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Research Article

A STUDY ON CORRELATION BETWEEN THE AGE, ANTHROPOMETRIC MEASUREMENT AND HAND GRIP STRENGTH IN HEALTHY INDIVIDUALS

Neelam M Jadhav*

MGM School of Physiotherapy

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ABSTRACT

Aim- To study the correlation between the age, anthropometric measurement and hand grip strength in healthy individuals.

Objective -To measure and find the correlation between the age, anthropometric measurement and hand grip strength in healthy individuals.

Results- From this study it is concluded that age and BMI has influence on grip strength and should be considered as important indicators for assessing grip strength.

Key Words:

Hand grip strength, BMI, anthropometric measurement

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INTRODUCTION

The thumb of human hand, which unlike other fingers, is opposable¹. It refines the hand grip to hold objects.² The human hand is an organ of function and execution.³ In most of the activities of daily living which are-carrying loads, lifting objects, holding objects, opening or closing doors, self-care activities to name a few hand functionality is considered to be vital^{4,5}

"Grip strength is the force applied by the hand to pull on suspend from objects".^{1, 6} The grip is an act of holding, using the hand, and keeping a firm grasp of differently shaped objects, tools or instruments⁷. The ability of contractile tissue to produce tension and a resultant force based on the demands placed on the muscle. More specifically, during a single maximum effort muscle strength is the greatest measurable force that can be exerted by a muscle or a muscle group to overcome resistance⁸. Grip strength is commonly used in clinical settings for assessment of upper body function.⁹

Power grip is a forceful act resulting in flexion of all fingers joints.^{10, 11, 12, 13} In power grip, by the more proximal joints the object is grasped so that it can be moved through space. To hold the object between the fingers and the palm the thumb acts as a stabilizer.¹² The synergistic action of the flexor and

extensor muscles and the interplay of the muscle groups is an important factor in the strength of the resulting grip.^{1, 11}

Biomechanics of Power grip-Power grips are primarily isometric functions of the hand wherein the fingers assume a position of sustained flexion. The fingers are flexed, laterally rotated, and ulnarly deviated. The flexion of fingers varies in degree with the size, shape and weight of the object. The palm contours the object. An additional surface to the finger-palm is provided by the thumb by its adduction against the object. The direction of force is controlled by the reinforcement of the thumb to the fingers thereby helping to make small adjustments in power grip.⁽⁸⁾

To assess and evaluate the grip strength manual and mechanical methods are normally are used⁽⁴⁾ Grip strength is measured using a number of different measuring tools, E.g. the Oxford muscle scale, and various instruments such as the Strain Gauges, E.g. MIE Digital pinch/Grip Analyser, Mechanical instruments such as the Smedley or Stoelting dynamometer or Hydraulic instruments such as Jamar dynamometer.⁹ Handgrip strength is measured by squeezing a handgrip strength dynamometer with one's maximum strength in either kilograms or Newtons.⁶

Specific variables like dominance of hand, body postures position of various segments like shoulder, elbow and wrist are considered to affect grip strength.^{4,6,15,16,17,18,19} Certain variables

*Corresponding author: Neelam M Jadhav
MGM School of Physiotherapy

like BMI (body mass index), time of testing, gender , age affect grip strength.^{4,13,14,15}

Hand grip strength is common clinical evaluation done by Physical therapist and hand surgeons for various musculoskeletal, neurological, pre and post operative cardiovascular evaluation Hand grip strength varies greatly with age, gender and anthropometric measures when measured by hand dynamometer. The prediction of hand grip strength from age and anthropometric trait is rare. So it is important to established a relationship among age, anthropometric traits and hand grip strength measured by Jamar dynamometer.

Aim To study the correlation between the age, anthropometric measurement and ahnd grip strength in healthy individuals.

Objective

To measre handgrip strength in healthy individuals in sitting position.

MATERIALS AND METHODS

Study Design

Cross sectional study.

Sample Size

120 individuals

Type of Sampling

Convenience

Study setting

Various community centres

Inclusion Criteria

Individuals in the age group of 18 and above years who do not exhibit any symptoms mentioned in the exclusion criteria.

Exclusion Criteria

- Any musculoskeletal conditions involving upper limb, lower limb and spine. E.g.:- Cervical Radiculopathy, Lumbar radiculopathy etc.
- Any musculoskeletal injuries since 1 year. E.g.:- Cumulative trauma disorders, Lateral epicondylitis, carpal tunnel syndrome etc.
- H/O trauma or surgery in last 1 year affecting grip strength. E.g.:-Fracture of hand, forearm, Tendon injuries etc.
- Neuromuscular disorders affecting grip strength. E. g:- DMD, Myopathies etc.
- Cardiopulmonary conditions affecting grip strength. E. g:-Bronchial asthma, bronchitis, Myocardial infarction etc.
- History of endocrine, metabolic, infective, malignancy and rheumatoid disorders etc.
- Pregnancy.
- Regular exercising, recreational or professional sports playing individuals.

The outcome measure considered for statistical analysis was

Grip strength (Kgs)

METHODOLOGY

The study was approved by the institutional ethics committee, the following procedure was carried out in various community centres. Study procedure started with screening of individuals according to inclusion and exclusion criteria for involvement in study. A group of 120 individuals fulfilling the inclusion criteria was selected. Written consent was obtained from the individuals after explaining the study procedure and the benefits of the study were explained to them in the language best understood. Basic information was recorded and documented in the case record form.

Participants were explained about the procedure on the day of study. Three anthropometric traits height, weigth and BMI were taken from each participant. Each participant’s height was measured using measuring tape stuck on wall with subject standing erect against wall without shoes. Weight was recorded without shoes with weighing machine. Body Mass Index was calculated by dividing the weight of the subject [in kilograms (kg)] by height [meters (m)] per meter squared.⁵

Hand dominance was determined by using Edinburg Handedness Inventory questionnaire (Revised).²⁰Grip strength of dominant hand was measured and recorded with Jamar dynamometer whose handle was kept on 2nd position (of the five positions available).^{2,3 21,22} Each participant squeezed the dynamometer 3 times and average of 3 trials was taken.² The dynamometer was set to zero before each trial. A rest of 60 seconds was given between each squeeze.² Participants were seated comfortably on a chair with back supported with armrest and feet flat on ground.¹⁶ (American Society of Hand Therapist) Hand grip strength was recorded The data was collected and analysed for statistical purpose.

RESULTS AND ANALYSIS

Data Analysis

Phase 1- The data was entered using Microsoft excel 2010 and analysed using Statistical Package for Social Sciences (SPSS) version 20 and Primer of Biostatistics software.

Demographic data was not normally distributed; hence following tests were applied for correlation analysis.

- Spearman’s correlation test for correlation between age and grip strength.
- Spearman’s correlation test for correlation between BMI and grip strength

P value less than 0.05 was considered as statistically significant.

Table No 1 Descriptive Statistics of Demographic Data

	Min	Max	Mean	Median	SD
N=120					
Age (years)	18	67	33.16	35.0	10.04
BMI (kg/m ²)	13.90	38.00	23.70	22.0	5.13

Table no 2 Distribution of Gender

	Gender		Total
	Male (M)	Female (F)	
No of individuals	51	69	120
Percentage (%)	42.5%	57.5%	100%

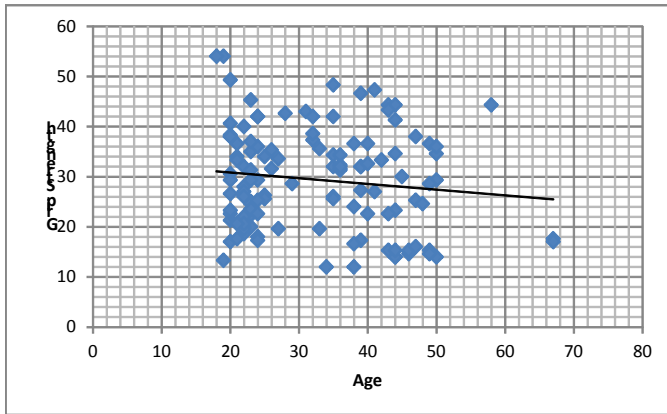
Phase 2-correlation analysis

Analysis of correlation between age and grip strength

Table No. 3 Correlation between age and grip strength

Spearman's Correlation Coefficient	p value	Significance
r = -0.05	p = 0.5	Non-significant

*Correlation is significant at p<0.05

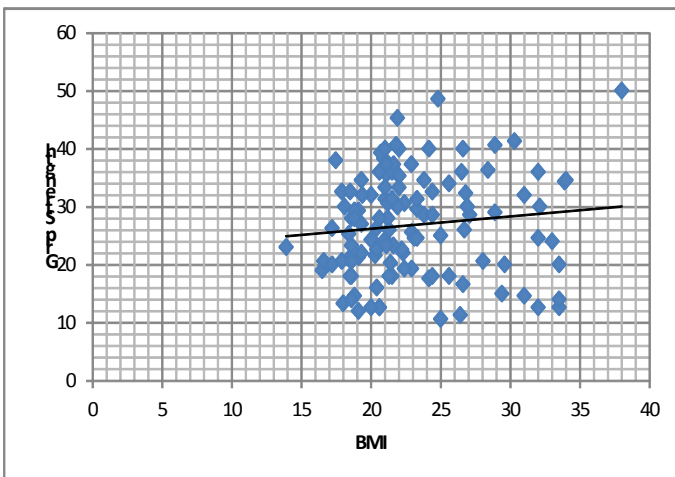


Graph No. 1 Scatter Plot representing the Correlation between age and grip strength

Inference: The above table and graph show that there is a negative correlation between age and grip strength however, this correlation is not statistically significant.

Table No. 4 Correlation between BMI and grip strength.

Spearman's Correlation Coefficient	p value	Significance
r = 0.16	p = 0.06	Non-significant



Graph No. 2 Scatter Plot representing the Correlation between BMI and grip strength

Inference: The above table and graph show that there is a positive correlation between BMI and grip strength but however this correlation is not statistically significant.

DISCUSSION

Grip strength is an important indicator of overall muscular strength.²⁴ Martine J. H. Peters *et al* (2011) found that there was a significant curvilinear age-dependent decrease of normative values of grip strength in both genders. The maximum median grip strength was reached among women

aged 30–39 and among men aged 40–49 and a marked decline of grip strength was seen after 60 years of age.⁽²⁸⁾ In our study it was observed that there was negative correlation between age and grip strength which was statistically not significant. (r = -0.05, p = 0.5) (Table no 3, Graph no.1)The possible reason for non-significant correlation of grip strength with age, could be that the occupation of the participants can be the reason which was not considered study.

As the age advances use of body parts continues to decrease. However, this decrease in function is relatively less in hands as compared to other body parts.²³The study by Anneli Peolsson *et al* (2001), found non-significant age-related change in grip strength for male and female. This can be possible explanation for the non-significant difference in handgrip strength. Also study by Hackel *et al.* and Bassey & Harris, who reported that in frequently used muscles there was less loss of strength as the age advances.

Handgrip strength decreased by only about 0.5% a year from the age of 30 until 45-49 years of age and thereafter decline accelerated to about 1% a year until the age of 75, followed by an even larger decrease.²³

In agreement with other researchers our study showed that there was positive correlation between BMI and grip strength which was statistically not significant. (r = 0.16, p = 0.06) (Table no.4, Graph no.2)Anthropometric measures are population-dependent and vary from race to race.

Oseloka *et al* (2104) found that there was positive correlation between handgrip strength and BMI

A study by Jasmin N Al -Asadin (2018) there was positive and statistically significant relation between hand grip strength and BMI.²⁵ A study by Rufuse A.Adedoyin *et al* (2009) found a positive and weak correlation between hand grip strength and BMI only in the female gender, with no statistical significance in individuals aged between 20 and 70 years in Nigeria.²⁶

T Kamarul *et al* (2006) found that there was no correlation between grip strength and BMI in Malaysian population in the age group of 18-65 years.²⁷ The possible reason could be that BMI does not reflect body composition (fat mass). Excess weight for greater muscular strength as verified by BMI is not a determinant factor²⁸. Hence, in the present study there was non-significant positive correlation between grip strength and BMI which was supported by the findings of T Kamarul *et al* (2006) and Jasmin N Al –Asadin (2018).

CONCLUSION

Age and BMI were not statistically significant but had negative and positive relation with grip strength respectively. Hence, age and BMI has influence on grip strength and should be considered as important indicators for assessing grip strength.

Limitations

The study was conducted in one geographical area. Occupation of the individuals were not considered. The study was performed in healthy individuals. It is assumed that these results will generalize to individuals with pathology, but this has not been investigated.

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