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Measure Hand Grip Strength and Hand Anthropometric in Intellectual Disabled Person and Compare Without Intellectual Disabled Person in Indian Population

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ABSTRACT
The strength of hand grips of human beings differs according to different factors prevailing in the body. In this aspect, the study has been aligned to the objective of finding out the differences in the hand grip strengths of intellectually disabled and non-intellectually disabled people. The age group has been maintained in the groups of participants to be younger in the case of intellectually disabled people and older in the case of non-intellectually disabled people. The factors subsequent to the influence of strength of the hand grips such as age, weight, height and anthropometric measurements of the hands of the participants have also been included in the derivation. The usage of statistical tests, especially inferential statistical analyses has been involved in the evaluation of the hand grips of the participants. The findings have been discussed according to the facts that have been obtained in the evaluation of the data procured from 400 participants in the Indian region.

INTRODUCTION

Different aspects of intellectual disability have been identified in the population of India based on the prevailing situations in the country. The evaluation that has been done in the report is based on the impacts of intellectual disability on the hand grip of individuals. Further, the hand grip of the individuals has also been assessed for old age people with no intellectual disorder.

MATERIALS AND METHODS

In order to derive the desired results from the data procured from both the groups, out of which one includes the intellectually disabled people and the other contains the old age non-intellectually disabled people. The age limit of the mentally retarded people has been kept at 18-40 years. On the other hand, the age group of the non-intellectual people has been set at 52-80 years. Correlations between these two groups have been depicted according to the hand grips and the relative anthropometric measurements of the hands of each of the groups. The factors of strength in the hand grip have been determined to identify the relative differences between the groups. SPSS has been used to determine the outputs of the evaluation considered for the study.

RESULTS

The findings of the study have been mentioned in this section based on the outputs that have been derived from the inferential statistical tests in SPSS. Various perspectives of the findings have been compared in the following subsections according to the research objective.

Correlation between the intellectually disabled and non-intellectually disabled people: In order to derive the relationship between the different aspects of hand grip and anthropometric measurement based on intellectual disability and older people, correlation analysis has been evaluated. The factors of the "shape index" and "palm ratio" of the participants have been considered for depicting the relationship between the values of both groups.

The correlation coefficients have been depicted in the above output to be based on the comparison between the groups that have been included in the evaluation of the study. According to the results that have been derived from the Table 1, it has been depicted that there is a statistical significance in the coefficients at the significance level of 0.01. It has been found that the coefficient has been depicted at -0.230 between the right-hand shape indices of intellectually disabled and non-intellectually disabled participants. According to the derivation of the outputs that have been found in the case of the right-hand palm ratio.

Table 1: Correlation between the shape index and palm ratios of the intellectually disabled and non-intellectually disabled participants

Correlations		ID AM RH SI	Non-ID AM RH SI	ID AM RH PR	Non = ID AM RH PR	ID AM LH SI	Non-ID AM LH SI	ID AM LH PR	Non-ID AM LH PR
ID AM RH SI	Pearson correlation	1	-230**	-0.997**	-217**	-0.419**	-0.210**	-0.401**	-0.206**
	Sig. (2 tailed)		0.001	0.000	0.002	0.000	0.003	0.000	0.003
	N	200	200	200	200	200	200	200	200
Non-ID AM RH SI	Pearson Correlation	-0.230**	1	0.236**	-0.997**	-0.207**	0.670**	0.214**	-0.671**
	Sig. (2 tailed)	001		0.001	0.000	0.003	0.000	0.002	0.000
	N	200	200	200	200	200	200	200	200
ID AM RH PR	Pearson Correlation	-0.997**	0.236**	1	-0.224**	-0.403**	0.216**	0.385**	-0.212**
	Sig. (2 Tailed)	000	0.001		0.001	0.000	0.002	0.000	0.003
	N	200	200	200	200	200	200	200	200
Non-ID AM RH PR	Pearson Correlations	-217**	-0.997**	-0.224**	1	0.204**	-0.669**	-0.213**	0.661**
	Sig. (2 tailed)	002	0.000	0.001		0.004	0.000	0.002	0.000
	N	200	200	200	200	200	200	200	200
ID AM LH SI	Pearson Correlation	0.419**	-0.207**	-0.403**	0.204**	1	0.000	-0.997**	-0.002
	Sig (2 Tailed)	0.000	0.003	0.000	0.004		0.995	0.000	0.976
	N	200	200	200	200	200	200	200	200
Non-ID AM LH SI	Pearson Correlation	-0.210**	0.679**	0.216**	-0.669**	0.000	1	0.003	0.-996**
	Sig (2 Tailed)	0.003	0.000	0.002	0.000	0.995		0.966	0.000
	N	200	200	200	200	200	200	200	200
ID AM LH PR	Pearson Correlation	-0.401**	0.214**	0.385**	-0.213**	0.997**	0.003	1	-0.002
	Sig.(2 tailed)	0.003	0.000	0.003	0.000	0.976	0.000	0.983	
	N	200	200	200	200	200	200	200	200
Non- ID AM LH PR	Pearson Correlation	0.206**	-0.671**	-0.212**	0.661**	0.-002	-0.996**	-0.002	1
	Sig.(2 tailed)	0.003	0.000	0.003	0.000	0.976	0.000	0.983	
	N	200	200	200	200	200	200	200	200

**Correlation is significant at the 0.01 level (2 tailed), ID: Intellectual disabled, AM: ANthropometric measurement, RH: Righthand, LH: Left hand, SI: Shape index and PR: Palm ratio

This has been derived from the correlation coefficient of -0.224, which is statistically significant at the significance level of 0.01.

In the case of the left hand, it has been found that there is a statistical significance depicted based on the coefficients computed. This is also depicted from the output that the coefficients of the palm ratios that have been derived in the case of the left hand are significant at a 0.01 level of significance[1]. Hence, it can be inferred that the results derived from the correlation analysis show that the anthropometric measurements of the older age non-intellectually disabled participants and the intellectually disabled people are significant based on the statistical outputs of the participants. Moreover, it has been depicted that there is a difference in the case of the left-hand measurements where differences have been depicted. This is because, in the case of intellectually disabled people, there is a factor of the dominance of the left hand more than the right[2].

According to the correlation analysis derived in the Table 2, it has been found that the coefficient computed for the relationship between the hand grip mean of the right hand of both the groups is -0.49. This shows that there is a statistical significance in the coefficient computed at a significance level of 0.01. Further, it has been derived that in the case of the left hand, there is significant relevance based on the statistical significance that has been derived. This has been inferred based on the first, second and third trials of grip strengths that have been measured for the participants of both groups[3]. It has also been found that the correlation coefficients of the hand grip means are based on the relative strengths of both the groups that have been considered for the study.

Correlation between anthropometric measurement and hand grip: The correlation analysis and the measurements that have been observed in the Table 3 output show that there is a significant relationship between the anthropometric measurements of the palms and the hand grip means. It has been found that the coefficients that have been depicted in the case of the relationship between length and hand grip mean of the right hand is 0.375 and that of breadth and hand grip mean is 0.515. The coefficients have been found to be statistically significant based on the significance level of 0.01. Further, it has been found that there is a statistical significance in the coefficients derived in the case of the left hand[2]. It has been derived that the coefficient between the length and breadth of the hand grip mean is 0.332 and 0.454. The coefficients are also statistically significant aligned to the significance level of 0.01.

Table 2: Correlation analysis between the hand grips of the intellectually disabled and non-intellectually disabled participants

Correlations

		ID HG RH mean	Non-ID HG RH mean	ID HG LH mean	Non-ID HG LH mean
ID HG RH mean	Pearson correlation	1	-0.049	0.670**	-0.075
	Sig. (2tailed)		0.488	0.000	0.288
	N	200	200	200	200
Non-ID HG RH mean	Pearson correlation	-0.049	1	-0.039	0.925**
	Sig. (2 tailed)	0.488		0.580	0.000
	N	200	200	200	
ID HG LH mean	Pearson correlation	0.670**	0.039	1	-0.032
	Sig.(2 tailed)	0.000	0.580		0.648
	N	200	200	200	200
Non-ID HG LH mean	Pearson correlation	-0.075	0.925	-0.032	1
	Sig.(2 tailed)	0.288	0.000	0.648	
	N	200	200	200	200

**Correlation significant at the 0.01 level (2tailed), ID: Intellectual disabled , HG: Hand grip, RH:Right hand and LH: Left hand

Table 3: Correlation analysis between the anthropometric measurements and hand grips of intellectually disabled participants

		ID AM RH length	ID AM RH breadth	ID HG RH mean	ID AM LH length	ID AM LH breadth	ID HG LH mean
ID AM RH length	Pearson coefficient	1	0.650**	00.375**	00.917**	00.694**	00.395**
	Sig. (2 tailed)		0.000	00.000	00.000	00.000	00.000
	N	200	200	200	200	200	200
ID AM RH breadth	Pearson coefficient	00.650**	1	00.515**	00.689**	00.769**	00.412**
	Sig. (2 tailed)	00.000		00.000	0.000	0.000	0.000
	N	200	200	200	200	200	200
ID HG RH mean	Pearson coefficient	00.375**	00.515**	1	0.300**	0.450**	0.670**
	Sig. (2 tailed)	00.000	00.000	00.000	0.000	0.000	0.000
	N	200	200	200	200	200	200
ID AM LH length	Pearson coefficient	00.917**	00.698**	00.300**	1	0.706**	0.332**
	Sig. (2 tailed)	00.000	00.000	00.000	0.000	0.000	0.000
	N	200	200	200	200	200	200
ID AM LH breadth	Pearson coefficient	00.694**	00.769**	00.450**	0.706**	1	0.454**
	Sig. (2 tailed)	00.000	00.000	00.000	0.000	0.000	0.000
	N	200	200	200	200	200	200
ID HG mean	Pearson coefficient	00.395**	00.412**	00.670**	0.332**	0.454**	1
	Sig. (2 tailed)	00.000	00.000	00.000	00.000	0.000	0.000
	N	200	200	200	200	200	200

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

In the case of the non-intellectual disabled participants, it has been found that there is a significant relationship between the length and hand grip mean based on the correlation coefficient of 0.303. The correlation coefficient derived between the breadth and hand grip mean has been derived at 0.421. Further, in the case of the correlation between the length and the breadth of the left hand with the hand grip mean is 0.317 and 0.474 respectively. This shows that there is a statistical significance between the variables that have been considered for the evaluation of the left hand. Hence, in both cases, it has been found that there is a statistical significance in the correlation coefficients computed for the variables[4]. It has been derived that there is a substantial relationship between the variables of anthropometric measurements and the hand grip means of the non-intellectually disabled participants (Table 4).

Correlation between the age, height, weight and hand grip: It can be analysed from the Table 5 output that the correlation coefficient between the right-hand grip mean and height is 0.187. This shows that there is a statistical significance found in the case of these two variables. It has also been found that there is a statistical significance established in the case of the relationship between the left-hand grip mean and the height and weight of intellectually disabled participants[5]. The coefficients in this case have been derived at 0.315 and 0.329 respectively for height and weight. All statistical significance has been derived based on the significance level of 0.01.

Considering the outputs derived in the Table 6, it has been found that there is a relationship between the weight and the right-hand grip means of the non-intellectually disabled participants. This has been derived from the computed coefficient of 0.434, which is statistically significant based on the significance level of 0.01. The same has been derived in the case of the relationship between weight and hand grip mean of the left hand. The coefficient in this case has been computed at 0.355. Hence, there is a relationship between the weight and the hand grip means of the participants in this case.

Difference between male and female hand grip of both intellectually disabled and non-intellectual disabled: According to the observations derived in the Table 7, it has been found that there is a similarity in the grip means of both genders based on the F-statistic that has been computed. This has been found that the value has been derived at 57.67 for equal variances and 51.92 for unequal variances. Further, the t-test coefficient has been derived at 4.12 for equal variances and 3.83 for unequal variances. The same has been observed in the case of left-hand coefficients that have been derived.

Table 4: Correlation analysis between the anthropometric measurements and hand grip means of non-intellectually disabled participants

Correlations

		Non-ID AM RH length	Non-ID AM RH breadth	Non-ID RH mean	Non-ID AM LH length	Non-ID AM LH breadth	Non-ID LH mean
Non-ID AM RH Length	Pearson coefficient	1	0.491**	0.303**	0.826**	0.526**	0.283**
	Sig.(2 tailed)		0.000	0.000	0.000	0.000	0.000
	N	200	200	200	200	200	200
Non-ID AM RH Breadth	Pearson coefficient	0.491**	1	0.421**	0.504**	0.855**	0.453**
	Sig. (2 tailed)	0.000		0.000	0.000	0.000	0.000
	N	200	200	200	200	200	200
Non-ID RH Mean	Pearson coefficient	0.303**	0.421**	1	0.290**	0.411**	0.925**
	Sig.(2 tailed)	0.000	0.000		0.000	0.000	0.000
	N	200	200	200	200	200	200
Non-ID AM LH Length	Pearson Coefficient	0.826**	0.504**	0.290**	1	0.530**	0.317**
	Sig. (2 tailed)	0.000	0.000	0.000		0.000	0.000
	N	200	200	200	200	200	200
Non-ID AM LH Breadth	Pearson coefficient	0.526**	0.855**	0.411**	0.530**	1	0.474
	Sig.(2 tailed)	0.000	0.000	0.000	0.000		0.000
	N	200	200	200	200	200	200
Non-ID LH Mean	Pearson Coefficient	0.283**	0.453**	0.925**	0.317**	0.474**	1
	Sig.(2 tailed)	0.000	0.000	0.000	0.000	0.000	
	N	200	200	200	200	200	200

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

Table 5: Correlation analysis between age, height, weight, and hand grip means of intellectually disabled participants

Correlations

		ID person age	ID person height	ID person weight	ID HG RH mean	ID HG LH mean
ID person age	Pearson coefficient	1	0.190**	0.202**	0.041	0.285**
	Sig. (2 tailed)		0.007	0.004	0.564	0.000
	N	200	200	200	200	200
ID person height	Pearson coefficient	0.190**	1	0.480**	0.187**	0.315**
	Sig. (2 tailed)	0.007		0.000	0.008	0.000
	N	200	200	200	200	200
ID person weight	Pearson coefficient	0.202**	0.480**	1	0.162**	0.329**
	Sig. (2 tailed)	0.004	0.000		0.022	0.000
	N	200	200	200	200	200
ID HG RH mean	Pearson coefficient	0.041	0.187**	0.162*	1	0.670**
	Sig. (2 tailed)	0.564	0.008	0.022		0.000
	N	200	200	200	200	200
ID HG LH mean	Pearson coefficient	0.265**	0.315**	0.329**	0.670**	1
	Sig. (2 tailed)	0.000	0.000	0.000	0.000	
	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), ID: Intellectual disabled, HG: Hand grip, RH: Right hand and LH: Left hand

Table 6: Correlation analysis between age, height, weight, and hand grip means of non-intellectually disabled participants

Correlations

		Non-ID person age	Non-ID person weight	Non-ID person RH mean	Non-ID person LH mean
Non-ID person age	Pearson coefficient	1	0.314**	0.030	0.049
	Sig. (2 tailed)		0.000	0.668	0.488
	N	200	200	200	200
Non-ID person weight	Pearson coefficient	-0.314**	1	0.434**	0.355**
	Sig. (2 tailed)	0.000		0.000	0.000
	N	200	200	200	200
Non-ID person RH mean	Pearson coefficient	0.030	0.434**	1	0.925**
	Sig. (2 tailed)	0.668	0.000		0.000
	N	200	200	200	200
Non-ID person LH mean	Pearson coefficient	-0.049	0.355**	0.925**	1
	Sig. (2 tailed	0.488	0.000	0.000	
	N	200	200	200	200

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

Table 7: Differences between the hand grips based on gender for intellectually disabled participants

Group statistics

	ID gender	N	Mean	Std. deviation	Std. error mean
ID HG RH mean	Male	88	9.4008	7.08259	0.75501
	Female	108	6.3241	2.84513	0.27377
ID HG LH mean	Male	88	11.3106	5.49274	0.58553
	Female	108	7.7602	2.79955	0.26939

Independent sample test

		Levene's test for equality of variance		t-test for equality of mean						
									95% confidence interval of the difference	
		F	Sig	t	df	Sig (2-tailed)	Mean difference	Std. error difference	Lower	Upper
ID HG RH mean	Equal variances assumed	57.679	0.000	4.126	194	0.000	3.07668	0.74566	1.60605	4.54732
	Equal variances not assumed			3.831	109.839	0.000	3.07668	0.80311	1.48508	4.66829
ID HG LH mean	Equal variances assumed	51.924	0.000	5.851	194	0.000	3.55042	0.60677	2.35370	4.74714
	Equal variances not assumed			5.509	123.239	0.000	3.55042	.064453	2.27465	4.82619

Considering the outputs derived in the Table 8, it has been found that there is a derivation of the gender-based difference that has been depicted in the above table. The values that have been found to be correlated in the case of the left-hand grip mean of the males and females have been found to be similar. This has been found that there is a depiction of the values of the t-test statistic that has been computed for the equal and unequal variances derived from the evaluation. It has been analyzed from the results that the strengths of the hand grips of each of the participants according to the depiction of the t-test statistic.

Depiction of hand dominance by knowing the hand grip: The hand grip of the participants can be depicted to derive hand dominance based on the hand grip means. It can be observed by the intensity of the values of each of the hands of the participants compared to the others based on dominance. According to the observations of the values of the hand grip means the values of some participants can be depicted to be having lower values compared to other participants. This shows that the hand is not dominant for the participant and the same value is depicted to be higher compared to others for the other hand. This infers that there is less dominance on the

Table 8: Differences between the hand grips based on gender for non-intellectually disabled participants

Group statistics

	Non-ID person gender	N	Mean	Std. deviation	Std. error mean
Non-ID HG RH mean	Male	114	15.3655	7.27300	0.68118
	Female	86	8.9771	4.10491	0.44264
Non-ID HG LH mean	Male	114	13.9222	5.97742	0.55984
	Female	86	8.4659	3.62144	0.39051

Independent sample test

		Levene's test for equality of variance		t-test for equality of mean 95% confidence interval of the difference						
		F	Sig.	t	df	Sig (2-tailed)	Mean difference	Std. error difference	Lower	Upper
Non-ID HG RH mean	Equal variances assumed	65.328	0.000	7.312	198	0.000	6.38837	0.87373	4.66535	8.11138
	Equal variance not assumed			7.864	184.780	0.000	6.38837	0.81237	4.78566	7.99107
Non-ID HG LH mean	Equal variance assumed	42.604	0.000	7.489	198	0.000	5.45633	0.72858	4.01956	6.89310
	Equal variance not assumed			7.994	189.9	0.000	5.45633	0.68258	4.10992	6.80274

other hand based on the derived values. This has been depicted from the breadth of the palm and the grip means that have been found in the evaluation of the grip strength.

DISCUSSIONS

Considering the findings that have been derived from the statistical analyses of each of the factors of the study, it can be derived that the hand grip is not dependent on whether the individual is intellectually disabled or not. However, the hand grip and the strength of the hand depend on the dominance of the hand and the gender, age, height and weight of the participants. This shows that if any individual is intellectually disordered, it does not mean that the strength will be less than a person with non-intellectually disabled person. However, there are similarities in some cases where the person who is old is having the same hand grip as that of the intellectually disabled young person. This shows that there is some weakness based on the type of intellectual disorder the person is suffering. Moreover, it has also been derived that the measurement of the hand has a relationship with the hand grips of the individual based on the shape index and palm ratios that are possessed by the participants. This has an inference with the type of hand grip that is found in each of the participants and the findings of the anthropometric measurements of the individuals' hands. The length and breadth of the hands have been considered for such measurements of the values that have been derived for each of the participants. This shows that there is an inference in the hand grips based on the factors that are associated with the effects of intellectual disability and the age of the participants.

CONCLUSION

Thus, it can be concluded that the participants suffering from intellectual disability have less strength than normal individuals. This is based on the finding that there is more strength in non-intellectually disabled people who are older. According to the findings that have been derived from the correlation analysis, it has been observed that the factors of age, height, weight and gender have relevance to the hand grip of the participants. Moreover, it has also been found that there is a relationship between the hand grip and the hand dominance of the participants.

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