

The Effect of Shoulder Position on Hand Grip Strength among University Students

Babar Bashir^{1*}, Arooj Ashfaq¹ and Maryam Altaf

¹University Institute of Physical Therapy, The University of Lahore, Lahore, Pakistan
*babarawan401@gmail.com

Highlights:

- Shoulder position affect the hand grip strength
- There is a statistically significant difference present between hand grip strength measurements of both the genders.
- There is strong positive correlation present between most of the shoulder movements.

Abstract:

Hand grip-strength evaluation is an important variable for assessment of upper extremity deformities. Many studies have observed hand grip-strength in different positions and postures but no importance on further resulting positions that are being utilized in our clinical setups.

Objective:

To evaluate the effect of shoulder position on hand grip strength among university students.

Methodology:

42 (22 males, 20 females) physically healthy and active individuals 22.76 ± 1.96 years old were involved in this study. Study design was cross sectional. Hand grip-strength (kg) using hand grip dynamometer (Jamar dynamometer) was measured in three different positions of shoulder joint after obtaining informed consent. Participants were requested to carry out five seconds maximum contractions in each position. Position of wrist was kept neutral i.e. 0° . Participants were requested to stand with wider base and to increase further stability they were made to stand with the wall behind them. Both right and left hands were tested three times in every position. At the end average was calculated from 3 values and 60 seconds rest interval was also given to the participants.

Results:

Participants with no previous history of

showed that mean right neutral shoulder rotation value of male participants was 77.18 ± 19.23 whereas mean right neutral shoulder rotation value of female participants was 20.20 ± 7.34 kilograms where p-value is <0.001 which showed the presence of statistically significant difference between both the genders. Pearson correlation stated that very strong positive correlation ($r= 0.960$) was present between right neutral shoulder rotation and 90° shoulder abduction in males.

Conclusions:

Shoulder positions affect hand grip strength. There is significant difference present between both the genders and presence of positive correlation has been recorded in shoulder positions which states that shoulder positions affect hand grip strength.

Key Words:

Hand Grip Strength, Healthy Population, Shoulder positions, Hand Grip Dynamometer.

Introduction:

Grip strength is an indicator of several necessary parameters that include energy, nourishment, debility and reduced activity.^{1,2} Thus, Grip Strength (GS) measure necessarily contributes in screening for individuals that may have the benefit of avoidance or early intercession protocol and observation for more diminution.^{2,3} These three positions are handy and can be utilized to evaluate GS: Neutral shoulder rotation, 90° shoulder abduction and 90° strength involving leading as well as non-dominant extremities. According to studies a usual hand grip activity in a disinterested position triggered some muscle groups; infraspinatus and supraspinatus.⁴ GS is being correlative with the upper extremity strength

and overall body strength⁵, at the same time as a quantitative measure of upper limb action.⁶ GS is extensively considered just as a forecaster of purposeful performance⁷ and it is influenced by various factors that include hand dominance, anthropometric indices⁸ and positions of the elbow⁹, shoulder¹⁰, as well as forearm.¹¹ Hand grip dynamometers have been made known as a precise and dependable for estimating GS and they are user friendly.^{12,13} GS measurement is of use in evaluation of those individuals who experience detriments in their everyday life activities, measure of upper extremity function, and efficiency of hand rehabilitation procedures.¹⁴ The value of such an alteration is achieved by comparing individual's GS with well-known normal values. Many factors influence GS it is very important to evaluate GS in such postures that are similar to those utilized in standard researches.¹⁵ Some studies tested Hand Grip Strength (HGS) in two different positions with elbow joint flexed¹⁶ or in unusual postures¹⁷ but they didn't use same organized procedure to evaluate grip in sitting or supine positions. So, the relationship to standard norms can be present when arm position is held constant. To understand when a special individual test can be contrasted with standard examples, we must be aware of such body positions which provide comparable GS value and which one of the positions provides changed GS value. Progression of shoulder muscle's strength is most important outcome of almost every rehab exercise course regarding recovery of impaired shoulder function because it plays a major part in shoulder joint's stability. Continuous observation of these variations facilitates researchers to improvise the rehab protocol whenever needed and support them, in formulating conclusions concerning the patients, go back to pre-injured state. Shoulder injuries arise often in participant who execute overhead activities at various stages of sports.¹⁸ HGS is basic method to evaluate the subject's condition after injuries. A precise, scientific

evaluation of HGS assists the researchers create sensible management objective.¹⁹ Alizadehkhayat *et al.*, proposed in his study that a consistent hand-grip movement in disinterested position increased the activity of GS correlated with upper extremity strength⁴. Julia-Ann Lee *et al.*, carried out a study on how GS is affected by wrist positions. According to this study the maximum GS at the neutral position of wrist is considerably greater than all other five positions of interest.²⁰ The objective of this research was to observe the HGS values acquired from three different testing positions and how these positions significantly affect the GS among group of young healthy males and females and to determine if there are considerable differences for both sexes and for each group in three different testing positions and to determine association between GS values which if present could be employed in rehabilitation and other clinical settings to investigate function of shoulder musculature.

Methodology:

42 physically healthy and active individuals (22 males, 20 females) were recruited from different Universities of Lahore with no past history of any kind of upper extremity, shoulder or neck injury. HGS using Hand grip dynamometer was measured in three different testing positions i.e. neutral shoulder rotation, 90 degree shoulder abduction, 90 degree abduction of shoulder and external rotation after obtaining informed consent. Participants were requested to carry out five seconds maximum contraction in all these positions. Position of wrist was kept neutral i.e. 0 degree. Participants were requested to stand with wider base in such a way that feet should be kept at shoulder width away from each other and to increase stability they were made to stand with wall at the back. Both right and the left hands were tested three times in every position and participants were encouraged verbally to perform maximum contraction. At the end average was calculated from 3 values. There was a rest time of about 60 seconds between every

contraction to avoid fatigue.

Results:

Mean age of participants was 22.76 ± 1.96 years and mean weight of participants was 68.83 ± 15.17 kilograms. Independent t test revealed that there was a statistically significant difference present between both genders. The results indicated the presence of very strong correlation between Right hand neutral shoulder rotation and 90° abduction of right shoulder in males and a strong correlation was seen between right neutral shoulder rotation and 90° abduction and external rotation of right shoulder. There was also a strong correlation present between 90° degree shoulder abduction and 90° abduction and external rotation of right shoulder. There is a statistically significant difference between both the genders for which independent sample t test was used and there is significant difference found (p value <0.001).

Gender		n	Mean	Std. Deviation	t-test	p-value
Right neutral shoulder rotation	Male	22	77.18	19.23	12.44	<0.001
	Female	20	20.20	7.34		
Right 90° shoulder abduction	Male	22	75.02	22.13	11.29	<0.001
	Female	20	16.61	6.97		
Right 90° shoulder abduction and ER	Male	22	68.08	21.92	9.84	<0.001
	Female	20	16.89	8.11		
Left neutral shoulder rotation	Male	22	68.64	13.29	15.61	<0.001
	Female	20	17.06	6.74		
Left 90° shoulder abduction	Male	22	67.01	15.86	13.3	<0.001
	Female	20	16.39	6.44		
Left 90° shoulder abduction and ER	Male	22	64.31	12.65	16.57	<0.001
	Female	20	14.98	4.32		

Table 1: T-test: Presence of statistically significant difference between males and females

Pearson correlation stated the presence of positive correlation among each position of shoulder. Very strong correlation was present between right neutral shoulder rotation and 90° shoulder abduction in males.

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

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

Gender		Right 90 degree shoulder abduction	Right 90 degree shoulder abduction and ER	Left neutral shoulder rotation	Left 90 degree shoulder abduction	Left 90 degree shoulder abduction and ER
Male	Right neutral shoulder rotation	0.960**	0.873**	0.449*	.501*	0.507
	Right 90 degree shoulder abduction		.881**	.521*	.547**	.536**
	Right 90 degree shoulder abduction and ER			.435*	.470*	.417**
	Left neutral shoulder rotation				.877**	.848*
	Left 90 degree shoulder abduction					.822*

Table 2: Pearson correlation

Pearson correlation stated that strong correlation was found between right neutral shoulder rotation and right 90° shoulder abduction in females

Gender		Right 90 degree shoulder abduction	Right 90 degree shoulder abduction and ER	Left neutral shoulder rotation	Left 90 degree shoulder abduction	Left 90 degree shoulder abduction and ER
Female	Right neutral shoulder rotation	0.775**	.666**	0.361	0.371	0.355
	Right 90 degree shoulder abduction		.564**	.168	.27	.159**
	Right 90 degree shoulder abduction and ER			.354	.398	.412**
	Left neutral shoulder rotation				.712**	0.725
	Left 90 degree shoulder abduction					0.764

Table 3: Pearson Correlation

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

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

Discussion:

Previous studies also state that men have increased scores of HGS. It also suggest that there was lot of variation in scores obtained from females and it can be seen in this study as well. There may be some other factors that contribute to variation among females but that need further research to be done on this topic. Studies also verify that different positions of joints can influence HGS particularly the shoulder joint.²¹ As indicated previously in methodology that participants were asked to perform the HGS task in standing position as standing position is expected to provide the highest scores. Preceding studies also agree to this.²² Preceding studies have stated that gender, age affect the GS when being measured with Jamar

dynamometer. These conclusions can be clarified by raise of HGS in both genders was vigorously correlated with varied muscle bulk throughout their adolescence. In real meaning of research verifies that a variety of joint positions can affect GS particularly the shoulder joint.²¹ With the understanding obtained from current research specific intervention protocol can be planned to take care of the patients in a particular upper extremity functioning.

Conclusions:

Shoulder positions affect HGS. There was very strong correlation found in right neutral shoulder rotation and 90° degree shoulder abduction followed by 90° degree shoulder abduction and 90° shoulder abduction with external rotation.

Recommendations:

Upcoming researches are recommended to observe the results of GS dimensions obtained with different angles and positions of shoulder then it may be possible to say that which of the position affects more. Researchers should be aware of the effect of different testing positions on GS evaluation.

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