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[ORIGINAL ARTICLE]

Influence of Low, Medium and High BMI on Hand Grip Strength among Community Dwelling Elderly Population.

Ms. Bhakti Gorhe[1], Dr. Shyam Ganvir (PT)[2]
[1]Intern, [2]Principal & HOD, Department of Community Physiotherapy, D.V.V.P.F's College of Physiotherapy, Ahmednagar.

ABSTRACT :

Background : Aim of the study is to find out the influence of low, medium and high body mass index on hand grip strength among community dwelling elderly population.

Methodology: This was an observational cross-sectional study performed on 30 community dwelling elderly population with age groups 60 and above 60. Out of total 30 participants 8 were having low BMI, 9 were having medium BMI and 13 were having high BMI. BMI was calculated by taking weight (in kg) by using weighing machine and height in (meters). Hand grip strength was measured by using hand held (JAMER) dynamometer.

Result: Data has summarized by using descriptive statistic of mean and standard deviation.

Then Pearson correlation test was used to measure relation between hand grip strength and BMI.ANOVA technique was used for multiple group comparison by using graph pad software. By using Pearson correlation, we got the result that there is positive correlation between High BMI with HGS and negative correlation between HGS with low and medium BMI. By using one-way ANOVA test, we got (p value>0.05) which is non-significant. One way ANOVA shows comparison of hand grip strength of low, medium and high BMI and it is like H>M>L for both dominant and non-dominant.

Conclusion: Our study concludes from the above result that there is correlation between Hand grip strength and body mass index.

Keywords: Body mass index, Hand grip strength, Community dwelling elderly population.

Introduction:

Hand grip strength (HGS) is very important to the human body for controlling objects and consists of 3 types of forces: grip, pinch, and torque and involves performance of tasks such as hand-eye coordination, which is also an important skill that allows humans to grasp, grip, and manipulate. A stronger HGS indicates a firmer grasp or grip. Several factors affect HGS performance, including sex, age, height, weight, and handedness. Body weight and stature (body height) are primary indicators of human growth.

Few studies have focused on the correlation between the ratio of weight and stature between BMI and HGS. BMI is a statistical measure of body weight based on a person's weight and height. Although it does not measure body fat, it plays an important role for maintenance of healthy body weight based on height and also is an important diagnostic tool for determining whether an individual is underweighted, overweight, or obese. 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)]. The formula that is universally used in medicine produces a unit measure of kg/m2. Specifically, the purpose of this study is to determine whether HGS is affected by BMI.[1]

An age-related reduction of muscle mass and strength is a major public health concern in older persons because of its important role in the causal

*Corresponding author
Dr. Bhakti Gorhe (PT)
Email :bhaktigorhe99@gmail.com
D.V.V.P.F's College of Physiotherapy, Ahmednagar.

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pathway leading to func¬tional limitations, increased risk of falls, disability, and mortality.[2]

The nutritional status can influence the muscle quality and so, the muscle strength. The association between the muscle strength and underweight and the muscle strength and overweight/obesity.[3] The decreased muscle strength in underweight can be explained on the basis of the energy deficiency. There are studies which have stated that the muscles of obese persons will have a fatty infiltra¬tion and a change in the distribution of the type I and type II muscle fibres, which will alter the muscle strength and endurance [4].

Excessive body adiposity is associated with increased risk for functional limitation. Obese persons need more muscle strength to move their body mass than normal-weight persons. Moreover, owing to their less centralized body mass, obese people are more vulnerable for balance problems and in consequence may need greater strength during walking. Therefore, hand-grip cut-points for increased risk for mobility limitation may need to be examined separately for normal-weight, overweight and obese persons among a representative older population[5]. HGS as a determinant of muscle strength in older adults. HGS, a commonly used indicator of muscle function, can also be used as a rapid, cost-effective method for nutritional assessment; many reports have indicated that it is significantly correlated with nutritional status. These previous studies indicated that people at nutritional risk have lower HGS. This may be because poor nutrient intake can result in reduced protein synthesis, which causes muscle fibre atrophy and decreased muscle mass, in turn leading to impaired muscle function [6].

There are many studies have been done on hand grip strength in association with obesity in young adults but none of the study has been done with influence of categories of BMI on hand grip strength in community dwelling elderly population.

Methodology: This is an observational cross-sectional study was of 3 months. A total 30 community dwelling elderly people having different BMI were recruited using purposive sampling method. Out of total 30 people 8 were having low BMI, 9 were having medium BMI and 13 were having high BMI. Hand held dynamometer (JAMER) was used to measure hang grip strength and BMI was calculated by taking weight and height. While the inclusion criteria were Community dwelling elderly population, both males and females, Age 60 and above 60 and Exclusion criteria were Person having neurogenic involvement, any recent fracture of hand, any systemic illness, not willing to participate.

Procedure: Institutional Ethical Committee approval was obtained before the commencement of the study. After explaining the importance of study, when a participant agreed to participate in the study, verbal and written informed consent form in Marathi was obtained from all the participants. The handgrip strength of the dominant hand and non-dominant hand have measured by using a handgrip dynamometer (JAMER).

The participants were advised to keep their hand on a table with the angle in the elbow was maintained at 90 degrees and I have asked to press the handle of the dynamometer with maximum strength and I have taken 3 readings for both hands that is dominant and non-dominant and noted the maximum value out of three reading. BMI was calculated by taking weight and height.

Result: -

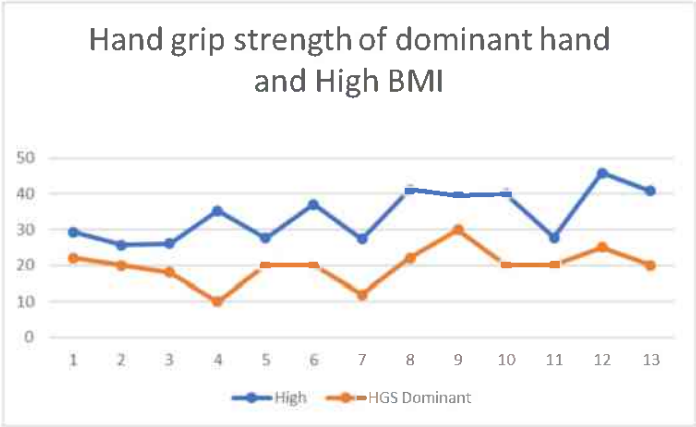
Table No 1: - Showing Baseline Characteristics of Anthropometric Measures.

Sr.no	Variables	Low (n=8) Mean ± SD	Medium (n=9) Mean ± SD	High (n=13) Mean ± SD
1	Age	71.62 ±8.17	69±6.16	75.30±11.10
2	Weight	42.25±9.55	56±10.94	73.53±11
3	Height	146.25±13.28	156.44±15.32	147.78±9.64
4	BMI	19.05±1.69	23.13±1.73	34.08±6.99
5	HGS (Dominant)	18.33±7.60	21.88±6.80	17.15±4.43
6	HGS (Non dominant)	14.75±6.81	18.55±5.15	20.30±5.20

Table No 2: - Showing correlation between HGS of Dominant and non-dominant hand with categories of body mass index.

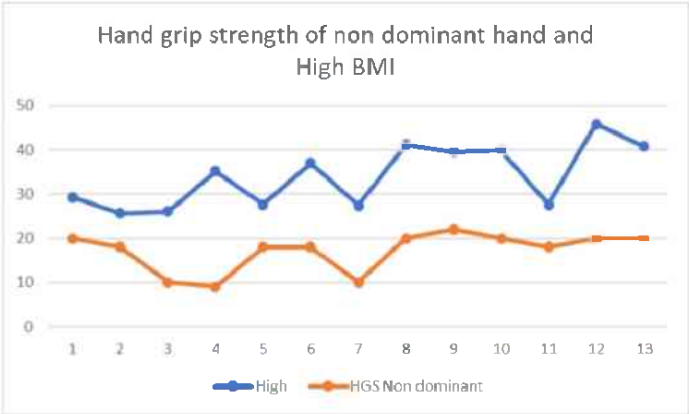
Sr no	BMI	HGS (Dominant hand) R	HGS (Nondominant hand) r
1	Low	-0.213	-0.33
2	Medium	-0.309	-0.276
3	High	0.478	0.489

It shows that HGS is positively corelated with high BMI and Negatively corelated with medium and low BMI.



GRAPH 1: - Showing correlation between hand grip strength of dominant hand with High BMI.
On X axis: - Hand grip strength
On Y axis: - BMI(High)

Positive correlation is present between High BMI and hand grip strength of dominant hand.



GRAPH 2: - Showing correlation between hand grip strength of non-dominant hand with High BMI.
On X axis: - Hand grip strength
On Y axis: - BMI(High)

Positive correlation is present between High BMI and hand grip strength of non-dominant hand.

TABLE NO 3:- Showing comparison of Hand grip strength of low, medium and high BMI participants using One way ANOVA Test.

Sr.no	Variables	Low	Medium	High	P value	F ratio	Post -Hoc
1	HGS Dominant	16.5±7.74	20.00±6.66	20.30±5.20	P>0.05	1.20	H>M>L
2	HGS Nondominant	12.25±7.42	16.77±7.56	17.15±4.43	P>0.05	1.66	H>M>L

It suggests that Higher the BMI higher is the hand grip strength, that is hand grip strength increases as BMI increases in community dwelling elderly population.

Discussion:

This study was conducted with purpose to see the influence of low, medium and high BMI on hand grip strength among community dwelling elderly population. Hand grip strength (HGS) is crucial to the human body for controlling objects. It is used to assess skeletal muscle functions and, over the years, it has also received notable attention from industrial engineers. The hand exerts three main types of force: grip, pinch, and torque. The performance of tasks involving hand-eye co¬ordination, which is a crucial skill that allows humans to grasp, grip, and manipulate. A stronger HGS indicates a firmer grasp or grip [1]. An age-related reduction of muscle mass and strength is a major public health concern in older persons because of its important role in the causal pathway leading to func¬tional limitations, increased risk of falls, disability, and mortality [2].

There are many studies have been done on hand grip strength in association with obesity in young adults but none of the study has been done with influence of categories of BMI on hand grip strength in community dwelling elderly population.

This was an observational cross-sectional study performed on 30 community dwelling elderly population with age groups 60 and above 60. Out of total 30 participants 8 were having low BMI, 9 were having medium BMI and 13 were having high BMI. BMI was calculated by taking weight (in kg) by using weighing machine and height in (meters).

The handgrip strength of the dominant hand and non-dominant hand have measured by using a handgrip dynamometer (JAMER).

The participants were advised to keep their hand on a table with the angle in the elbow was maintained at 90 degrees and I have asked to press the handle of the dynamometer with maximum strength and I have taken 3 readings for both hands that is dominant and non-dominant and noted the maximum value out of three reading.

Patients were excluded if they had functional limitations that made it difficult to measure HGS, a history of wrist surgery within the previous 3 months, or a history of wrist discomfort or pain.

In our study we got the result that HGS cut points are corelated with BMI so as BMI increases HGS of both dominant and non-dominant hand among community dwelling elderly population also increases. we got result that Higher the BMI higher is the hand grip strength but at the same time negative correlation is present between HGS of both dominant and non-dominant hand with low and medium BMI. In our study we have used Pearson correlation test and by that test we got this result. Correlation between High BMI with dominant hand has value (r= 0.478) and with non-dominant hand (r=0.489) so there is positive correlation and as r value for low BMI and HGS for dominant is (r= -0.213) and for non-dominant is (r = -0.33) and in medium BMI r value for dominant is (r= -0.309) and for non-dominant is (r= -0.276) so there is negative correlation between HGS with low BMI and medium BMI.

By using one-way ANOVA test, we got (p value>0.05) which is non-significant. One way ANOVA shows comparison of hand grip strength of low, medium and high BMI and it is like H>M>L for both dominant and non-dominant.

Young Jin Tak and Jeong Gyu Lee did study to determine optimal hand-grip strength cut-points for increased likelihood for mobility limitation among older people and to study whether these cut-points differ according to body mass index (BMI). Hand-grip strength test is a useful tool to identify persons with increased risk for mobility limitation. And he got result that among population the hand-grip strength cut-points for mobility increased along with BMI and it also depends on nutritional status [5].

Janne Sallinen, PhD*, Sari Stenholm did study Based on a representative population-based. To determine optimal hand-grip strength cut-points for increased likelihood for mobility limitation among older people and to study whether these cut-points differ according to body mass index (BMI). They did Cross-sectional analysis of data collected in the Finnish population-based Health 2000 Survey. Total participants were 1 084 men and 1 562 women aged 55 years and older with complete data on anthropometry, hand-grip strength. They determined optimal hand-grip strength cut-points for increased likelihood for mobility limitation for older men and women. They got result that Hand grip strength cut-points increased, along with increasing BMI, from 33 kg for normal-weight men to 39 kg for overweight men and further to 40 kg for obese men [4].

Hyesook Kim and Oran Kwon examined the association between HGS and three indices—the Korean Healthy Eating Index (KHEI), the Alternate

Mediterranean Diet (aMED), and Dietary Approaches to Stop Hypertension (DASH)—using data obtained on Korean elderly persons aged ≥65 years (n = 3675) from a nationally representative database. The cross-sectional data was collected as part of the Korea National Health and Nutrition Examination Survey (KNHANES, 2014– 2016). They found that better overall diet quality may be associated with higher HGS in the elderly Korean population by understanding the relationship between diet quality and HGS[6].

Above studies have proved that there is correlation between BMI and hand grip strength in community dwelling elderly population and hand grip strength is also depends on nutrition status and we also got the same result that nutritional level is very important in community dwelling elderly population because it affects the protein synthesis of muscles fibres so Hand grip strength has correlation with BMI.

Conclusion:

Our study concludes from the above result that there is correlation between Hand grip strength and body mass index.

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CONFLICT OF INTEREST– None

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