

STUDY TO FIND RELATIONSHIP BETWEEN HAND GRIP STRENGTH WITH HAND ANTHROPOMETRIC MEASUREMENTS AND BODY MASS INDEX AMONG YOUNG PHYSIOTHERAPY STUDENTS

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Abstract: Estimation of hand grip strength is important in the hand rehabilitation. It is a physiological variable that is affected by factors like age, gender and body size. Evidence has shown strong correlations between grip strength and various anthropometric traits, such as weight, height, hand length and BMI also the grip strength has been reported to be higher in dominant hand with right-handed subjects, but there were no such significant differences documented for left-handed people. The grip strength reported higher in dominant hand. To study relationship between handgrip strength with various anthropometric measurements like hand length, hand width, mid upper arm circumference (MUAC), BMI, arm length.

A sample of 100 students from BCIP was included in this study purposely aged between 18-24 years with mean age of (21.04). Various variables include height, weight, BMI, hand width and length, upper and lower arm length, MUAC and handgrip strength were measured using standard anthropometric measurement techniques. Spearman's correlation was used to analyze this data. Male students have higher mean values in (162.045) height (61.1kg) weight, (19.58cm) hand length, (10.09cm) hand width, (27.01cm) forearm length, (56.48cm) arm length, handgrip strength(R) (27.26), handgrip strength(L) (25.17) BMI (23.08) and MUAC 35.04). Male students had a higher mean handgrip strength which is significantly correlated ($P \leq 0.05$) with all the variables studied while female students had handgrip strength with a significant positive correlation ($P \leq 0.05$) with some variables. It is concluded that handgrip strength has strong positive correlations with all the anthropometric variables in students of BCIP.

1. INTRODUCTION:

Strength can be quantified by measuring the amount of static force that the hand can squeeze around a dynamometer. Hand grip strength is found to be a significant determinant of bone mineral content and bone area at the forearm sites and has a positive correlation with lean body mass and physical activity and determines the muscular strength of an individual. Hip and waist circumferences measurement are good markers of fat mass, bone mineral content and lean mass are strongly correlated with maximum isometric grip force¹. Skeletal muscle function is influenced by nutrition as well as cardiorespiratory fitness and hand grip strength (HGS) measurement determines motor fitness or skill-related fitness of the entire skeletal musculature of the arm², the grip strength reported higher in dominant hand with right-handed subjects. Hand grip strength was found to be a significant determinant of bone mineral content and bone area. Also, hand grip strength determines the muscular strength of an individual. Considering the relationships among body composition (arm and calf circumferences, trunk and extremity skinfolds, body mass index), physical activity (dash, standing long jump) and heart-rate monitoring with hand grip strength, it was found that there were better indices of body composition components in boys but low to moderate correlation was found between percent heart rate and body composition components with strength whereas better grip strength and cardio respiratory fitness in girls³. When comparisons were made between dominant right and left hand groups and non-dominant right and left hand groups, both in males and females, statistically no significant differences were noted in any case⁴. The handgrip strength has evolved as an important tool for the assessment of nutritional status; it is being considered as a reliable marker of the muscle quality^{6,7}. The assessment of hand grip strength assumes importance in a number of situations. It may be used in the investigation and follow-up of patients with neuromuscular disease. It is also of use as functional index of nutritional status and can predict the extent of complications following surgical intervention in hospitalized patient. The aim of the research was to study the association between hand grip strength and other anthropometries namely height, weight, BMI, hand length, hand width, forearm length, arm length, and MUAC. BMI is a statistical measure based on a person's weight and height. It estimates healthy body weight based on height. BMI is easy to measure and calculate, it is the most widely used diagnostic tool for determining whether an individual is under overweight, or obese⁵ BMI is

defined as a person’s body weight divided by the square of his or her height [BMI (kg/m²) = weight (kg)÷ height (m²)]. Although several studies have focused on the correlation between grip strength and stature, or grip strength and body weight, the covariance effect among sex, BMI, height, and weight has rarely been analysed statistically

2. AIM:

To study the relationship between handgrip strength with various hand anthropometric measurements like hand length - hand width, mid upper arm circumference body mass index, arm length and BMI in 100 physiotherapy students.

2.1 EXPERIMENTAL HYPOTHESIS

There is a significant relationship between hand grip strength and body mass index of physiotherapy students.

2.2 NULL HYPOTHESIS

There is no significant relationship between body mass index and handgrip strength of young adults.

3. METHODOLOGY: A group of 100 physiotherapy students from same college were taken in study purposely aged between 18-24years with mean age of (21.04). Various anthropometric variables studied include, the height, weight, BMI, hand width and length, upper and lower arm length, mid upper arm circumference (MUAC) and handgrip strength.

3.1 INCLUSION CRITERIA

- Young adults of age group 18 – 25 years of age
- BMI (18.5 –24.9kg/m²)
- Only right-hand dominant individual

3.2 EXCLUSION CRITERIA

- Subject with any recent trauma or surgery of upper limb
- Any diagnosed case of musculoskeletal disorder
- Neurological or psychiatric disorder
- Cardiorespiratory disorder that can affect the outcome.
- Diabetes mellitus
- Any deformity which may affect the outcome of study

3.3 PREOCEDURE

The individuals fulfilling the selection criteria were selected and after explaining the purpose and taking a written consent, the study was initiated. Procedure was explained to the subjects were asked to remove any bracelet, ring or watches and their hand dominance is recorded. After cleaning dynamometer, subject was explained how to hold dynamometer and the dial register the best result by squeezing as tightly as possible. Hand dynamometer used to measure the grip strength of the participants. Each participant was allowed to sit on a chair with the elbow flexed at 90 degrees and the forearm in semi pronation lying on an arm rest. Instructions were given hold press and release. Subject is instructed to press handle as strongly as they can similarly 3 readings were taken and average is calculated.

4. RESULT :

The data was analyzed by calculating the mean and standard deviation and by applying spearman correlation method to find out significant differences.

Table .1; Demographic data of sample

(Both male and female)
(N=100)

Parameter	MEAN±STANDARD DEVIATION
AGE	21.04±1.41
HEIGHT	164.32±8.81
WEIGHT	61.11±17.62
BMI	23.03±13.62

BMI= Body mass index

Table .1 is showing mean deviation and standard deviation of demographic data.

Table 2; Descriptive statistics

Parameter	MEAN	STANDARD DEVIATION	MEDIAN	MODE	STANDARD ERROR
AGE	21.04	5.53	21	22	0.14
HEIGHT	164.32	43.30	163.5	165	0.88
WEIGHT	61.11	18.49	58.2	47	1.76
BMI	23.03	5.81	21.8	18.7	1.36
HANDLENGTH	19.58	4.92	18	18	1.38
HAND WIDTH	10.09	2.36	9	9	1.47
MUAC	35.04	8.99	34	36	1.25
ARM LENGTH	56.48	15.73	55	54	1.13
FOREARM LENGTH	27.01	7.03	25.75	26	1.32
HANDGRIP STRENGTH(R)	27.26	7.56	24	20	1.61
HANDGRIP STRENGTH(L)	25.17	8.89	22.16	14	1.64

It is showing descriptive statistics of various hand anthropometric measures

Table 3; CORRELATION MATRIX: showing correlation of hang grip strength and various upper limb anthropometric variables

	HANDGRIP STRENGTH(R)	HANDGRIP STRENGTH (L)
BMI	0.810068	0.805295
ARM LENGTH	0.793323	0.804953
HAND LENGTH	0.835348	0.829444
HAND WIDTH	0.822404	0.821053
MUAC	0.829872	0.83393
FOREARM LENGTH	0.841356	0.840042
HAND GRIP STRENGTH (R)	1	0.967833
HAND GRIP STRENGTH(L)	0.967833	1

As per data analysis the right and left grip strengths are strongly correlated with body mass index, arm length, hand length, hand width, mid upper arm circumference, forearm length.

5. DISCUSSION :

The study of the Association between handgrip strength, BMI and other anthropometric parameters was undertaken in one hundred physiotherapy college Students of ages 18 to 24 years in Delhi. These were correlated as within female sample within male sample and between both male and female sample. Their body mass index are calculated with measuring scales, other hand anthropometric values are calculated using measuring tape and hand grip strength is calculated using a Jamar-dynamometer.

The mean and standard deviation are calculated to find any significant difference. The results revealed strong positive correlations between age, height and weight with handgrip strength in both males and females. The results from the present study are consistent with previous researches demonstrating stronger grip for men than women within the same age strata, and that hand grip strength decreases with advancement in age. Hand grip strength of male and female was found to be stronger in dominant hand as was previously concluded. The present study has demonstrated that males are generally taller, heavier, and have longer hand length, hand width, forearm length, and arm length, with higher Hand grip Strength than their female counterparts. Sartorio et.al in their study had reported that age dependent increase of handgrip strength in boys and girls were strongly associated with changes of muscle mass during their childhood. It was reported earlier that physical performance had a strong association with body strength, shape, size, form and structure of an individual. The findings of the present study follow the same direction highlighting a highly significant positive correlation between all the anthropometric variables measured and handgrip strength both in males and females.

It has been reported that as a rule, handgrip strength of both right- and left-hand dominant was stronger in males

than females across all age groups. The findings of the present study also followed the same direction in both male and female students. The Males have higher mean values in all the anthropometric variables than their female counterparts. It has been reported earlier that men possessed considerably greater strength than women for all muscle groups tested.

In a study by Manjunath hembaral, there was a positive correlation between all anthropometric data MGS in both males and females. The strength of the grip is influenced by factors like strength, hand dominance, fatigue, time of the day, age, gender, nutritional status, restricted motion and pain. According to them hand circumference is a good predictor of MGS (muscle grip strength) than BMI and forearm circumference.

When correlating HGS, in the general sample of males and females combined, with all the tested anthropometric variables, all the variables showed a strong positive correlation to Hand grip Strength. This was also shown to be true when the same correlation was made in male student samples only. In female samples, however, the correlation only showed a positive relationship between Handgrip

Strength and age, height, weight, hand length, forearm length while BMI, hand width, arm length, and MUAC showed no significant correlation. The regression formulae for predicting Hand grip strength were obtained according to age in males and females. and based on these findings, the present study was in agreement with the findings of the previous studies of Cagatay et al, Shyamal and Satinder.

This study indicated a strong correlation between hand grip strength and BMI also it shows strong positive correlation with hand anthropometric characteristics.

6. CLINICAL RELEVANCE:

It has been observed in present study that there is significant relation between hand grip strength and BMI, arm length, forearm length, MUAC, hand length, hand width.

7. LIMITATIONS OF STUDY:

- Small sample size
- Right-handed individuals are selected

8. SCOPE OF FUTURE REFERENCE:

Sample can be taken from other age group.

9. CONCLUSION:

The study concluded that there is a strong significant correlation difference between hand grip strength and hand anthropometric characteristics of hand including arm length, hand length, forearm length, mid upper arm circumference, hand width also there is strong positive correlation between body mass index and hand grip strength.

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