

## THE EFFECTS OF BODY MASS INDEX ON HAND GRIP STRENGTH IN PHYSICAL THERAPIST: A CROSS-SECTIONAL SURVEY

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Obesity, Grip hold, dynamometer, physical activity, and anthropometric variables.

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**Abstract****Background**

Handgrip strength (HGS) predicts the hand function, physical fitness, and nutritional status; however, the body mass index (BMI) shows the presence of obesity and malnutrition. To evaluate the correlation between the two, both parameters are significant.

**Objective**

To determine the effects of body mass index on hand grip strength in Physical therapists.

**Methodology**

A cross-sectional study approach was used in this research to investigate the effects of Body Mass Index (BMI) on Hand Grip Strength in physical therapists. A questionnaire was distributed among a sample size of 125 physical therapists of both sexes were divided into Group A (62 males) and Group B (63 females) using a non-probability purposive sampling technique. The hand grip strength of the dominant hand was measured through a hand-held dynamometer. Data was analyzed through SPSS Statistics software version 23.0. The questionnaire covered demographics, grip strength, Body Mass Index, physical activity, and injury-related questions.

**Result**

A total of 125 physical therapists participated in the study, comprising 62 males and 63 females. Among them, 14.4% were underweight, 65.6% had normal BMI, and 20% were overweight. Male participants demonstrated significantly higher hand grip strength compared to females. In males, 17.6% had weak HGS, 17.6% normal, and 14.4% strong. Among females, 32.8% had weak HGS, 16.0% normal, and only 1.6% strong. The dominant hand consistently showed greater strength across all participants. Overall, individuals with normal BMI tended to have better grip strength than those who were underweight or overweight.

## Conclusion

*Our study concluded that male participants had stronger hand grip strength as compared to females.*

## INTRODUCTION

Fitness is an important and essential component for healthy individuals throughout the world that helps a person to lead a normal and active lifestyle, but the increasing concerns occurring due to inactivity may lead to conditions like heart diseases, high blood pressure, and hyperglycemia.<sup>i</sup> Muscular strength or the capacity to carry out tasks requiring power from the muscles is one of the basic elements of physical wellness. One widespread test used to evaluate hand muscle strength is the handgrip.<sup>ii</sup> The pointer used in the assessment of muscular strength and nourishment is known as hand grip strength, which has profound significance and is an essential parameter during grasping and pulling activities.<sup>3</sup> The significant voluntary force of an individual's forceful flexion in kilograms is the outcome which is known as handgrip strength (HGS). When grasping and pulling activities, grip strength is essential for the control of sports and activities. The complexity of an individual's hand is customized to carry tangible data of sensation and proprioception.<sup>iii</sup> It is well acknowledged that grip strength serves as an objective indicator of the upper extremity's functional integrity and is the most widely used method for evaluating the efficacy of treatment plans. It is a basic parameter for evaluating the strength of muscles and their power respectively.<sup>iv</sup> The gripping and grasping tendency or power of the hand drops as a person gets older due to deterioration in overall body function. The majority of daily proactive tasks need repetitive forearm muscular contractions, which indicates that handgrip strength is a restricted element for various activities. Measurement of hand grip strength is a solid and suggested method for determining how well muscles are working in many different tasks. Numerous variables have an impact on grip strength, such as discomfort and restricted range of motion (ROM), which affect an individual in their daily life activities.<sup>v</sup> Additionally, research has indicated the grip strength of the dominant hand to be 10% more appreciable than that of the non-dominant hand, which is the main purpose of

numerous studies and research. BMI, which stands for Body Mass Index, has a significant association with grip strength and is thought to be an indicative parameter of stable grip strength. BMI is categorized into 5 classes according to the Asian classification, which are underweight, normal, overweight, obese 1, and obese 2. A simple way to calculate body mass is to determine whether someone is thin or fat, which can be obtained through an individual's BMI, computed by dividing the weight and height of that individual. The Body Mass Index (BMI) of a person is known to be influenced by several variables, including age, gender, ethnicity, race, and muscle mass. Furthermore, studies have revealed that BMI is influenced by genetics, nutrition, exercise, and sleep patterns. To establish an acceptable body mass index (BMI), the threshold values for those affected by overweight and obesity based on cultural background, a great deal of study has been done.<sup>vi</sup> Asian people appear to have distinct associations between the percentage of fat in their bodies, body mass index (BMI), and health concerns, according to the scientific research carried out. However, at lower BMIs, there is a large proportion of Asians who are at high risk for developing heart diseases and type 2 diabetes mellitus.<sup>vii</sup> Ageing persons exhibit a drop in handgrip strength in addition to other decreases in physical function, like endurance, balance, and strength. Research findings verify a solid connection between a decline in muscular strength, physical fitness, and reduced lean body mass. A dynamometer is a hand-held device that is used to assess hand grip strength. The use of a dynamometer in assessing hand grip strength is affordable, yet reliable and has an easy application.<sup>viii</sup> The maximal isometric tensile strength of the hand and forearm muscles is measured by the hand grip strength test. Physical therapists must have a precise and trustworthy way to measure muscle strength. Muscle testing with a handheld dynamometer is a common and frequently implemented approach. Reduction in everyday tasks,

which are necessary for survival and a good quality of life, can be due to a significant decline in hand grip strength. Loss of sensation, feeling of pain, difficulty in gripping items, muscular weakness, and an instinct for objects to fall out of the hand are the symptoms of reduced hand grip strength. A person's weight is negatively related to their level of true physical well-being. With the elevation in body mass index, cholesterol and fat count are increased in the body, which causes an increase in low-density protein, eventually hypertension and blood sugar levels are increased, with profound inflammation persisting in the body.<sup>ix</sup> Experts must maintain high levels of physical, hand, and forearm strength to do their regular tasks. Gripping strength varies depending on the work performed by the professionals. When performing manipulation and ambulation on patients, physical therapists need to have strong grips and strength to perform their duties and go about their everyday lives with ease, so it is crucial and essential for the well-being of a therapist for better treatment and management strategy of the patient. For mobilization, manipulation, transferring, and ambulation, physical therapists need strong hands. A firm hand grip is required for moving and lifting the patient. However, it is crucial for strategizing and assessing the success of rehabilitation. As a physical therapist's main domain in a clinical setup is handgrip strength and muscle power. It has been shown that younger physical therapists had a greater observed incidence of work-related musculoskeletal disorders (WMSDs). The application of mobilization and manipulation techniques has been linked to an increase in the appearance of thumb symptoms and hand strength. Specific hand actions like gripping and holding were found to be influenced by several characteristics like male/female gender, age, muscle count, and body mass index (BMI).<sup>x</sup> Hand grip strength (HGS) is a good indicator of several ailments, including cardiac, cerebrovascular, cognitive, and fracture risks. The relationship between handgrip and nutritional status, hand length, body mass index, age, bone mineral content, and upper arm circumference has been substantiated by many studies. To find a link and comparison between the dominant hand grip strength of Male and Female physical therapists and body mass index (BMI) is the major purpose of this study.<sup>11</sup>

## MATERIALS AND METHODS

To investigate the effect of body mass index on hand grip strength in physical therapists for which cross-sectional study was used. The Study was conducted in the following multiple setups: PNS Shifa Hospital (PNS Shifa), Jinnah Sindh Medical University (JSMU), Jinnah Postgraduate Medical Center (JPMC), National Medical Center (NMC), Patel Hospital, Zia-ud-din Hospital (ZU), Dow Hospital (DUHS), South City Hospital. After the approval of our synopsis from the Ethical Review Committee of Bahria University Health Sciences campus Karachi (BUHS), the duration of the study was 4 months, starting from September to January. The sample size was 125, and it was divided into two categories: 62 responses were collected from male physical therapists and 63 responses were collected from female physical therapists. The inclusion **Criteria were** A physical therapist who agreed to participate, of the Age group between 25-44 years of both male and female genders, and the physical therapist working in tertiary care hospitals for at least 6-8 hours with a minimum of 2 years of working experience. **For Exclusion Criteria,** the Students, interneers, house officers, technicians, and academic physical therapists were excluded from our study, individuals with any recent trauma of the upper limb, and any diagnosed case of neurological, pathological, or musculoskeletal disorder. For the data collection of our study, a validated questionnaire adopted by **Al-Asadi JN.et.al.2018** was used. A hand-held device named a dynamometer was used to measure the hand grip strength of the participants. The standard time of data collection was 1-2 pm, which is considered break time. The participants were given instructions on how to proceed and were requested to take off any jewelry or accessories they were wearing before having their hand dominance measured. After this, their hand dominance was recorded. Following dynamometer readings, study participants were given a questionnaire to complete to collect data. The tool used for data collection purposes was a questionnaire, which was distributed among clinical physical therapists. Questionnaires were received by the physical therapists with a brief description of the information sheet and the apparatus used in the study. The participants were explained how to handle and use a dynamometer. A

hand dynamometer is used to measure the hand grip strength of an individual. The subject was asked to sit on a chair comfortably with their elbow flexed at a 90° position at rest, then the subject was asked to squeeze the dynamometer, and a reading was recorded. After taking at least three measurements separated by 30 seconds gap each in between the measurements, the average reading was calculated for each individual. They were informed of the purpose and goals of the study and the methodology for gathering data. They were assured of the confidentiality of the data in addition to receiving no payment for participating in the study. The Statistical analysis was performed by the use of IBM SPSS Statistics software version 23.0.

RESULTS

The study aimed to evaluate the effects of Body Mass Index (BMI) on Hand Grip Strength (HGS) among male and female physical therapists. Table 1 provides the descriptive statistics for participants, indicating that males had a higher mean hand grip strength ( $1.94 \pm 0.81$  kg) than females ( $1.38 \pm 0.55$  kg). This trend corresponds with the greater average height (2.78 ft) and weight (2.69 kg) recorded in the male group, compared to females. Although the absolute values may reflect a scaled unit in the original analysis, the comparative trend remains valid, whereas Table 2 details the distribution of HGS among female participants across different BMI categories. Of the 63 females, 41 (65.1%) had weak HGS (<25.5 kg), 20 (31.7%) had normal HGS (25.6–35.5 kg), and only 2 (3.2%) exhibited strong HGS (>45.5 kg). Among underweight females, 88.2% had weak HGS, with none demonstrating a strong grip. In contrast, normal-weight females showed slightly improved strength distribution, though still skewed toward weak grip. Overweight females performed comparatively better with 38.5% weak, 53.8% normal, and 7.7% strong HGS, indicating that moderate increases in BMI might benefit grip strength in females. Table 3 presents HGS distribution among 62 male participants. The data show more balanced grip

strength in males across BMI groups. Among those with normal BMI, 30.6% had weak HGS, 36.7% normal, and 32.7% strong HGS. Interestingly, overweight males showed a decline in grip strength, with 58.3% having weak HGS, and only 16.7% classified with strong HGS. The sole underweight male had normal HGS, though this group is too small for conclusive interpretation. Overall, these figures suggest that while males have stronger grip strength overall, being overweight may negatively influence grip performance. Whereas Figure 1 likely depicts the gender-based comparison of hand grip strength, illustrating the significant disparity between male and female participants, with males outperforming females across all categories. Figure 2 likely shows HGS variation in females by BMI, supporting Table 2's finding that overweight females had better grip strength distribution. Figure 3 probably depicts similar variation in males by BMI, visually affirming that normal BMI in males is associated with better grip strength balance and In conclusion, the study demonstrates a clear association between BMI and hand grip strength. Males exhibited stronger grip overall, and participants with a normal BMI showed more favorable grip strength profiles than those who were underweight or overweight. While overweight status in females showed some benefit for grip strength, it appeared detrimental in males. The dominant hand consistently showed greater strength across participants. These findings suggest that maintaining a healthy BMI is important for optimizing muscular strength, especially for professionals like physical therapists whose roles rely heavily on hand function.

Table 1: Mean and SD values for participants' height, weight, BMI, and HGS categorized by gender

DESCRIPTIVE STATISTICS		
PARAMETERES	MEAN	STANDARD DEVIATION (std)

Height (ft)	2.7840	.50135
Weight (kg)	2.6880	.65274
BMI	2.0560	.58619
Handgrip strength in male (kg)	1.9355	.80716
Handgrip strength in females (kg)	1.3810	.55150

**Table 2: HGS Distribution in Females by BMI**

BMI Category	Weak HGS (<25.5 kg)	Normal HGS (25.6–35.5 kg)	Strong HGS (>45.5 kg)	Total (n)	% Weak	% Normal	% Strong	p-value	r (Linear)
Underweight	15	2	0	17	88.2%	11.8%	0.0%	0.079	0.005*
Normal	21	11	1	33	63.6%	33.3%	3.0%		
Overweight	5	7	1	13	38.5%	53.8%	7.7%		
Total (n=63)	41	20	2	63					

**Table 3: HGS Distribution in Males by BMI**

BMI Category	Weak HGS (<25.5 kg)	Normal HGS (25.6–35.5 kg)	Strong HGS (>45.5 kg)	Total (n)	% Weak	% Normal	% Strong	p-value	r (Linear)
Underweight	0	1	0	1	0.0%	100.0%	0.0%	0.271	0.110
Normal	15	18	16	49	30.6%	36.7%	32.7%		
Overweight	7	3	2	12	58.3%	25.0%	16.7%		
Total (n=62)	22	22	18	62					

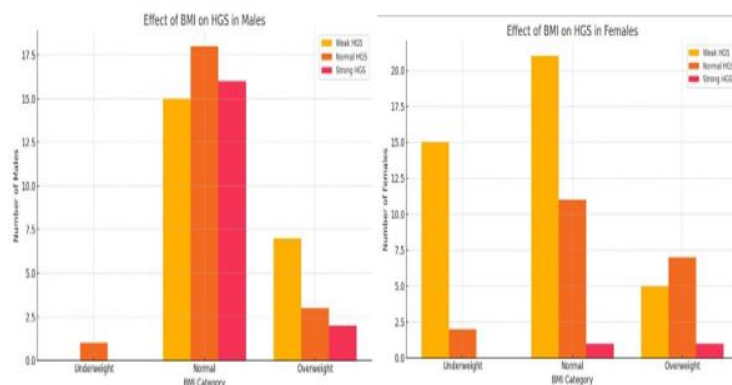


Figure 1

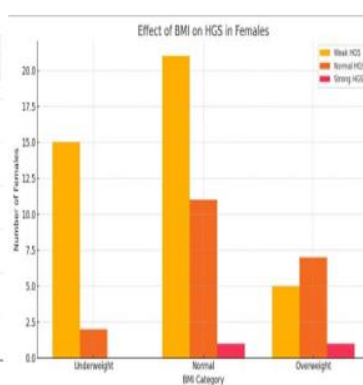


Figure 2

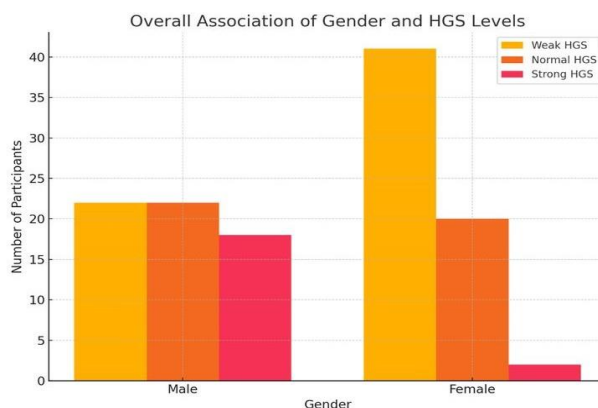


Figure 3

## DISCUSSION

In the present study of the effects of BMI on handgrip strength in physical therapists were examined in 125 physical therapists who were working in multiple tertiary care hospitals of age group between (25-29) years old. The purpose of our study was to determine whether HGS was correlated with BMI, working hours, height, weight, and dominant handgrip strength. So, we gathered and examined information provided by physical therapists in multiple tertiary care hospitals, we intended to learn more about these variables' relationships to HGS by looking at them. The present study showed that male physical therapists have higher handgrip strength as compared to female physical therapists, and the previous study, which was conducted on 400 secondary school students of age group 14- 18 years, compared their

handgrip strength with anthropometric measurement. Their result showed that male students have higher handgrip strength compared to female students. According to this study, BMI has a positive correlation with all anthropometric variables.<sup>xi</sup> Our study findings showed that the hand grip strength in males who were the age (25±29 years ) and had a working experience of (±2 years) and working hours ± 8 hours with the majority having a normal BMI having < 5 feet and weighing more than 50 kg had hand grip strength weak (17.6%) normal (17.6%) and strong (14.4%) in comparison to females who had weak HGS (32.8%) normal (16.0%) and strong (1.6%) 99.2% of the therapists were right-handed and only .8% were left-handed out of the 125 samples we took none of them had any health conditions affecting the HGS and if we take into account prior research and

contrast it with our findings we find that there is a significant correlation between handgrip strength in young physical therapy students. A previous study conducted on the 17-19 age group looked at the relationship between hand circumference and maximum handgrip strength. As a consequence, all anthropometric measurements and the maximal handgrip strength in both males and females showed a positive correlation. The most significant relationship between HGS and hand circumference was found in both. The present study also shows a positive association between all variables with handgrip strength.<sup>xii</sup> A previous study demonstrated a significant positive correlation between a dominant hand's hand span, age, body height, body weight, and BMI and the dominant hand's grip strength. However, our study also examined the grip strength of the dominant hand, and the results indicate a positive correlation between all BMI parameters.<sup>xiii</sup> Previous research for both dominant and non-dominant hands, handgrip strength, exhibited a somewhat positive correlation with weight and height. In the underweight, normal weight, and obese categories of the body mass index, handgrip strength showed a positive correlation, while the overweight category showed a negative correlation, whereas the present research demonstrates the favorable correlation between grip strength and dominant hand across all three BMI categories.<sup>xiv</sup> Prior research indicates that nurses' handgrip strength satisfied age and gender specific criteria, and that their average body mass index (BMI) was normal, and BMI was found to be significantly correlated with grip strength. The results of our investigation indicate a correlation between the physical therapist's hand grip strength and height, weight, and body mass index. Prior research was done on females in good health. The findings demonstrate a positive correlation between handgrip strength and height, weight, hand length, hand span, and wrist circumference. There is no correlation between handgrip and the current study also looked at both genders to determine whether there is a relationship between BMI and handgrip strength. The findings indicated that there is a positive correlation between these two factors. The previous study conducted on

analysis of handgrip strength in the dominant and non-dominant hands as well as the relationship between weight, height, and BMI was done in a prior study on both genders and the outcome demonstrates that for both genders, dominant hands had stronger grips than non-dominant hands and this was associated with their BMI, however the current investigation was also carried out on physical therapist of both genders to examine the dominant handgrip strength and its correlation with BMI, height, and weight and the outcome demonstrates that dominant hand had stronger hand grips in both genders, and that this was correlation with their BMI<sup>xv</sup>.

## CONCLUSION

The present study found a clear link between body mass index (BMI) and hand grip strength (HGS) in physical therapists. Male participants generally showed greater grip strength compared to females, and those within a normal BMI range demonstrated more balanced and favorable grip strength outcomes. The results also revealed that the dominant hand consistently had stronger grip strength than the non-dominant hand, emphasizing the role of hand dominance in physical performance. These findings highlight the potential of BMI and grip strength as practical, easy-to-measure indicators of physical function in clinical practitioners. Given the physical demands placed on therapists during routine care, regularly assessing these parameters could help identify early signs of fatigue or risk of injury. Promoting awareness about the impact of body composition on strength can support preventive strategies and improve work efficiency in healthcare environments.

## AUTHORS CONTRIBUTION

**SRB:** Idea, Concept, Manuscript Writing

**Z:** Designing and Manuscript Writing

**YF:** Literature Search

**YT:** Data Collection, Data Entry

**HKN:** Interpretation of Results

**MS:** Review and Editing

## REFERENCES

- <sup>i</sup> Kaido T. Proposal of definition and diagnostic criteria for sarcopenic obesity by ESPEN and EASO. *Hepatobiliary Surgery and Nutrition*. 2023 Jun 6;12(3):431.
- <sup>ii</sup> Jain A, Choudhary A. STUDY TO FIND RELATIONSHIP BETWEEN HAND GRIP STRENGTH WITH HAND ANTHROPOMETRIC MEASUREMENTS AND BODY MASS INDEX AMONG YOUNG PHYSIOTHERAPY STUDENTS. *AGE*.;21:1-41.
- <sup>iii</sup>Wilk KE, Arrigo C. Current concepts in the rehabilitation of the athletic shoulder. *Journal of Orthopaedic & Sports Physical Therapy*. 2020 Jul;18(1):365-78.
- <sup>iv</sup>Bohannon RW. Considerations and practical options for measuring muscle strength: a narrative review. *BioMed Research International*. 2019 Jan 17;2019.
- <sup>v</sup>Alahmari KA, Silvian SP, Reddy RS, Kakaraparthi VN, Ahmad I, Alam MM. Hand grip strength determination for healthy males in Saudi Arabia: A study of the relationship with age, body mass index, hand length and forearm circumference using a hand-held dynamometer. *Journal of International Medical Research*. 2019; 45(2):540-8
- <sup>vi</sup>Sun X, Yan N, Peng W, Nguyen TT, Ma L, Wang Y. Association between body mass index and body fat measured by dual-energy X-ray absorptiometry (DXA) in China: a systematic review and meta-analysis. *Global Health Journal*. 2023 Mar 26.
- <sup>vii</sup>Cokorilo N, Ruiz-Montero PJ, González-Fernández FT, Martín-Moya R. An intervention of 12 weeks of Nordic walking and recreational walking to improve cardiorespiratory capacity and fitness in older adult women. *Journal of Clinical Medicine*. 2022 May 20;11(10):2900.
- <sup>viii</sup>Cokorilo N, Ruiz-Montero PJ, González-Fernández FT, Martín-Moya R. An intervention of 12 weeks of Nordic walking and recreational walking to improve cardiorespiratory capacity and fitness in older adult women. *Journal of Clinical Medicine*. 2022 May 20;11(10):2900.
- <sup>ix</sup>Tumsatan P, Uscharapong M, Srinakaran J, Nanagara R, Khunkitti W. Role of shear wave elastography ultrasound in patients with systemic sclerosis. *Journal of Ultrasound*. 2022 Sep;25(3):635-43.
- <sup>x</sup>Dhananjaya JR, Veena HC, Mamatha BS, Sudarshan CR. Comparative study of body mass index, hand grip strength, and handgrip endurance in healthy individuals. *National Journal of Physiology, Pharmacy and Pharmacology*. 2017;7(6):594.
- <sup>xi</sup>Oseloka IA, Bello BM, Oliver HW, Emmanuel UU, Abraham MS. Association of handgrip strength with body mass index among Nigerian students. *IOSR-JPBS*. 2014 Feb;9:1-7.
- <sup>xii</sup>Hembaral M, Doreswamy V, Rajkumar S. Study of correlation between hand circumference and maximum grip strength (MGS). *National Journal of Physiology, Pharmacy and Pharmacology*. 2014 Sep 1;4(3):195.
- <sup>xiii</sup>Shrestha P, Maskey S, Shrestha S, Jha RK. Correlation between hand grip strength and anthropometric measurement among undergraduate medical students. *Journal of Kathmandu Medical College*. 2023 Apr 1;12(1):60-4.
- <sup>xiv</sup>Shah UN, Sirajudeen MS, Somasekaran PK, Mohasin N, Shantaram M. The association between hand grip strength and hand dimensions in healthy Indian females. *IJCRR*. 2012;4:36-42
- <sup>xv</sup>Agtuahene MA, Quartey J, Kwakye S. Influence of hand dominance, gender, and body mass index on hand grip strength. *South African Journal of Physiotherapy*. 2023 Oct 27;79(1):1923.