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RESEARCH ARTICLE
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Correlation Between Krogman's Index and Pinch Grip

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ABSTRACT

Introduction: Pinch grip is the strength of the grip between the tips of your four fingers along with the thumb. This grip is important in the various actions that one might partake in during the day such as holding an object, carrying a heavy object, opening the lid of a jar, throwing an object and much more.

Materials and methods: Vernier Calliper was used to measure the hand length and the jamar pinch gauge was used to measure the pinch grip of the participant.

Results: A strong correlation between Krogman's index and pinch grip is seen with $p \leq 0.001$

Conclusion: This study concludes that there is a significant correlation between pinch grip and Krogman's index in both genders.

Keywords: *hand dimension, Krogman's Index, Pinch grip, sex determination, Innovative anthropometry study*

INTRODUCTION

Our hands are one of the most active parts of our body during the day. We use our hands from the moment we are in our mother's womb. Once we are born we use our hands to roll over and later on we use our hands to prop ourselves up and start walking. In our adult life we use our hands from dawn to dusk, whether it is to brush our teeth in the morning, cook breakfast, drive to our place of work. Our hands make up a lot of our body language as well, which can be essential to our self expression, especially to those who are hearing impaired and might have to use ASL to communicate to those around them.

Our hands can be significant in our occupations, a surgeon must use his manual dexterity and steadiness of his hands to operate. Our hand has a rich network in a primary motor area (area 4) of our cerebral cortex. Anthropologists say that our hands cause the development of the brain, the hand has helped the formation of civilization, which eventually impacted the environment around us by the evolution of tool behavior of the earliest hominids (Susman 1998).

Pinch strength is the strength exerted between your finger and thumb, it is a standard measure of strength for hand therapy assessments (Zakariya 2016), pinch grip is one of the most important functions of the hand since it is usd to pick and stabilize an object in our hands, in order to open a lid or hold a pen we need the required pinch grip. Pinch grip can be dependent on many variable factors such as age, sex, muscular strength, size of hand therefore pinch grip is individualistic.

Pinch grip can be altered by grip surface, friction, orientation of hand during grip, movement of the hand during the grip assessment. ("Hand Grip and Pinch Strength" 2006). Occupational therapists measure the pinch grip to assess strength of hand function, determine stage of development, degree of impairment, disability or handicap of the hand (Daniels and Backman 1993).

Which is why certain disorders affecting hand weakness can lower pinch grip such as arthritis, multiple sclerosis, lupus and peripheral neuropathy. These disorders are prevalent in elderly patients, we can concur that age can be an important factor of pinch grip.

Hand measurement varies from person to person but there is a significant correlation between gender and hand measurement, since the majority of males have a higher Krogman's index compared to women, Krogman's index refers to the length and width of the right hand. Hand measurement can be used in predicting other measurements of the body such as stature (Guerra et al. 2014). Our team has extensive knowledge and research experience that has translated into high quality publications (Neelakantan, Grotra, and Sharma 2013; Aldhuwayhi et al. 2021; Sheriff, Ahmed Hilal Sheriff, and Santhanam 2018; Markov et al. 2021; Jayaraj et al. 2015; Paramasivam et al. 2020; Z. Li et al. 2020; Gan et al. 2019; Dua et al. 2019; Mohan and Jagannathan 2014).The aim of the study is finding the correlation between Krogman's index and pinch grip.

MATERIALS AND METHOD

The study was conducted among 72 people (26 male and 46 female) between ages 17–22. Sample population were selected using a convenient random sampling method to participate in the study.

Materials used:

Vernier caliper

Jamar pinch gauge

Method for hand measurement

Measurement of hand length: Hand length is measured between the highest point of the middle finger till the base of the palm of hand using a vernier caliper (Figure 1)

Measurement of hand width : Hand width is measured from the distal points of 2 and 5 metacarpals using a vernier caliper.(Figure 1)

Krogman's index was calculated using the formula Krogman's index = $\frac{hand\ width}{hand\ length}$ x 100.

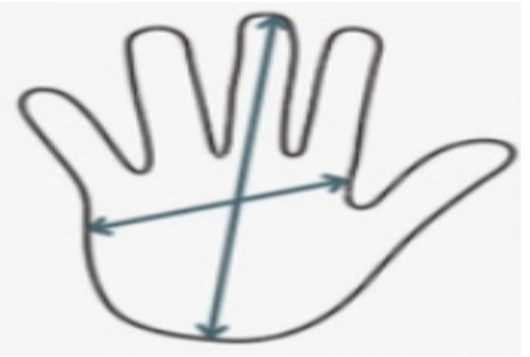

FIG. 1 measurement of hand length and hand width

Method for pinch grip measurement

Measurements of pinch grip were measured using the Jamar pinch gauge

The type of pinch that was measured is called the Palmar Pinch also known as Three-Point Pinch or 3-jaw chuck pinch. The palmar pinch involves the pinch meter being placed between the pad of the thumb and pad of the index and middle fingers.

Patient start position

The participant must be seated

The test arm must be placed on the arm of the chair with the elbow flexed at 90°

Palm of the participant must be facing down

Placement of pinch gauge

Pinch gauge between thumb and the index and middle fingers

Position of person holding the gauge

In front of participant

Stabilize pinch gauge

Test

Have participants squeeze the pinch gauge and hold for 5 seconds then release.

All measurements were tabulated, Paired T test was done using SPSS software version 23.

RESULTS

TABLE . 1 Mean, standard deviation, standard error mean of Krogman's index and pinch grip strength in both genders

	GENDER	N	MEAN	STANDARD DEVIATION	STANDARD ERROR MEAN
Krogman's Index	Male	29	44.16	3.30	0.614
	Female	46	42.26	2.99	0.442
Pinch Grip Strength (in Kgs)	Male	29	7.72	1.09	0.202
	Female	46	5.91	1.28	0.189

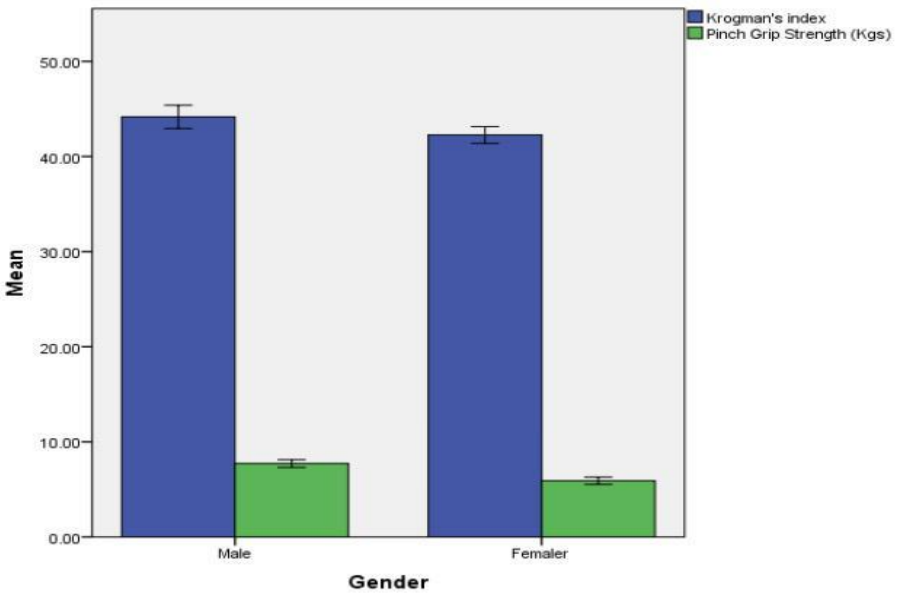

FIG.2 Bar graph comparing Krogman's index and pinch grip strength in both genders

Table 1. shows that the mean value of Krogman's index for males are higher than females as well as the pinch grip with a significantly higher value of pinch grip in men comparatively to women. The standard deviation of Krogman's index in men is higher than in women showing that there is higher variety of Krogman's index within the male participants of the sample.

Fig.2 is a bar graph representing the Krogman's index and pinch grip of both genders, this graph shows that men have a higher Krogman's index and pinch grip than women. This indicates the correlation between the Krogman's index and pinch grip since those with a higher Krogman's index tend to also have a stronger pinch grip. A strong correlation between Krogman's index and pinch grip is seen with $p \leq 0.001$ was found in both the genders in the paired T test performed

DISCUSSION

There is a significant correlation between the pinch grip and the genders. Previous studies done by Lin Li mention how pinch grip depends on gender because males have a larger hand and a large area of skin contact than females do while exerting a force (L. Li et al. 2022). This correlates with our study since our findings show that the Krogman's index is higher in men than women.

Based on the correlation between Krogman's index and gender, our study shows that there is a correlation between the gender and the pinch grip as well, with men having a stronger pinch grip. While analyzing the variables affecting the pinch grip it is understandable that the Krogman's index is the factor influencing the strength of pinch grip being higher in men.

CONCLUSION

This study concludes that there is a strong correlation between pinch grip and Krogman's index in both genders.

LIMITATIONS

This study uses a small sample group, with an unequal number of male and female participants, therefore the sample size lacks variability. The age range of the sample was limited.

FUTURE SCOPE

To develop the study further, a larger sample size with a wider age range can be implemented to represent the overall population and acquire statistically significant results from the analysis.

AUTHOR CONTRIBUTION

Serafina Andrew: Study Design, Data collection, Data Analysis, manuscript writing

Yuvaraj Babu K: Study Concept, Data verification, Data Analysis, manuscript drafting and correction

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CONFLICT OF INTEREST

The author declares, there is no conflict of interest.

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