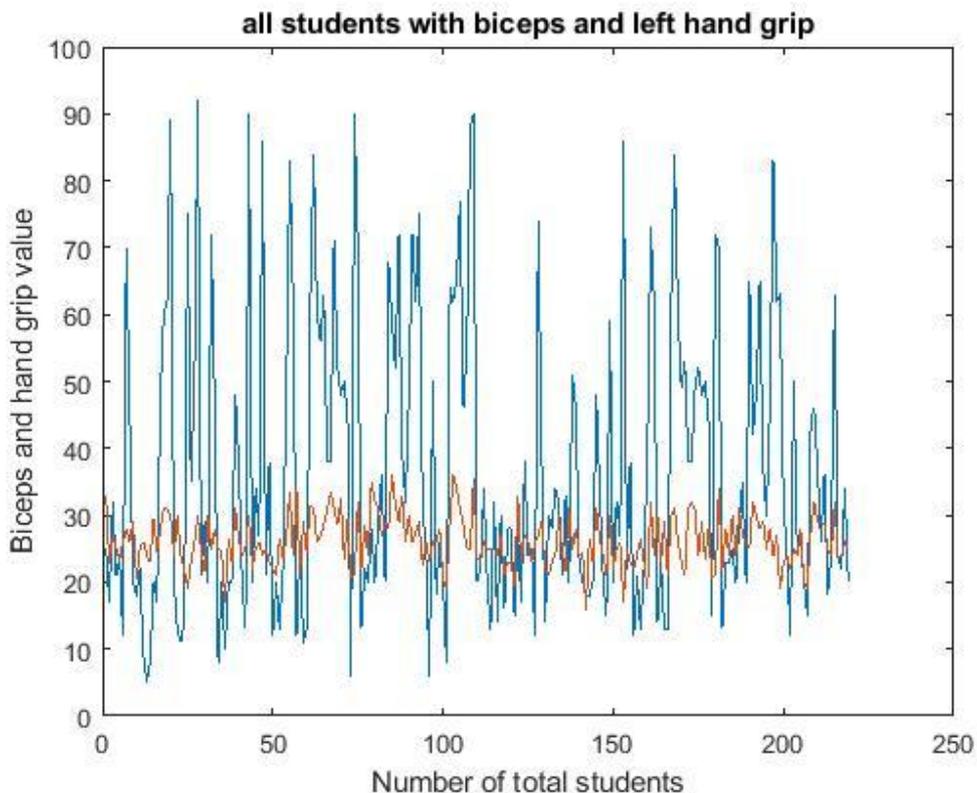
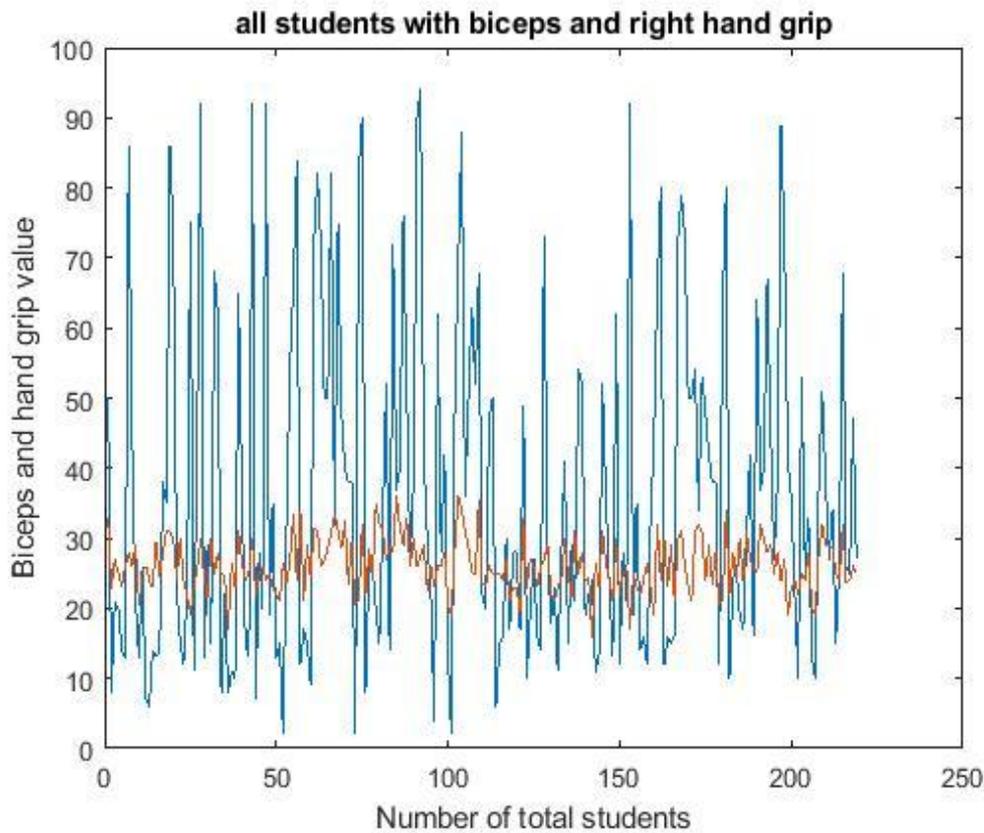


Fig. 6. All students with biceps value and left-hand grip



**Fig. 7. Students with biceps and right-hand grip**

Fig. 1 shows the Left-hand grip of all male and female members. It illustrates the left-hand grip of all male and female participants for the analysis. Here the x Grip strength is the most frequent measurement used to evaluate the effectiveness of rehabilitation, predict mortality, and design tools and equipment. Fig. 2 Shows the Right-hand grip of all male and female members. It illustrates the right-hand grip of both male and female members in relation to the body mass index is depicted in depending on the arm posture in which grip strength is tested, grip strength increases or decreases.

Fig. 3 Shows the BMI index related to the hand grip it depicts the BMI index in relation to hand grip. The number of people is represented on the x axis, while the BMI and hand grip value are represented on the y axis. Figure 4 and 5 Shows the Hand grip plot for female and male health care workers. Participants were medical, dental, physiotherapy, and nursing professionals working at Chennai hospitals. Fig. 7 shows the biceps with their right-hand grip. The total number of pupils is represented by the X axis in the graph. The hand grip values are represented on the Y axis, which represents the biceps.

Using the measured strength in the opposite hand and demographic characteristics, we ran a multiple data analysis using MATLAB data analysis tool to evaluate the strength. Previous research has found a strong link between right- and left-hand grip and pinch strength. In these models, gender was still the main predictor. The final outcome from the analysis may provide that the efficient analysis is processed out using this proposed method.

#### 4. CONCLUSION

The data is collected from the medical college with different parameters of the patients. Using this data, the comparison is using the MATLAB software. When comparing models, gender is the most relevant demographic variable. Despite the fact that power grip strength is common in many sports. Students and health-care employees are successfully categorized, and their hand grip strength is measured. There are two sorts of hand strength for convenience and time savings. The outcome of the comparison for the different members in the given data is figured out efficiently than the conventional techniques used.

## DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Kim CR, Jeon YJ, Kim MC, Jeong T, Koo WR. Reference Values for Hand Grip Strength in the South Korean Population. Plos One. 2018;13:12.
2. Mendes J, Amaral TF, Borges N, Santos A, Padrao P, Moreira P, Afonso C, Negrao R. Handgrip Strength Values of Portuguese Older Adults: A Population Based Study. BMC Geriatr. 2017;17:12.
3. Ong HL, Abdin E, Chua BY, Zhang YJ, Seow E, Vaingankar JA, Chong SA, Subramaniam M. Hand-Grip Strength among Older Adults in Singapore: A Comparison with International Norms and Associative Factors. BMC Geriatr. 2017; 17:11.
4. Steiber N. Strong or Weak Handgrip? Normative Reference Values for the German Population across the Life Course Stratified by Sex, Age, and Body Height. Plos One. 2016;11:14.
5. Trajković N, Sporiš G, Krističević T, Bogataj Š. Effects of Small-Sided Recreational Volleyball on Health Markers and Physical Fitness in Middle-Aged Men. Int. J. Environ. Res. Public Health. 2020; 17:3021.
6. Bogataj S, Pajek M, Pajek J, Ponikvar JB, Paravlic AH. Exercise-Based Interventions in Hemodialysis Patients: A Systematic Review with a Meta-Analysis of Randomized Controlled Trials. J. Clin. Med. 2020;9:43.
7. Trajkovic N, Bogataj, S. Effects of Neuromuscular Training on Motor Competence and Physical Performance in Young Female Volleyball Players. Int. J. Environ. Res. Public Health. 2020;17: 1755.
8. Eksioğlu M. Normative Static Grip Strength of Population of Turkey, Effects of Various Factors and a Comparison with International Norms. Appl. Ergon. 2016;52: 8–17.
9. Wu S-W, Wu S-F, Liang H-W, Wu Z-T, Huang S. Measuring Factors Affecting Grip Strength in a Taiwan Chinese Population and a Comparison with Consolidated Norms. Appl. Ergon. 2009;40:811–815.

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