Research Report

A pilot study on grip strength among Filipino men and women aged 20-44 in Metro Manila

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ABSTRACT

Objectives**:* This study is aimed to establish grip strength values among Filipino subjects. The comparison of grip strength among age groups and the differences in the values between dominant and non-dominant hand and among work categories were also examined. ***Methodology**:* Subjects were recruited within Metro Manila. An orientation was conducted to explain the purpose and the procedures of testing. Eligibility and work classification of the consenting subjects were determined using a questionnaire. Hand grip strength was measured using JAMAR Grasp Dynamometer following the testing position recommended by the American Society of Hand Therapists. ***Results**:* Average grip strength of males and females was highest both in the 30-34 age group. A significant difference was found between the dominant and non-dominant hand grip strength, but not between different types of work for both males and females. Bigger muscle mass, age of 30-34 years and hand dominance, appear to be the most significant factors that contribute to stronger grip strength. ***Conclusions: Males were significantly stronger than females in terms of handgrip of the dominant hand. In both males and females, the dominant hand was significantly stronger than the non-dominant hand. In all work types, there was no significant difference in grip strength in both males and females.

***Keywords:** dynamometer, grip*

INTRODUCTION

Grip strength is one of the body functions that allows a person to perform his activities of daily living, work and leisure. It is used when force is needed in order to hold on to or grasp objects. A study done by Tyler, Adams and Ellis in 2005 reviewed researches that examined the correlation between grip strength and hand function and evidences showed that grip strength can reveal a person's ability to use his hands to perform daily activities.[1]

Decreased grip strength may result to difficulty or inability in performing daily tasks, such as opening containers.[1] This is one of the reasons why people with problems with grip strength seek rehabilitation. Grip strength therefore, can be used to predict the risk of disability in individuals especially in the older population[2]. It is also used for the assessment and evaluation of upper extremity function, determining work capacity following hand injuries, and gauging the effectiveness of a treatment program.[3]

Several tools are available to measure grip strength, and they are generally categorized into hydraulic, pneumatic, mechanical, and strain gauges. Of the four, the hydraulic instruments are the most reliable and most widely used, an example of which is the JAMAR dynamometer.[3, 4]

Numerous studies have investigated grip strength testing, including determining the reliability and validity of the different testing methods, and establishing normative data in different countries investigating different factors that affect grip strength values such as age, sex, dominance, and type of physical activity.[3, 4, 5] However, no studies about hand grip strength have been published in the Philippines.

The main purpose of the study was to establish grip strength values among Filipino subjects. The authors investigated which age group has the strongest grip strength and identified the differences in the values between dominant and non-dominant hand, and among work categories.

METHODOLOGY

This observational study made use of convenience sampling to recruit participants from various establishments in Metro Manila. The purpose of the study and the procedures of the test were discussed to the participants in detail by the

assigned researcher. Verbal consent was then obtained from the participants. A questionnaire was administered to determine the participants' eligibility to undergo testing and to classify them according to type of work. Participants were included if they were 20 – 44 years old and free from injury affecting the upper extremity. They were excluded if they had existing health problems that could compromise performance or if they suffered from a musculoskeletal injury, especially in the upper extremity, within the last 6 months.

Subjects were then classified according to the different work categories: light, moderate, or heavy (vigorous) work.[6]

A calibrated JAMAR Grasp Dynamometer was used to measure grip strength of all participants who were eligible to undergo testing. JAMAR dynamometer is the most widely researched grip strength evaluation tool and has been recommended by the American society of Hand Therapists (ASHT) as the standard instrument for measuring grip strength. This tool was found to be inexpensive, accurate, and simple to use, and has reproducible assessment procedure. Calibration of the equipment was done for validity and accuracy of results. It was set at the second handle position to determine the maximal effort given by the subject during the test, as was proven by other studies that conducted the same test. [3, 4, 5]

During testing, standardized procedures based on the recommended standard position for testing by the American Society of Hand Therapists were used, requiring the subject to sit in a chair with straight backrest, feet flat on the floor, shoulders adducted in neutral, arms unsupported, elbows flexed at 90°, forearm rotated to neutral, and wrist in 0-30° dorsiflexion and 0-15 degrees ulnar deviation[3, 4, 5]. Each participant was instructed to provide three firm controlled grips for both hands during the test. The dominant hand followed by the non-dominant one was tested for each grip. Two researchers simultaneously read the results for each subject for reliability purposes, and two researchers recorded the results for double data entry. The average score for the three trials on each hand was then calculated.

Descriptive statistics were used to summarize grip strength values per gender and age group. Independent t-test was used to determine differences between male and female values, as well as between values of the dominant and non-dominant hand. One-way ANOVA was used to determine differences in grip strength values across work categories. Level of significance was set at 0.05.

RESULTS

A total of 248 subjects were included in this study. There were 146 males (59%) and 102 females (41%). Of the 146 males, 121 were right-hand dominant and 25 were left-hand dominant. Of the 102 females, 91 were right-hand dominant and 11 were left-hand dominant.

Grip strength distribution according to age and gender groups is shown in Tables 1 and 2.

Male Age Bracket	Dominant Hand		Non-dominant Hand	
	Mean	SD	Mean	SD
20 - 24	39.62	7.5	38.04	7.53
25 - 29	39.58	8	37.44	7.99
30 - 34	42.68	6.77	38.56	6.10
35 - 39	38.22	6.19	35.05	5.46
40 - 44	25.3	6.82	38.26	7.22

Table 1. Grip strength (in pounds) of dominant and non-dominant hand in males of different age groups

Female Age Bracket	Dominant Hand		Non-dominant Hand	
	Mean	SD	Mean	SD
20 - 24	22.4	4.19	19.76	3.97
25 - 29	22.79	3.81	22.60	3.95
30 - 34	25.3	3.58	23.43	4.06
35 - 39	25.29	5.38	23.07	5.78
40 - 44	24.61	4.79	22.19	4.55

Table 2. Grip strength (in pounds) of dominant and non-dominant hand in females of different age groups

Average grip strength of males and females was highest both in the 30-34 age group. The lowest grip strength value for males was at the 40-44 age group and 20-24 age group for females.
The mean dominant hand grip strength of males was 40.33 ± 7.23 pounds while that of females was 24.26 ± 4.5 pounds. Results of independent t-test showed a significant difference between male and female values (p=1.9E-53).

For the males, the dominant hand had a mean grip strength of 40.33 ± 7.23 pounds while the non-dominant hand showed a mean of 37.47 ± 6.98 pounds. There was a significant difference between dominant and non-dominant hands for males (p=1.7325E-19).

For the females, on the other hand, the dominant hand had a mean grip strength of 24.26 ± 4.50 pounds while the non-dominant hand showed a mean of 22.00 ± 4.54 pounds. There was a significant difference between dominant and non-dominant hands for females (p=2.66613E-14).

Mean grip strength values across different types of work are shown Table 3.

Type of Work	Male Grip Strength (pounds)		Female Grip Strength (pounds)	
	Mean	**SD**	**Mean**	**SD**
Heavy	41.69	7.16	24.98	4.63
Moderate	39.41	7.5	23.28	4.03
Light	39.64	6.96	24.24	4.65
ANOVA (p value)	0.22	Not significant	0.32	Not significant

Table 3. Comparison of male and female grip strength in different types of work

There were no significant differences among all types of work for both males and females as computed using One-way ANOVA.

DISCUSSION

This study found that males are generally stronger than females in terms of grip strength. This finding is similar to the study of Innes in 1999 where a review of literature about hand grip strength testing was conducted.[3] Several factors were said to have influenced this finding. According to Doherty in 2001, muscle mass was the most significant factor affecting muscle strength[7]. On the other hand, Nicolay and Walker in 2005, mentioned that hand anthropometric measurements, particularly palm width, was the most important variable to affect grip strength.[8] The size of the hand is also directly proportional to the hand grip strength as found by Nevill and Holder in 2000.[9] Males generally have larger body size, resulting to longer palm width, and greater muscle mass. This provides males the mechanical advantage when gripping objects, such as the Jamar hand dynamometer, thus resulting to greater grip strength.

The average grip strength was highest in the 30-34 age group for both males and females. This is also similar to the results of the study of Innes in 1999 and Mathiowetz et al in 1984 where the same age group also had the highest grip strength values.[3, 5] These same values are within the range mentioned by Doherty in his literature review, wherein he stated that overall body strength peaks at 25 to 35 years old. Muscle mass, primarily, was said to have resulted to this finding. [7] An individual has the greatest muscle strength until approximately 30 years of age, and begins to decline gradually thereafter, and this has been attributed to age-related loss of muscle mass. This also explains the lowest grip strength values found in the 40-44 age group for the males, being the oldest age group in this study. However, the role of other factors such as physical activity, hormones, and nutrition should not be discounted. According to a study done by Sinaki et al in 2001, decreased demands on the muscles and decreased physical activity are related to the age-related decline in muscle strength.[10] People tend to participate in less physically demanding activities, as they grow older.

Significant difference was found between the dominant and non-dominant hand grip strength in both males and females. Armstrong and Oldham in 1999, Incel et al in 2002 and Nicolay and Walker in 2005 reported similar findings. The dominant hand was found to have greater grip strength than the non-dominant hand[8,11,12]. The difference was a result of the dominant hand being used more in daily activities, and is therefore exercised more than the non-dominant hand. One hand being used more often than the other results to greater muscle mass on the dominant hand, causing stronger grip.

There was no significant difference in handgrip among different types of work for both males and females. Heavy work is defined as jobs that are very physically demanding such as those done by construction workers, junk shop workers, automobile mechanics and other manual workers. Moderate types of work require workers to be very physically active, but cannot be classified under heavy work, mostly done by skilled workers, such as dressmakers, hairdressers and painters. On the other hand, fair or light physical activity is performed by workers doing light work, such as students, sales ladies, and office workers.[6] Although these types of work have different muscular strength demands on individuals, it was found out that grip strength for both males and females was not significantly different statistically across all types of work. This may be because only the general physical requirements of the types of work were considered and not the specific task demands on the hand and its functions like gripping and manual dexterity skills, which could be the same for all work types. Other factors outside work like hobbies, leisure activities and sport participation which were not assessed in this study may also affect the hand grip of the subjects.

CONCLUSION

To conclude, the authors were able to conduct a pilot study on determining grip strength of Filipino subjects in Metro Manila. Males were significantly stronger than females in terms of handgrip of the dominant hand. In both males and females, the dominant hand was significantly stronger than the non-dominant hand since most activities are done primarily using the dominant hand. In all work types, there was no significant difference in both males and females.

This study earns its clinical significance by providing objective data that local rehabilitation practitioners

can use as guide during evaluation and treatment. However, because of the very limited number of participants chosen by a sampling of convenience, these values have limited external generalizability and cannot be used to determine specific levels of disability. This poses a challenge to other research bodies to do further studies on grip strength in the Philippine setting. A better representation of the Filipino population may be achieved by doing a nationwide study to establish normative handgrip strength for Filipinos. It is important to take note of the different variables affecting grip strength as they are important in the clinical practice of health care practitioners with regards to assessment and management of problems in hand strength.

REFERENCES

1. Tyler H, Adams J and Ellis B. What can Hand Grip Strength tell the Therapist about Hand Function? *British Journal of Hand Therapy*. 2005;10(1):4-9.
2. Giampaoli S, Ferrucci L, Cecchi F, Lo Noce C, Poce A, Dima F, Santaquilani A, Vescio M, Mennoti A. Hand-grip strength predicts incident disability in non-disabled older men. *Age and Ageing*, 1999;48:283-8.
3. Innes, E. Handgrip strength testing: A review of the literature. *Australian Occupational Therapy Journal*. 1999;46:120-40.
4. Ashton LA, and Myers S. Serial Grip Strength Testing- It's Role In Assessment Of Wrist And Hand Disability. *The Internet Journal of Surgery*. 2004;5(2).
5. Mathiowetz, V. et al. Grip and Pinch Strength: Normative Data for Adults. *Archives of Physical medicine and Rehabilitation*. 1985 Feb;66(2)69-74.
6. The Scottish Executive Department of Health. The Scottish Health Survey 1998. UCL: Joint Health Surveys Unit; 2000. Accessed from http://www.sehd.scot.nhs.uk/**scottishhealthsurvey**/sh806-02.html on May 12, 2007.
7. Doherty TJ. The influence of aging and sex on skeletal muscle mass and strength. Current Opinion in Clinical Nutrition & Metabolic Care. 2001 Nov;4(6)503-8.
8. Nicolay CW and Walker AL. Grip strength and endurance: Influences of anthropometric variation, hand dominance, and gender. *International journal of Industrial Ergonomics*. 2005;35:605-18.
9. Nevill AM and Holder RL. Modelling handgrip strength in the presence of confounding variables: results from the Allied Dunbar National Fitness Survey. *Ergonomics*. 2000;43(10):1547-58.
10. Sinaki M, Nwaogwugwu NC, Phillips BE, Mokri, M. Effect of Gender, Age, and Anthropometry on Axial and Appendicular Muscle Strength. *American Journal of Physical Medicine and Rehabilitation*. 2001;80(5):330-8.
11. Armstrong CA and Oldham JA. A comparison of dominant and non-dominant hand strengths. *Journal of Hand Surgery*. 1999;24B(4):421-5.
12. Incel NA, Ceceli E, Durukan PB, Erdem HR, Yorgancioglu ZR. Grip Strength: Effect of Hand Dominance. *Singapore Medical Journal*. 2002;43(5):234-7.