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THE CORRELATION AMONG MAXIMAL GRIP STRENGTH, LENGTH OF PALM, FORE ARM AND HAND CIRCUMFERENCE IN HEALTHY SUBJECTS

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Abstract: Grip strength is variable which may be important to measure and follow in various population. Muscular strength of the adult population is the key factor for their potency. There are many factors which may affect the hand grip strength and very few studies especially in India have shown their correlation with hand grip. **AIM OF THE STUDY**: To find out the correlation between the maximal grip strength and length of palm, fore arm and hand circumference in healthy subjects. **MATERIALS AND METHODS**: The study included 160 healthy subjects. Palm length, fore arm and hand circumference was measured using inch tape and maximal grip strength was measured using the standard adjustable Jamar hand held dynamometer. Sample size: 160 (80 males and 80 females).Study design: Descriptive study. Study setting: college of physiotherapy. **RESSULTS & CONCLUSION**: In boys, the length of palm and forearm circumference are positively correlated with the MGS and hand circumference is negatively correlated with the MGS. In girls, length of the palm and forearm circumference are negatively correlated with the MGS and hand circumference is positively correlated with the MGS.

Keywords: Maximal grip strength, palm length, fore arm circumference, hand circumference, Jamar hand held dynamometer.

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INTRODUCTION

The length of palm varies in individuals with age and gender and the component of maximal grip strength (MGS) is an essential element to follow people during growth, aging, injury, rehabilitation, training or therapeutic trails. There are number of situations in which maximal grip strength references are in need during rehabilitation.

Grip strength measurement is performed using dynamometer, which estimates the muscle strength primarily generated by the flexor muscles of the hand and the forearm. Different types of dynamometers are available such as hydraulic, pneumatic, mechanical and electronic.[1-2] The Jamar dynamometer is a hydraulic device most widely used to measure grip strength.[3-10] The American Society of Hand Therapists (ASHT) has recommended the jamar dynamometer as the gold standard, leading to its widespread use in clinical practice and research.[11] The jamar has many useful features for routine screening as well as in the evaluation of hand trauma or disease. The jamar displays grip force in both pounds and kilograms, with a maximum of 200lb and 90 kgs. It has a peak- hold needle that automatically retains the highest reading until reset.[12] The jamar test is isometric, with no perceptible motion of the needle, regardless of the grip strength applied.

AIM OF THE STUDY: To find out the correlation among the MGS, length of palm, forearm and hand circumference in healthy subjects.

OBJECTIVES OF THE STUDY:

1. To assess the length of palm in boys and girls.

2. To assess the MGS in boys and girls.

3. To find out the correlation between the length of palm and MGS in both boys and girls.

4. To assess the forearm circumference in boys and girls.

5. To assess the hand circumference in boys and girls.

6. To find out the correlation among the forearm circumference, hand circumference and MGS in boys and girls.

MATERIALS AND METHODS:

- Study design- Non-interventional study design (Descriptive study).
- Study setting-College of physiotherapy and college of nursing in SVIMS, University, Tirupati.

- Sample size – 160 subjects (80 boys and 80 girls).
- Duration -2 months.

INCLUSIVE CRITERIA:

1. Healthy subjects both boys and girls.

2. Age group between 18 to 25 years.

EXCLUSIVE CRITERIA:

1. Subjects suffering from disabling disorders such as Duchene muscular dystrophy or spinal muscular atrophy.
2. Subjects who underwent any surgeries of the upper limb.

METHODOLOGY:

- Participants are all healthy subjects' boys and girls who are pursuing the Bachelors and Master degrees in physiotherapy and nursing courses. Subjects who were voluntarily willing to participate in the study were recruited. Anthropometric hand data such as length of palm, forearm circumference and hand circumference was measured by experimenter using a standard 1000 millimeter tape measure.

- Palm length is defined as the distance from the tip of the middle finger to the mid line of the distal wrist crease.

- The circumference of the forearm is defined as the perimeter of the largest part of the forearm, located over the bulk of the brachioradialis muscle, at the proximal quarter of the whole forearm length.

- The circumference of the hand is measured at the two major transverse palmar creases.

- All anthropometric data were measured to the nearest millimeter with the forearm and hand in an outstretched and supinated position. Dominant side is defined as the hand with which the subject writes.

- After assessing the length of the palm, fore arm and hand circumferences, the MGS was assessed using the Jamar hand held dynamometry for all the subjects in the following way.

- The subjects were seated on a height- adjustable plinth in order to obtain right angle at the hip, knee and ankle joints with the legs being vertical and feet flat on the ground. The subjects

had their body, with their elbow in full extension. Subjects were verbally encouraged to produce their maximal grip strength.

- Two trails were first recorded, consisting of a 2-4 second maximal contraction, with a 30-second rest period between each trail. If the relative difference between these two maximum grip strength was within 10%, no additional trails was required. The maximal value of the two reproducible trails was retained for the analysis. The contra-lateral side was then tested according to the same procedure.

DATA ANALYSIS: After collecting the data, the data is fed in the Microsoft excel spread sheet and the data was analyzed using Statistical Package for social Sciences (SPSS 21.0) version.

RESULTS:

Table 1: Mean and standard deviation of **right and left palm length**

	Gender	N	Mean	S.D	t
Right palm length in cm	Boys	80	18.8	0.93	6.01
	Girls	80	16.7	0.95	(p< 0.01)
Left palm length in cm	Boys	80	18.8	0.92	14.42
	Girls	80	16.7	0.95	(p<0.01)

Interpretation: The mean and standard deviation of right palm length for 80 boys is 18.8±0.93 and the mean and standard deviation of left palm length is 18.8±0.93. In girls mean and standard deviation of right palm length is16.7±0.95 and left palm length is 16.7±0.95.

Figure 1: Correlation between Length of Palm and Hand Grip

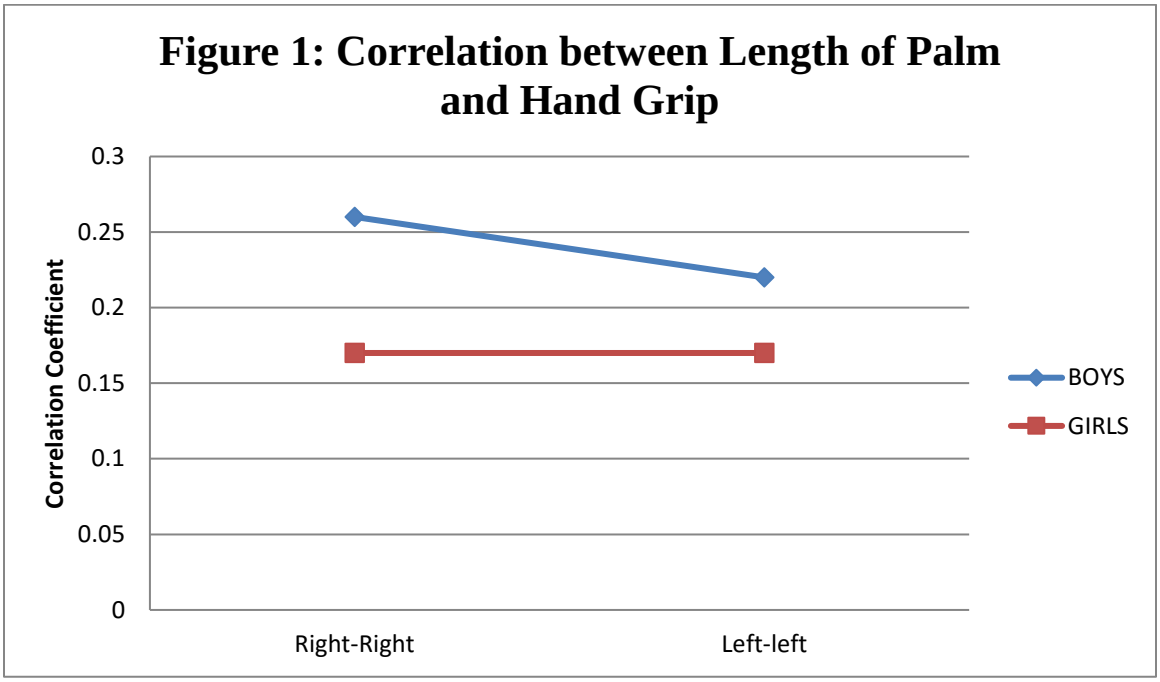

Table 2: Mean and standard deviation of right and left maximal grip strength

	Gender	N	Mean	S.D	T
Right MGS(pounds)	Boys	80	33.62	14.86	14.52
	Girls	80	8.31	5.15	(p<0.01)
Left MGS(pounds)	Boys	80	32.5	15.17	15.25
	Girls	80	6.21	3.17	(p<0.01)

Interpretation: The mean and standard deviation of right MGS for 80 boys is 33.62±14.86 and the mean and standard deviation of left MGS for 80 boys is 32.5.The mean and standard deviation of right MGS for 80 girls is 8.31±5.15 and the mean and standard deviation of left MGS for 80 girls is 6.21±3.17.

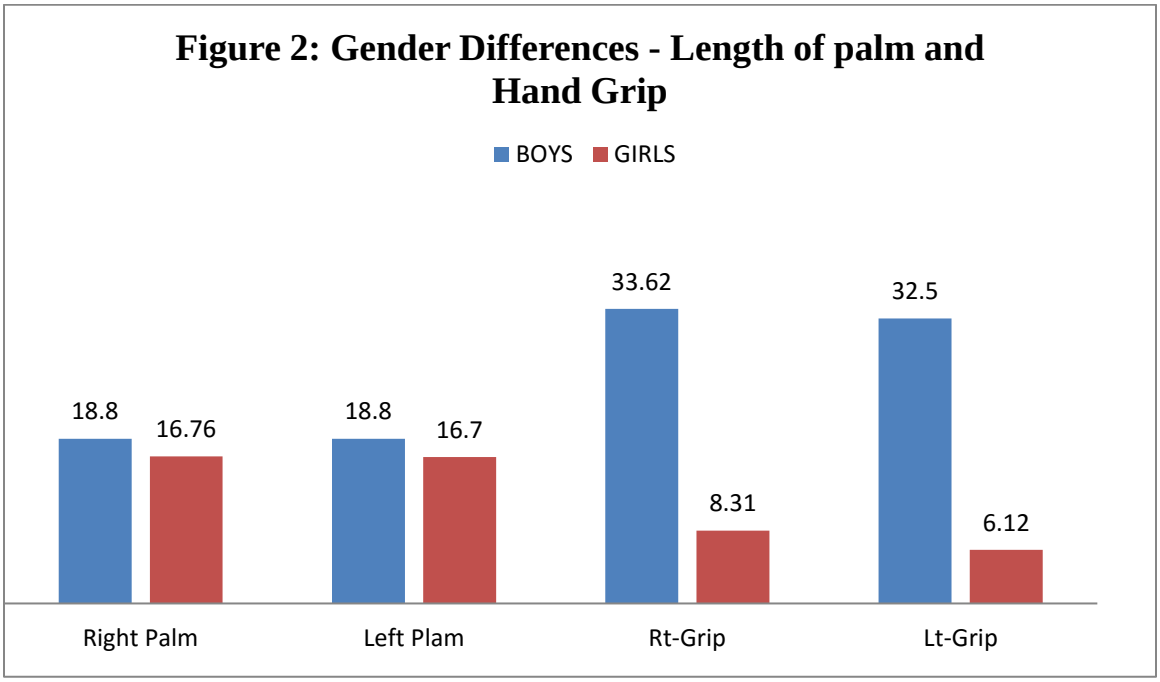

Table 3: Correlation between the right and left palm length, MGS:

Gender	Right palm length and grip	Left palm length and grip
Boys	0.26	0.17
Girls	0.22	0.17

Interpretation: The correlation between the palm length and maximal grip strength among boys and girls is observe to be positive correlation that is increases in palm length is directly related to the maximal grip strength. However the co-efficient for both boys and girls regarding right and left maximal grip strength lies between 0.17 and 0.26 these values are not much significant thus it can be concluded there is less correlation between the length of palm and corresponding maximal grip strength.

TABLE 4: Correlation between the forearm circumference and MGS, hand circumference and MGS:

Gender	N	RT: FAC and RT: MGS	RT: HC and RT: MGS	LT: FAC and LT: MGS	LT: HC and LT: MGS
Boys	80	0.11	-0.25	0.15	-0.12

Girls	80	-0.30	0.19	-0.16	0.27

(RT: right: FAC: forearm circumference: HC: hand circumference: LT: left: MGS; maximal grip strength.)

Interpretation: In this table, the results show that there is positive correlation between the forearm circumferences and MGS and negative correlation between hand circumferences and MGS in boys.

There is negative correlation between the forearm circumference and MGS and positive correlation between hand circumference and MGS in girls.

DISCUSSION: This study wished to examine the correlation of hand anthropometry towards grip strength in normal subjects.

Table 1, showed that the value of mean and standard deviation of right and left palm length in boys is greater than that of girls of the similar age groups.

Table 2, showed that the value of mean and standard deviation of right and left MGS in boys is greater than that of the girls. The increase in MGS in boys than the girls might be due to more involvement in lifting and carrying activities which results in the more usage of forearm musculature. It has been reported that as a rule, handgrip strength of both right and left hand dominant was stronger in males than females across all age groups.

The study done by Newman et al. 1984; Mathiowetz etal. 1986; Naeem et al. 2008; Lad et al. 2013, the findings followed the same direction in both male and female students. The males have higher mean values in all the anthropometric variables than the females.[14]

It has been reported earlier that men possessed considerably greater strength than women for all muscle groups tested (McArdle etal. 2001; Bohannon et al. 2006; Shyamal and Sat-inder 2011; Montalcini et al. 2013).[14]

Sartorio et al. (2002) had reported that the age dependent increase of hand grip strength in males and females were strongly associated with changes of muscle mass during the child-hood. The results from the present study are consistent with previous researches demonstrating stronger grip for men than women within the same age strata, and that hand grip strength decreases with advancement in age (Chatterjee and Chowdhuri 1991; Bohannon et al. 2006; Charles and Burchfiel 2006).[15]

Table 3, shows that the palm length and MGS had positive correlation in boys whereas negative correlation in girls.

Table 4, shows that there is positive correlation between the forearm circumferences and MGS and negative correlation between hand circumferences and MGS in boys. There is negative correlation between the forearm circumference and MGS and positive correlation between hand circumference and MGS in girls.

CONCLUSION: In boys, the length of palm and forearm circumference are positively correlated with the MGS and hand circumference is negatively correlated with the MGS. In girls, length of the palm and forearm circumference are negatively correlated with the MGS and hand circumference is positively correlated with the MGS.

LIMITATIONS:

1. Studies may be done on a larger sample size.

2. Anthropometric variables of upper limb such as arm length, fore arm length can be included.

REFERENCES

1. Bohannon RW. Hand-grip dynamometry predicts future outcomes in aging adults. J Geriatric Phys, Ther. 2008; 31(1):3–10.
2. Innes E. Handgrip strength testing: a review of the literature. Aust Occupy Their J. 1999; 46:120–40.
3. Ashford RF, Nagelburg S, Adkins R. Sensitivity of the Jamar Dynamometer in detecting sub maximal grip effort. J Hand Surge Am. 1996; 21(3):402–5.
4. Beaton DE, O'Driscoll SW, Richards RR. Grip strength testing using the BTE work simulator and the Jamar dynamometer: a comparative study. Baltimore Therapeutic Equipment. J Hand Surge Am. 1995; 20(2):293–8.
5. Balance JV, Healy D, Baser MP, Byron T, Holmen L. Validity of the Dexter Evaluation System's Jamar dynamometer attachment for assessment of hand grip strength in a normal population. J Hand Their. 2000; 13(1):46–51.
6. Bohannon RW. Parallel comparison of grip strength measures obtained with a MicroFET 4 and a Jamar dynamometer. Percept Mot Skills. 2005; 100(3 Pt 1):795–8.
7. Desrosiers J, Hebert R, Bravo G, Dutil E. Comparison of the Jamar dynamometer and the Martin vigor meter for grip strength measurements in a healthy elderly population. Scand J Rehabil Med. 1995; 27(3):137–43.
8. Harkonen R, Harju R, Alaranta H. Accuracy of the Jamar dynamometer. J Hand Their. 1993; 6(4):259–62.
9. Mathiowetz V. Comparison of Rolyan and Jamar dynamometers for measuring grip strength. Occupy Their Int. 2002; 9(3):201–9.

10. Van den Beld WA, vain der Sanden GA, Sengers RC, Verbeek AL, Gabreels FJ. Validity and reproducibility of the Jamar dynamometer in children aged 4–11 years. Disabil Rehabil. 2006; 28(21):1303–9.
11. Mathiowetz V, Weber K, Volland G, Kashman N. Reliability and validity of grip and pinch strength evaluations. J Hand Surg Am. 1984; 9(2):222–6.
12. Fess EE. Grip strength. In: Casanova JS, editor. Clinical Assessment Recommendations. 2nd ed. Chicago: American Society of Hand Therapists; 1992. p. 41–5.
13. Sartorio A, Lafortuna CL, Pogliaghi S, Trecate L 2002. The impact of gender, body dimension and body composition on hand-grip strength in healthy chil-dren. J Endocrinol Invest, 25(5): 431-435.
14. Shyamal K, Arvinder PS 2010. Effect of hand domi-nance in grip strength in colligiate population-based Amritsar, Punjab, India. Anthropologist, 12(1): 13-16.
15. Shyamal K, Satinder PK 2011. Colligiate of hand grip strength in selected hand-arm-anthropometric vari-ables in Indian inter-university female volleyball players. Asian Journal of sports Medicine, 2(4): 220–226.