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Corresponding Author
Eti Mantri,
Department of Anatomy, Index Medical College Hospital and Research Centre, Malwanchal University, Indore Madhya Pradesh, India

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Comparison and Measurement of Hand Anthropometric and Hand Grip Strength in Intellectual Disabled Person

Eti Mantri and Sudha Shrivastav
Department of Anatomy, Index Medical College Hospital and Research Centre, Malwanchal University, Indore Madhya Pradesh, India

ABSTRACT
There are various factors that have an impact on the hand grip strengths of the individuals which has a difference in the case of intellectually disabled people. In this study, the factors affecting the hand grip strengths of the people who are intellectually disabled have been taken into consideration. About 200 participants have been considered for the study and the data collection which is based on the hand grip strengths that have been measured using primary data collection. The findings of the data collection have been analysed using statistical analysis through "IBM SPSS Statistical Tool". Inferential statistical tests have been used to derive the correlation between the factors and the hand grip means. All the findings have been interpreted in order to derive the type and degree of relationships that exist between these variables.

INTRODUCTION

The factor of gripping strength has been considered a vital function of the hands as it is required for significant daily activities. In this study, the hand grip strength of intellectually disabled or mentally retarded individuals from India has been evaluated using statistical analysis. Different factors such as age, weight, height and other anthropometric measurements of the hands of the participants have been considered for evaluating the effect of such factors on hand grip strength. The interpretations have been done according to the coefficients that have been derived for each of the statistical tests done for different variables.

MATERIALS AND METHODS

In this study, the data collection has been done using the primary method of data collection from 200 participants from the region of India. The measurements of hand grips have been taken using an "Camry Digital Hand Dynamometer" for both hands. Further, the age, weight and anthropometric measurements of the hands have been taken. The grips of both the hands of each participant have been measured in three trials with Consecutive breaks between the trials. The means of the hand grip strengths have been calculated in order to get a more accurate reading of the grip strengths. In order to facilitate the evaluation of the relationships of different variables with the hand grip strengths, statistical analysis has been done using inferential statistical tests using "IBM SPSS Statistical Tool".

RESULTS

The derivations from the statistical tests in the form of the coefficients of correlations and compared means, the interpretations have been provided in this section. It includes the test results and the outputs that have been computed using SPSS and the correlations between each of the variables.

Correlation between the anthropometric measurements and hand grip strength of right hand: According to the depictions from the correlation between the anthropometric measurements of the right hand and its gripping strength it has been found that there is a relationship between the variables. It has been inferred from the correlation coefficient of the relationship between right-hand length and hand grip that the value is 0.375. On the other hand, the coefficient of the correlation between right-hand breadth and hand grip has been computed at 0.515. This shows that there is a statistical significance derived between the anthropometric measurements and the hand grip means of the right hand (Table 1)[1].

In Fig. 1, graphical interpretation, it has been derived that there is a positive correlation between the breadth of the right hand and the hand grip strength. This has been derived from the line that has been observed to be sloping upwards towards the left[2]. The clustered scatter plots around the line infer the correlation existing between the two variables.

Considering the outputs derived from the Table 2 it can be depicted that there is a significant correlation between the anthropometric measurements and the hand grip mean of the left hand as well. The correlation coefficient between the variables of left-hand length and hand grip mean has been computed at 0.332 and that between left-hand breadth and hand grip mean has been derived at 0.454. This shows that there is a statistical significance in both the correlation coefficients at a significance level of 0.01. Hence, it can be depicted that the hand grip strength of the left hand has a positive correlation

Table 1: Pearson's correlation analysis of the anthropometric measurements and the hand grip means of the right hand

Correlations		Intellectual_Disabled_Person_ Mentally_Retarded_Anthropometric_ Measurement_Right_Hand_Length	Intellectual_Disabled_Person_ Mentally_Retarded_Anthropometric_ Measurement_Right_Hand_Breath	Intellectual_Disabled_Person_ Mentally_Retarded _Hand_ Grip_Right_Hand_Mean
Intellectual_Disabled_Person _Mentally_Retarded_Anthropometric_ Measurement_Right_Hand_Length	Pearson correlation	1	0.650**	0.375**
	Sig. (2-tailed)		0.000	0.000
	N	200	200	200
Intellectual_Disabled_Person_Mentally_ Retarded_Anthropometric_Measurement _Right_Hand_Breadth	Pearson correlation	0.650**	1	0.515**
	Sig. (2-tailed)	0.000		0.000
	N	200	200	200
Intellectual_Disabled_Person_ Mentally_ Retarded_Hand_Grip_ Right_Hand_Mean	Pearson Correlation	0.375**	0.515**	1
	Sig. (2-tailed)	0.000	0.000	
	N	200	200	200

**Correlation is significant at the 0.01 level (2-tailed)

Table 2: Pearson's correlation analysis of the anthropometric measurements and the hand grip means of the left hand

Correlations		Intellectual_Disabled_Person_ Mentally_Retarded_Anthropometric_ Measurement_Left_Hand_Length	Intellectual_Disabled_Person_ Mentally_Retarded_Anthropometric_ Measurement_Left_Hand_Breadth	Intellectual_Disabled_Person_ Mentally_Retarded_Hand_ Grip_Left_Hand_Mean
Intellectual_Disabled_Person_ Mentally_Retarded_Anthropometric_ Measurement_Left_Hand_Length	Pearson correlation	1	0.706**	0.332**
	Sig. (2-tailed)		0.000	0.000
	N	200	200	200
Intellectual_Disabled_Person_ Mentally_Retarded_Anthropometric_ Measurement_Left_Hand_Breadth	Pearson correlation	0.706**	1	0.454**
	Sig. (2-tailed)	0.000		0.000
	N	200	200	200
Intellectual_Disabled_Person_ Mentally_Retarded_Hand_Grip_ Left_Hand_Mean	Pearson correlation	0.332**	0.454**	1
	Sig. (2-tailed)	0.000		0000
	N	200	200	200

**Correlation is significant at the 0.01 level (2-tailed)

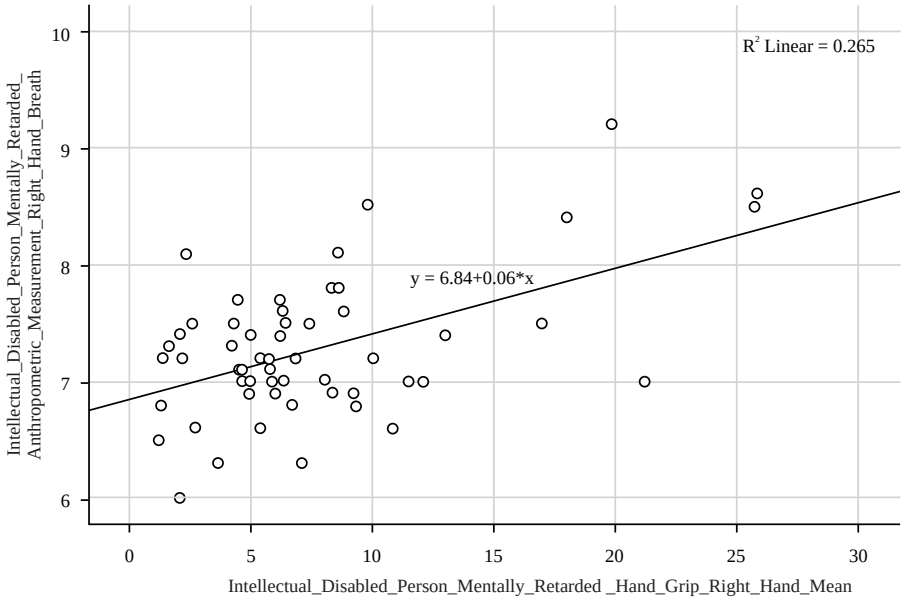

Fig. 1: Graphical interpretation of the correlation between anthropometric measurements and the hand grip means of the right hand

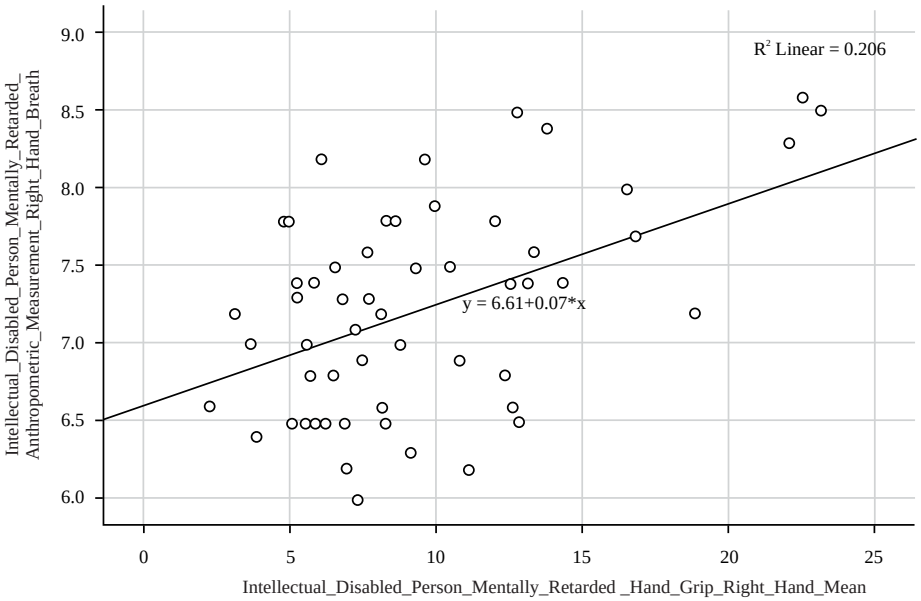

Fig. 2: Graphical interpretation of the correlation between anthropometric measurements and the hand grip means of the left hand

with the anthropometric measurement[3]. Moreover, it has been found that the statistical significance, in this case, is at a higher degree compared to that of the right hand.

Analysing the scattered plot derived from the correlation between the breadth of the left hand and the hand grip mean shows that there is a positive correlation between the variables. However, in this case, the correlation has been observed to be higher than that of the right hand. This shows that there is a dominance of the left hand in the case of intellectually disabled people[4]. This is because the breadth of the left hand of these participants has been found to be more than the right hand (Fig. 2).

Correlation between palm ratio, shape index and hand grip means: According to the output derived from the correlation analysis of the left-hand shape index and the hand grip mean it has been found that the coefficient is 0.230. On the other hand, the

Table 3: Pearson's correlation analysis of the palm ratio, shape index and the hand grip means of the right hand

Correlations		Intellectual_Disabled_Person_ Mentally_Retarded_Anthropometric_ Measurement_Left_Hand_Length	Intellectual_Disabled_Person_ Mentally_Retarded_Anthropometric_ Measurement_Left_Hand_Breadth	Intellectual_Disabled_Person_ Mentally_Retarded_Hand_ Grip_Left_Hand_Mean
Intellectual_Disabled_Person_	Pearson correlation	1	-0.997**	0.230**
Mentally_Retarded_Anthropometric_	Sig. (2-tailed)		0.000	0.001
Measurement_Right_Hand_Shape_Index	N	200	200	200
Intellectual_Disabled_Person_Mentally_	Pearson crrelation	-0.997**	1	-0.206**
Retarded_Anthropometric_Measurement_	Sig. (2-tailed)	0.000		0.004
Right_Hand_Palm_Ratio	N	200	200	200
Intellectual_Disabled_Person_Mentally	Pearson crrelation	0.230**	-0.206**	1
_Retarded_Hand_Grip_Right	Sig. (2-tailed)	0.001	.004	
_Hand_Mean	N	200	200	200

**Correlation is significant at the 0.01 level (2-tailed)

Table 4: Pearson's correlation analysis of the palm ratio, shape index and the hand grip means of the left hand

Correlations		Intellectual_Disabled_Person_ Mentally_Retarded_Anthropometric_ Measurement_Left_Hand_Length	Intellectual_Disabled_Person_ Mentally_Retarded_Anthropometric_ Measurement_Left_Hand_Breadth	Intellectual_Disabled_Person_ Mentally_Retarded_Hand_ Grip_Left_Hand_Mean
Intellectual_Disabled_Person_	Pearson crrelation	1	-0.997**	0.231**
Mentally_Retarded_Anthropometric_	Sig. (2-tailed)		0.000	0.001
Measurement_Left_Hand_Shape_Index	N	200	200	200
Intellectual_Disabled_Person_Mentally_	Pearson crrelation	-0.997**	1	-0.234**
Retarded_Anthropometric_Measurement	Sig. (2-tailed)	0.000		0.001
_Left_Hand_Palm_Ratio	N	200	200	200
Intellectual_Disabled_Person_	Pearson crrelation	0.231**	-0.234**	1
Mentally_Retarded_Hand_	Sig. (2-tailed)	0.001	0.001	
Grip_Left_Hand_Mean	N	200	200	200

*Correlation is significant at the 0.01 level (2-tailed)

Table 5: Pearson's correlation analysis of the age, height, weight and hand grip means of both Hands

		Intellectual_Disabled _Person_Mentally_ Retarded_Age	Intellectual_Disabled _Person_Mentally_ Retarded_Weight	Intellectual_Disabled _Person_Mentally_ Retarded_Height	Intellectual_Disabled_ Person_Mentally_ Retarded_ Hand_Grip_ Right_ Hand_Mean	Intellectual_Disabled_ Person_Mentally_ Retarded_Hand_ Grip_Left_Hand_Mean
Intellectual_Disabled	Pearson	1	0.202**	0.190**	0.041	0.265**
_Person_Mentally_	Correlation	Sig. (2-tailed)	0.004	0.007	0.564	0.000
Retarded_Age	N	200	200	200	200	200
Intellectual_Disabled_	Pearson	0.202**	1	0.480**	0.162*	0.329**
Person_Mentally_	Correlation	Sig. (2-tailed)	0.004	0.000	0.022	0.000
Retarded_Weight	N	200	200	200	200	200
Intellectual_Disabled	Pearson	0.190**	0.480**	1	0.187**	0.315**
_Person_Mentally_	Correlation					
Retarded_Height	Sig. (2-tailed)	0.007	0.000		0.008	0.000
	N	200	200	200	200	200
Intellectual_Disabled_	Pearson	0.041	0.162*	0.187**	1	0.670**
Person_Mentally_	Correlation					
Retarded_Hand_Grip	Sig. (2-tailed)	0.564	0.022	0.008		0.000
_Right_Hand_Mean	N	200	200	200	200	200
Intellectual_Disabled_	Pearson	0.265**	0.329**	0.315**	0.670**	1
Person_Mentally_	Correlation					
Retarded_Hand_Grip_	Sig. (2-tailed)	0.000	0.000	0.000	0.000	
Left_Hand_Mean	N	200	200	200	200	200

**Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed)

correlation coefficient derived between the palm ratio and the hand grip mean has been computed at -0.206. This shows that in both cases, there is a correlation prevailing between the variables based on the statistical significance that has been observed at a significance level of 0.01[5]. However, it has been analyzed that there is a positive correlation between shape index and hand grip but a negative correlation between palm ratio and hand grip (Table 3).

It has been derived from the computed correlation coefficient of the relationship between shape index and hand grip means that the value has been found to be 0.231. Hence, it can be inferred that there is a positive correlation between the two variables. Moreover, the coefficient correlation between the variables of palm ratio and hand grip means has been derived at -0.234, which shows a negative relationship between the variables. Hence, it can be depicted that there exists a similar kind of correlation in the case of the left hands of the intellectually disabled participants as has been observed in the case of the right hand (Table 4).

Correlation between age, height, weight and hand grip means: According to the output derived from the correlation analysis between the variables of age and hand grip mean it has been depicted that the coefficient is 0.041. Further, the correlation coefficient between the weight and hand grip mean has been depicted at 0.162 and that between height and hand grip mean has been found to be 0.187. This shows that there is a significant correlation between height and weight and the hand grip mean of the right hand of intellectually disabled people (Table 5).

In the case of the left hand, it has been derived that there is a statistically significant correlation coefficient that has been observed between the age, weight, height and hand grip means of the left hand at a significance level of 0.01. Hence, the relationship has been found to be significant in the case of the left hand for all the variables in a positive aspect.

Hand grip mean differences between the groups of gender: It has been depicted from the T-test of independent samples done in the above output that

Table 6: Difference between the hand grips of males and females in intellectually disabled people

Group Statistics	Intellectual_Disabled_Person_Mentally_Retarded_Gender	No.	Mean	Std. deviation	Std. error mean
Intellectual_Disabled_Person_ Mentally_Retarded_Hand_ Grip_Right_Hand_Mean	Male	92	9.0819	7.08658	0.73883
	Female	108	6.3241	2.84513	0.27377
Intellectual_Disabled_Person_ Mentally_Retarded_Hand_ Grip_Left_Hand_Mean	Male	92	11.3638	5.37651	0.56054
	Female	108	7.7602	2.79955	0.26939

where the males and females have been considered for depicting the differences in the hand grips. According to the coefficients observed in the above table it has been found that there is a very slight difference between the hand grips of the two genders as the p-values have been depicted at 0. Further, the F-statistic in the case of the right hand has been found to be 54.6 and in the case of the left hand has been found to be 46.1. This shows that the hand grips of the participants differ very less based on their gender (Table 6)[5].

Additional findings: Considering the statistical outputs derived in each of the cases, it has been found that the hand grip means of the participants are related to almost all of the variables that have been considered for the study. However, it has been found that there is a significant dominance of the left hand of intellectually disabled people. Moreover, it has been found that the variables of age, weight and height of the participants and the hand grip means are correlated more in the case of the left hand. This shows that the dominance of the left hand is more in this case.

DISCUSSIONS

It has been derived from the statistical outputs derived from SPSS that there is a significant relationship between the anthropometric measurements of the hands and the hand grips. This has been depicted in the case of both hands, which shows that there is a significant relationship between the length, breadth and hand grip means. The positive correlation between the variables shows that if the length and breadth of the hand are more, it has resulted in a better hand grip for the intellectually disabled participants. Moreover, it has been found that there is a significant correlation between the weight and height of the participants and the hand grip means of the right hand. However, in the case of the left hand, there is a positive correlation between all the variables of age, weight and height with the hand grips. This shows that if the weight and height of the participants are more, it leads to a better hand grip and the young aged participants have more gripping strength.

It has also been found that the results of the relationship between the shape index of the palms and the hand grip mean have been derived from a positive correlation. This infers that if the shape index of the palms is more, it leads to a higher gripping strength of the individuals. On the other hand, it has been found that there is a negative correlation between the palm ratios and the hand grip means of the participants[2]. This shows that as the palm ratio of the participants is more then there is less gripping strength and as the palm ratio is less it results in higher gripping strength. It has also been found that there is a similarity in the hand grip strengths of the males and females in the participants. This shows that the gripping strength of the participants does not differ in the aspect of gender and it is just the anthropometric measurements and the weight of the participant which affects the gripping strength more.

According to the depiction of the results of the statistical output, it can also be inferred that the left hand of the participants is more dominant than the right hand. This has been analyzed from the breadth of the left hands that have been procured during the measurements which have been found to be higher compared to the right hand. This shows that there is more gripping strength for intellectually disabled people in the left hand as the factor of the breadth of the palm affects the gripping strength of the hands. This has a significant relationship based on the effects of the variables that have been considered impactful variables on the strength of the hand grips.

CONCLUSION

It has been concluded from the findings depicted in the statistical outputs that the relationship between the variables that have been taken into consideration and the hand grip strengths. It has been found that there is a positive correlation between the anthropometric measurements and the hand grips of the participants in the case of both hands. This shows that the length and breadth of the individuals are significant factors that affect the hand grip means of the individuals. The weight and age of the participants have also been found to be related to the hand grip means. Further, no significant differences have been found in the hand grip means of the males and females.

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