

Research Article

Association of Hand Grip Strength and with Writing Speed (endurance) Among the Students

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Abstract

Objective: The objective of current study was to determine the association of hand grip strength and endurance with handwriting speed among the students.

Background: Grip strength of hand indicates overall muscle strength that was measured by using a hand dynamometer, which was considered to be the gold standard for measurement of grip strength and endurance.

Methods: Observational study was conducted at Lahore College of Physical Therapy LMDC Lahore with a sample of 87 undergraduate male and female students after prior consent. The maximal grip strength and muscle endurance were measured through dynamometer whereas the writing speed was measured through Letters Per Minute (LPM) test. A Collective data comprising strength, endurance and the total letters written by each subject was analyzed by using SPSS.

Results: This study shows that a significant difference was present in handgrip strength of females than males but writing speed and endurance of females was much greater than males. 77% of females, who fell into the minimal strength category that was (strength<23) had a better endurance and were able to write greater number of letters as compared to those who fell into the maximal strength category that was (strength>23) evident from the significant value (P < 0.000). Whereas 23% of males who fell into the maximal strength category that was (strength>37.5) also had a maximal endurance and were able to write greater number of letters as compared to the males who fell into the minimal strength category that was (strength<37.5), they had minimal endurance and were able to write less number of letters, evident from the significant value (P < 0.05).

Conclusion: The findings of this study concluded that there was a positive association between strength and writing speed (endurance).

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Introduction

Hand Grip strength was being used worldwide due to portability and practicality of dynamometer.¹ Grip strength of hand indicates overall muscle strength that was measured by using a hand

dynamometer, which was considered to be the gold standard for measurement of grip strength and endurance.² Both strength and endurance of the hand was tested in students by using the dynamometer and writing speed assessment. Gender based differences were also noted as men being stronger in hand grip

with dominant hand.³

Grip strength simply tests the isometric contraction of hand. The position in which grip strength was measured was making the subject sit in comfortable position with shoulder in abduction, elbow flexed to 90 degree, forearm and wrist in neutral position.⁴ The three consecutive attempts are made to record grip strength and average of three attempts was used as results. Grip strength was measured in Kilograms or pounds. Task based training programs helps to refine the performance of students with difficulty in handwriting.⁵ The quality of the handwriting was greatly influenced by the strength to control the graphical movements.⁶ We can measure writing speed by estimating (NOL) wrote in one minute.⁷ Letters per minute test (LPM) was used as oppose to words per minute test (WPM) due to the high variability of words.

Physical therapy can play an important role in improving the strength and endurance of intrinsic muscles of hand. A study was done on 180 individuals to find out the correlation between the BMI, the body fat percentage and the handgrip endurance. Statistically a difference was noted in both the genders. The group with normal weight had the maximum handgrip endurance and the underweight group had the minimum endurance. The study concluded that a higher handgrip strength and endurance was seen in males with ideal weight group then the underweight and overweight males. The correlation showed a decrease in handgrip endurance in both the genders with normal BMI and a decrease in the handgrip strength in both the genders with high body fat percentage.⁸

The study conducted to measure the endurance of hand grip and quadriceps muscles in Twenty one healthy adults of age 18–35 years was carried out by the help of Jamar isokinetic dynamometer respectively. An endurance test comprising of 12 repetitions was performed with a hold of 3 seconds and a resting phase of 5 seconds. The mean hand grip strength calculated for the first repetition was 9.9 kg and for the last three repetitions was 8.1kg. The above calculated values revealed that fatigue was induced during the 12th repetition and endurance was decreased.⁹ A study done on product and process evaluation of handwriting difficulties aimed at the assessment of

handwriting by developing standard evaluation scales to produce quantitative score for the quality of handwriting. In one such scale, children were asked to transcribe a paragraph of 57 words on a blank paper within 1 minute. The writing speed evaluations were based on letters wrote in one minute. The reliability of the scale was extremely high.¹⁰

The rationale of study was just to find out the association between hand grip strength and endurance with writing speed which will help the therapists to manage writing issues followed by weak musculature of hand.

Methodology

An observational cross sectional survey with convenient sampling technique was done in 6 months after approval of topic. The data were collected from 87 male and female undergraduates of Lahore College of Physical Therapy LMDC after excluding those who had fracture or any other pathology in the dominant hand. A standardized dynamometer was used to measure the hand grip strength. The dynamometer was scored using force production in Kilograms (0-90). A brief session was held with the subjects to familiarize them with the procedure and the equipment. Each subject was measured at early morning considering the strength difference with the passage of time. The participants were seated in comfortable positions, their elbow supported by their side on elbow rests and elbow joint was flexed to 90 degrees (right angle), forearm and wrist were in neutral position.⁹ The first task was of maximal grip strength, determined as the average of 3 maximal voluntary isometric contractions.¹¹ The subject was asked to squeeze the dynamometer and the readings of 3 maximal contractions were noted down in 3 trials i.e. T1, T2, and T3 with a rest period of 1 minute between each trial to prevent muscle fatigue. For each subject the dynamometer was reset to zero before the reading of next grip strength. For writing speed measurement, Letters per Minute Test (LPM) was used. Students were given the option of handwriting and the researcher monitored the time using a standard stopwatch. An A4 size paper with a paragraph of 57 words printed on it was provided to each subject along with a standard quality of pen. Since our data was not distributed normally therefore we used non-parametric test for comparing values. Association of

strength and endurance with hand writing speed was assessed by using Kruskal-Wallis Test. SPSS version 23 was being used to analyze the data.

Results

Gender Distribution:

The total numbers of subjects recruited for this study were 87 healthy young adults. 20 subjects were male (23%) and 67 subjects were female (77%).

Comparison of strength:

The results showed that a significant difference was

Gender	Frequency	Percentage
Males	20	23%
Females	67	77%

present in handgrip strength of females than males but writing speed and endurance of females was much greater than males. 77% of females, who fell into the minimal strength category i.e. (strength<23) had a better endurance and were able to write greater number of letters as compared to those who fell into the maximal strength category that was (strength>23) evident from the significant value ($P < 0.000$). Whereas 23% of males who fell into the maximal strength category i.e. (strength > 37.5) also had a maximal endurance and were able to write greater number of letters as compared to the males who fell into the minimal strength category i.e. (strength < 37.5), they had minimal endurance and were able to write less number of letters, evident from the significant value that is $P = 0.000$

Variables	(Kruskal-Wallis Test)			
	Females		Males	
	Strength < 23kg	Strength > 23kg	Strength < 37.5kg	Strength > 37.5kg
Strength NOL	P = 0.000		P = 0.000	

Discussion

Results of the study represent association of strength of handgrip and endurance of wrist muscles with writing speed of students which was indeed a matter of great concern from students' point of view as well as other individuals. Several studies showed that

there was interdependency among these three parameters. According to Wang W.C et al. Hand grip strength can be measured by evaluating the amount of static force required by the hand to squeeze the dynamometer. Hand grip strength was considered as a steady measurement when standardized ways and means and calibrated apparatus are used, even when there are different assessors or different brands of dynamometers. The already published normative data for hand grip strength are available from many countries, and in many cases, the data are divided into age and gender sub-groups. In evaluating the analysis of grip strength among gender; shows higher grip by males and lower grip by females at all ages. This trend was always present even though some studies divide the subjects by their age, gender, and then by hand dominance right and left, while a small number of studies divide participants by their age gender and then dominant and non-dominant hand. This trends can be seen in the current study also.⁹

Current study according to Myer E showed the baseline grip strength of right hand in males to be 37.5 kg and in females the baseline grip strength of the right hand was found to be 23 kg. This difference of strength between male and female was more marked in females as compared to males and showed higher grip strength in males and lower grip strength in females according to the study carried out. In 2011 proposed a study which was based on gender difference and laterality in maximal hand grip strength and well-ordered force exertion in young adults, done on 125 subjects. This study measured that the maximal hand grip strength was considerably higher in males as compared to females and was also significantly higher in right hand of males than females. The current study also suggested that males had considerably higher grip strength than the females.¹²

Foster D et al reported a study based on gender difference in muscle strength and endurance among young adults. The results of the study presented that males had close to twice the handgrip strength as compared to females in absolute terms ($P < 0.01$). In comparison, the frequency or rate of decline of muscle strength during continuous isometric contraction was lower in females as compared to males ($P < 0.05$) which suggests greater muscle endurance was in females. Results of our study were almost similar, which comprised of maximal strength and minimal

endurance measured in males and minimal strength and maximal endurance measured in females.¹³

A study conducted in 2015 by Danna and Velay, on hand writing speed in an adult population included 300 individuals. Letters per Minute Test was selected to assess the handwriting speed. He concluded that the Letters per Minute Test was very useful for the hand therapists to establish the handwriting speed among young adults by improving their hand grip strength. In the present study, the maximal strength and endurance of the right hand showed a positive association with handwriting speed which was similar to above mentioned study.¹⁴

Thus going through all the literatures which showed a positive association between strength, endurance and writing speed, it can be concluded that the males with greater strength had lesser endurance as compared to females; they had a greater endurance than strength.

Conclusion

The findings of this study concluded that there was a positive association between strength and writing speed (endurance).

Ethical Approval: Given

Conflict of Interest: None

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