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Original Article

Assessment of the Correlation Between Hand Grip Strength Test and Seated Medicine Ball Throw Test at 45° Angle Among Physiotherapy Students: An Observational Study

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ABSTRACT

Seated Medicine Ball Throw (SMBT)test at 45 degrees throw angle is used to measure the Upper body power. Measurement of grip strength, is an important component in body strength evaluation and can provide us with a quick assessment of an individual's upper limb strength**.** **Objective** To assess the relationship between handgrip strength and upper body power among physiotherapy students via Digital Handgrip Dynamometer and Seated Medicine Ball throw test respectively. **Methods:** A cross-sectional study was carried out at Shalamar School of Allied Health Sciences, Lahore. This study recruited 45 participants of both gender, age between 18 to 24 years. Peak grip strength of both hands was taken using digital handheld dynamometer in kg. Seated Medicine Ball Throw, also called the medicine ball chest pass was performed by the participants using 2 kg medicine ball. SPSS was used to calculate the correlation of all variables. When the ball is released at 45 degrees, this study found a high association between handgrip strength and Seated Medicine Ball throw distance. SMBT has a mean of 149.7837.14, Right Handgrip Strength has a mean of 21.26kg5.3, and Left Handgrip Strength has a mean of 20.53kg4.69. **Results:** Grip strength left (r=.0.899) and right (r=.871) were found to have a significant link with Seated Medicine Ball throw (SMBT) performance in Pearson product-moment analysis. The dependent variable, SMBT, and the independent variables, HGS and Height, had a strong positive linear association (r=0.908). **Conclusion:** A higher Handgrip strength leads to a longer Throw distance, implying that a stronger Handgrip signifies a stronger Upper body.

INTRODUCTION

Strength is a state of being physically strong. It is the ability to handle a significant amount of force or pressure. A strong physique helps you conduct powerful actions and activities without becoming exhausted [1]. Grip strength is the control of fingers to hold objects and is an important factor when assessing hand function. It is a good analyst of functional decline and disability. The ability to grip things depends highly on the shoulder stability as increased shoulder stability leads to increased handgrip strength [2]. Upper body strength plays a major role in day-to-day activities. It is the ability to perform various tasks, including lifting, pulling, pushing, reaching, and stabilizing. According to previous researches upper body strength can be determined by seated medicine ball throw test (SMBT). The SMBT test only requires a weighted medicine ball and a measuring tape. The distance at which the medicine ball lands indicate the upper body strength that the participant possess [3]. Physiotherapy profession is physically demanding. A therapist needs to engage in activities that require a good amount of upper body strength. While manually handling patients, good upper body strength prevents abnormal posture and injury. For students of physiotherapy, it is important to understand the demands of this profession and their own actual physical fitness.

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Physiotherapy students are future professionals whose attitudes and beliefs should convince their patients to maintain a healthy lifestyle [4]. Many tools are available to measure the handgrip strength. The most commonly used tools include the digital handgrip dynamometer. It is a simple and a practical test that is highly reliable. The use of a digital handgrip dynamometer is a standard approach for determining grip strength and also upper body strength [5]. Researches concluded that medicine ball throw test is easy to learn and master. Medicine ball throw isn't just for sports. It can be used on a wide range of people, including kindergarten children, healthy adults and the elderly [6]. The use of distance thrown in SMBT, is a solid indicator of upper body strength. This test is inexpensive and easy to administer in both indoor and outdoor settings. While various approaches, like motion capture, force plates with motion capture, and a medicine ball with an incorporated accelerometer, can be used to assess SMBT performance and variations, these methods are often more expensive and need more technical expertise. It is crucial to throw the medicine ball at a certain angle to achieve maximum horizontal distance [7]. Several factors influence grip strength and upper body strength which include age, gender, muscle strength, pain, restricted movement, nutritional status, fatigue and anthropometric measures. Hand and upper body strength measurements are used to assess appropriate clinical data designed to utilize in rehabilitation process [8]. Upper limb function is fully reliant on distal functional movement and proximal stability. The proximal stability is provided by parascapular muscles while distal movement depends upon hand musculature. A launch angle of 45° is important to maintain while throwing a certain object as it is considered to produce maximum horizontal throw distance. In this study launch angle of 45° was controlled via videography. Also, there was a need to find applicability of SMBT as an alternate to handgrip strength test to assess physiotherapy students' strength in order to measure where their upper body strength lies and whether they were prepared to meet the professional physical fitness demands that they would face in the employment settings in the near future [9].

METHODS

The study included 46 undergraduate physiotherapy students from the Shalamar Medical and Dental College in Lahore, ranging in age from first to final year. There are 32 female students and 14 male students in the sample. Subjects between the ages of 18 and 25, with a normal BMI and no recent upper-body injuries, were chosen. Subjects who had engaged in strenuous upper body exercise within 48 hours after testing were eliminated, as were those with bodily pain greater than 3 on a numeric pain rating scale. After being instructed verbally on the study protocols, the volunteers were asked to sign a consent form. First, both hands' grip strength was measured. The second test was to throw a medicine ball from a seated position. The individual was seated with his feet flat on the ground and his hips and knees at a 90° angle. The participant was put to the test while holding the dynamometer. The shoulder was kept in adduction with the elbow flexed 90-120°, the wrist extended 0-30 degrees, and the ulnar deviation 0-15°. The dynamometer's base was on the heel of the palm, and the grip was on the middle four fingers. When the person was ready, he or she squeezed the dynamometer maximally isometrically. The value was recorded after the isometric contraction was maintained for 5 seconds. For each hand, three recordings were made [10]. Medicine ball throw test was then carried out. The subject was on the floor in long sitting position, with his back against a wall. The chart paper illustrating the 45° angle was placed on a wall right next to participant. The subject kept his arms parallel to the 45° angle illustrated on the chart while doing a chest pass with the medicine ball held in both hands. The subject threw the medicine ball as vigorously, far and straight forward as he/she could. The subject tossed the medicine ball as hard as he could, as far as he could, and as straight as he could. The entire time, the back was against the wall. It was measured the distance between the heel of the foot and the landing point of the medicine ball. The measurement was taken to the nearest 0.5ft (10cm) increment. A video camera was used to record the entire process. The best three throws result was recorded [3]. Numerical data like age, height and weight were represented in the form of Mean and Standard deviation whereas, qualitative data like gender and handedness were presented in the form of frequency tables (percentage). To determine the link between SMBT and grip strength factors, the Pearson/ Spearman's correlation was used. If the correlation coefficient is close to 1, the co-efficient correlation is good. There is statistically significant association if the p-value is less than 0.05, while there is no statistically significant correlation if the p-value is more than 0.05. For all statistical analysis, a 5% level of significance was used. For a more in-depth look at this association, a basic linear regression was used. A p-value of less than 0.05 is regarded significant, whereas a p-value of more than 0.05 is deemed inconsequential.

RESULTS

A total of 46 physiotherapy students (32 females and 14 males) between the ages of 18 and 25 years were recruited for this study, with an average mean age of 22.26 1.323 years and a standard deviation of 22.26 1.323 years. The

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descriptive statistics of physiotherapy students for SMBT and grip strength factors were determined, as shown in Table 1. The mean of the SMBT is 149.78 37.14. The Grip Strength Left having a mean of 20.53kg± 4.69 and Grip Strength Right having a mean 21.26kg± 5.35. As shown in Table 2, the Pearson's Correlation between Right Handgrip strength with SMBT test at 45° angle is 0.871 which indicates a strong positive correlation. Correlation of left handgrip strength with SMBT test is 0.899. Age in years and BMI have weak negative correlation with SMBT that is -0.387 and -0.492 respectively. As shown in Table 3, Correlation of Right Dominant hand grip strength with Left grip strength is 0.927 and with Seated Medicine Ball throw test is 0.924. This shows the correlation is significant. Correlation of Left Dominant hand grip strength with Right grip strength is 0.955 and with Seated Medicine Ball throw test is 0.857, which shows the correlation is significant.

As shown in Table 4, in Females with Right hand dominance, grip strength Right have a correlation of 0.701 with SMBT and with grip strength Left is 0.733 which shows a moderate correlation. In Males with Right hand dominance, grip strength Right had a correlation of 0.971 with SMBT and that with grip strength Left is 0.39. In Females with Left hand dominance, grip strength Left has a correlation of 0.216 with grip strength Right and that with SMBT is 0.437 which shows a weak correlation. In Males with Left hand dominance, grip strength Left has a correlation of 0.845 with Right grip strength and that with SMBT is 0.788 which shows moderate correlation. As shown in Table 5, there was strong positive linear relationship between dependent variable i.e., SMBT and independent variable i.e., HGS and Height (r=0.908). The equation explains 81.6% of the variation in SMBT by the dependent variables. The model is fit (p-value <0.001). The equation that was developed is as follows: SMBT test =-156.602 +3.937 Dominant Handgrip Strength +1.365 Height in cm. Keeping the effect of dominant handgrip strength and height in cm the SMBT test score would be -156.602. keeping the effect of other variables constant, the unit increase in dominant hand will increase the SMBT test score 3.93 times whereas keeping the effect of others constant, unit increase in height will increase the SMBT 1.365 times Table 1.

Variables	SD	Mean	N
Seated Medicine Ball throw (SMBT)	37.14770	149.7826	46
Right Handgrip Strength	5.35907	21.2652	46
Left Handgrip strength	4.69093	20.5304	46

Table 1: Mean values of SMBT, right and left handgrip strength

pearson Correlation	Body Mass Index	Right Handgrip Strength	Left Handgrip strength	Seated Medicine Ball throw at 45 degrees (SMBT)
Age in years	0.234	-0.516**	-0.299*	-0.387**
Body Mass Index		-0.652**	-0.585**	-0.492**
Right Handgrip Strength			0.858**	0.871**
Left Handgrip strength				0.899**

Table 2: Pearson's Correlation

Dominant Hand		Body Mass Index	Right Handgrip Strength	Left Handgrip strength	Seated Medicine Ball throw test (SMBT)
Right	Age in years	0.112	-0.640**	-0.434*	-0.553**
	Body Mass Index		-0.497**	-0.453*	-0.368*
	Right Handgrip Strength			0.927**	0.924**
	Left Handgrip strength				0.939**
Left	Age in years	0.34	-0.036	0.063	0.215
	Body Mass Index		-0.895**	-0.889**	-0.653**
	Right Handgrip Strength			0.955**	0.780**
	Left Handgrip strength				0.857**

Table 3: Comparison between Right and Left Dominant Hands

Dominant Hand	Gender		Body Mass Index	Right Handgrip Strength	Left Handgrip strength	Seated Medicine Ball throw test
Right	Female	Age in years	-0.031	-.586**	-0.089	-0.392
		Body Mass Index		-0.292	-0.011	0.06
		Right Handgrip Strength			0.733**	0.701**
		Left Handgrip strength				0.776**
	Male	Age in years	-0.452	-0.226	0.466	-0.08
		Body Mass Index		0.462	0.017	0.364
		Right Handgrip Strength			0.39	0.971**
		Left Handgrip strength				0.523
Left	Female	Age in years	0.840**	-0.411	0.202	0.373
		Body Mass Index		-0.681*	-0.233	0.42
		Right Handgrip Strength			0.216	-0.2
		Left Handgrip strength				0.437
	Male	Age in years	0.728**	0.327**	0.743**	0.631**
		Body Mass Index		0.639**	0.784**	0.534**
		Right Handgrip Strength			0.845**	0.763**
		Left Handgrip strength				0.788**

Table 4: Comparison between Genders

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Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	21.346	11.239		1.899	0.064
	Right Handgrip Strength	6.040	0.513	0.871	11.778	0.000
2	(Constant)	-156.602	45.498		-3.442	0.001
	Right Handgrip Strength	3.937	0.687	0.568	5.730	0.000
	height in cm	1.365	0.341	0.397	4.003	0.000
a. Dependent Variable: Seated Medicine Ball throw test						

Table 2: Pearson's Correlation

DISCUSSION

According to our knowledge, it is the first study which measures correlation of handgrip strength and SMBT test at 45° angle among physiotherapy students of Shalamar School of Allied Health Sciences, Lahore. Despite various studies looking at athletes' grip strength, the link between grip strength and upper body performance has remained a mystery. According to Wind et al., the handgrip strength test demonstrates overall muscle strength in a clinical setting [11]. The medicine ball throw test was created to evaluate upper-body strength [12]. According to Harris et al., the SMBT appears to be a very dependable test of upper body power for older persons. Tossing a medicine ball from a seated posture requires muscle strength and power in the shoulder flexors and elbow extensors, hence the SMBT looks to be a very reliable test of upper body power for older adults [3]. The SMBT is a low-cost, safe, and reliable assessment of upper-body strength for older people. Upper-body power did not alter with age because there was no significant association between mean throw distance and age [13] and [14] also found "that age has little bearing on young players' upper-body strength" The purpose of this study was to examine if there was a link between handgrip strength and physiotherapy students' sitting medicine ball throw test at a 45° angle. The findings of this study showed that using a medicine ball with a 45° launch angle, having a stronger handgrip resulted in a greater throw distance. The sitting medicine ball throws (SMBT) test successfully predicted upper body strength of physiotherapy students when the grip strength test was used as a standard test to measure upper body strength and handgrip strength of the participants. These results were consistent with some studies [11]. "Total muscle strength was substantially linked with grip strength, with correlation values ranging from 0.736 to 0.890 ($p < 0.01$)". In this study, the Model summary table reports the strength of the relationship between the Handgrip strength and SMBT (Adjusted R square = 0.839).According to our research it was concluded that restricting the angle of throw at 45° while performing the SMBT, produced much authentic throw distance as it eliminated any throwing errors and purely demonstrated the upper body strength, this result contradicts the study of [7], "Restricted release angle appears to be unnecessary, as some researches have produced reliable results without regulating release angle". Despite the fact that the total mean BMI was within the WHO's normal range, the acquired scores for handgrip strength and the Seated Medicine Ball toss test were below the average for age-adjusted values [15]. This is not surprising, given that a bigger proportion (52.5%) of the physiotherapists polled appear to be unaware of any appropriate physical fitness practice, despite their knowledge of its benefits. Shoulder girdle support trainings can be combined in the drill platform to progress grip strength as they have a constructive modest association [16]. HGS appears to be an quality of best sportspersons and a covariate of complete higher- and lower-body strength, imprudent skill [17]. The Basket ball Throw Test is a viable amount of upper-body well-developed strength in school-aged kids [18]. Advanced standards of physique mass index were related with deteriorations in bodily fitness, free of age [19]. Power in higher and inferior limbs are connected to judo-specific responsibilities in new judo sportspersons and can temperately forecast the enactment [20]. The current study is one of the few to look at the association between upper body strength and grip strength in physiotherapy students; however, more research is needed to validate or dispute this conclusion.

CONCLUSION

Left and Right Handgrip Strength showed strong positive correlation with Seated Medicine Ball throw test at 45°. On the other hand, BMI and age had moderate negative correlation with Handgrip strength and SMBT. In pair wise comparison, handgrip strength of females showed moderate correlation with SMBT and that of males showed strong correlation with SMBT. In conclusion, a higher Handgrip strength leads to a longer Throw distance, implying that a stronger Handgrip signifies a stronger Upper body. The importance of sex and age in relation to grip strength and upper body strength suggests that they could be viewed as useful variables to encourage physiotherapists to achieve physical fitness.

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