Normal Hand Grip Strength in the Adult Malaysian Population

T Kamarul*, T Sara Ahmad**, William Y C Loh***

*University of Malaya Medical Centre (UMMC), Kuala Lumpur, Malaysia **Department of Orthopaedic Surgery, UMMC, Kuala Lumpur, Malaysia, ***Department of Orthopaedic Surgery, Southport District General Hospital, Town Lane, Kew, Southport, Merseyside PR8 6PN, United Kingdom

ABSTRACT

Hand grip strength is an important indicator of hand function. Normal Malaysian data is not readily available. A study was undertaken to review the normal grip strength of Malaysians between the ages of 18 to 75. Four hundred and twelve subjects were recruited, 200 women and 212 men, from the University of Malaya Medical Centre staff, students and visitors. Using standardized positioning and instructions modified from a number of different hand grip protocols, data was collected using the LIDO kinetic work set. There were significant correlations noted between hand dominance, sex, height and weight and hand grip strength. None was noted in BMI. No statistical significance was noted between races, occupation and levels of income. Grip values of age and sex matched subjects showed that the left hand dominant group was comparatively stronger than the right. The strongest grip in the right dominant group fell in the age group of 25-34 age, whereas in the left hand dominant group, the age group with the strongest grip belonged to 35 to 44 years. In contrary to most belief, the right hand was always stronger regardless of the hand dominance.

Keywords: Grip strength, normative data, LIDO kinetic workset

INTRODUCTION

A reliable hand grip assessment is important in assessing the various surgical procedures and result of treatment. To be able to interpret what is abnormal, a baseline grip strength value of the normal population need to be established. To date, there has been no study on the normative grip strength of the adult Asian population. Most normative data are based on the Western literature which is not suitable in the Malaysian context.

Correspondence should be sent to:
Dr Tunku Kamarul Zaman
Department of Orthopaedic Surgery
University of Malaya Medical Centre
Lembah Pantai, 59100 Kuala Lumpur

MATERIALS AND METHODS

Four hundred and twelve subjects were recruited in the study. Strict criteria were adopted eliminating any subjects with the history of upper limb injury, upper limb deformity or related health conditions. Subjects were interviewed at the Rehabilitation Unit of University Malaya Medical Centre. They comprised of volunteers from the hospital staff, medical students and visitors to the hospital. A standard questionnaire revealing data regarding the subjects' socio economic background, health condition and lifestyle were filled and collected. Weight and height were also measured prior to hand grip strength testing.

A LIDO® kinetic work set was used to test the grip strength. A grip device attached to the rotatory arm of the work set was calibrated on each subject testing. A dedicated technician was employed to operate the machine to ensure consistent results. The protocol used in this study was an adaptation of Illinois State University School of Kinesiology and recreation protocol, NY state University hand grip protocol. The subject was seated in an upright position with the elbow flexed at 90° and adducted. The hand was so placed that the wrist was in neutral position facing inwards. The device handle was opened up to fit on the palm with the fingers position in 90° flexion at the PIPJ and DIPJ and the thumb in 90° abduction.

Subjects were instructed to grasp the handle on the examiner's instruction for duration of 5 seconds followed by a period of rest of 5 seconds. The cycle continued with another grip and rest for the same 5 seconds duration each and stopping after one minute. A brief trial about 10 seconds was done before the actual testing was commenced. During the actual testing, data was recorded, collected and analyzed. The average value of the 3 most powerful grips were taken and compared.

Four hundred and twelve (n=412) subjects were recruited, 200 male and 212 female. Of these, (93%) were right hand dominant while the remaining (7%) were left hand dominant. Subjects comprised of 53.4% Malay, 16.5% Chinese and 30.1% Indian.

RESULTS

The peak grip strength was noted at ages between 25 to 34 in the right hand dominant while in the left handed group it was between the ages of 34 to 44. In general, Male were stronger than female in all age groups. There was an average of about 60% difference in strength between male and female in both hands (Table 1 and 2).

Table 1. Comparing the right and left hand in different sexes in the right dominant group.
*There is statistical significant difference between the grip strengths of male and female ($p<0.05$) as well as between the right and left hand ($p<0.05$). Spearman correlation test showed significant correlation between the grip strength of either/both hands with the different sexes at 0.01 level.

Hand	Men	Women	Difference
R	104.4 ± 28.4	62.7 ± 17.1	60.07%
L	92.5 ± 27.3	53.8 ± 15.6	58.16%
Difference	88.60%	85.81%	

Table 2. Comparing the right and left hand in different sexes in the left dominant group.
*There is statistical significant difference between the grip strength of male and female ($p<0.05$) as well as between the right and left hand ($p<0.05$). Spearman correlation test showed significant correlation between the grip strength of either/both hands with the different sexes at 0.01 level.

Hand	Men	Women	Difference
R	103.3 ± 28.6	63.3 ± 16.4	61.28%
L	99.9 ± 31.2	55.8 ± 17.4	55.86%
Difference	96.71%	88.05%	

In both groups the right hand was stronger. In the right hand dominant group, the right hand was stronger than the left hand by 12.19% whereas in the left hand dominant group it was only by 7.62%. Comparing the mean values of the grip strength in the different hand dominance group, we found that there were no statistical differences in the strength of the right hand ($p=0.735$) but significant differences was noted for the left hand ($p=0.17$). However, in both groups (the right hand and left hand dominance) there were significant difference noted between the grip strength of both the left and the right hand with p values of < 0.05.

Using T-paired test, there were significant statistical differences noted in the grip strength for different sexes and different hand dominance. Male and left hand dominant were stronger. There was correlation noted between grip strength with height (p value < 0.05), weight (p value <0.05) and age (p value< 0.05).However, there were no correlation between grip strength and body mass index (BMI) with a p value$= 0.34$.

There were 143 (34.7%) subjects who are bimanual worker, 243 (56.8%) office workers and the rest consisting of pensioners and retirees 35 subjects (8.5%). Using one-way Anova statistical analysis, there were no differences noted between the different occupations. P value for the right hand grip was 0.15 whereas the left hand grip was 0.05.

There were three main races examined during this study. The Malay race represented 53.4% of the whole population (n=220), Chinese 16.5% (n=68) and Indian 30.1% (n=124). Using one-way Anova statistical analysis, there were no significant differences noted for the grip strength in the different races with the right hand having a p value of 0.577 and left hand of p value of 0.541.

We used a multivariate analysis to compare the left and right hand grip strength of subjects taking into account the different factors that may influence grip strength which includes sex, age, weight, height, BMI and occupation. We found that only age, weight, height and sex had statistical significance influencing grip strength with P value of < 0.05. BMI, occupation and race showed no statistically significance with P values of 0.303, 0.824 and 0.404 respectively.

DISCUSSION

When we compared our results with various data from the Western literature, we found that our population was significantly weaker than the American and European population. This was however was done comparing the grip strength of the respective sex and age groups. In this study we were unable to compare categorically the different factors influencing the grip strength of our subjects to other results as these factors were not considered by other authors. In our literature review, previous authors did not publish the data describing their subjects' parametric measurements such as height and weight to allow us to compare their data with ours. In comparing the grip strength of our normal population against Western data based solely on age and sex, a large proportion of our normal population would be categorized as abnormal. If this was so, many Asian centres also using the same data would be misinterpreting the patient's grip strength.

Our results showed a regression value of between 0.13 to 0.25 for grip strength against height and weight. It is our belief that because of this correlation, height and weight must be accommodated in reference to the normal value

and not just the age. Agnew et al[1] supported our finding that grip strength correlated with gender and age while Petersen et al[2] supported our finding for the influence of hand dominance. In our literature review, only one paper had been published correlation between weight or height with grip strength[3].

In this study, we found that there was an increase of grip strength between ages 18 to 35 for the right dominant group followed by a steady decrease thereafter. In the left hand dominant, the peak strength was between ages 35 to 44. This data supports a curvilinear relationship with hand strength peaking somewhere between 25 and 50 years of age and decreasing thereafter as described by Mathiowetz et al[4]. Kellor's assumption of a linear regression to predict adult hand strength scores for a normative data based on a linear inverse relationship is not well supported and needs to be questioned[5].

Some limitations have been noted in the analysis of the present report. The biggest limitation was that the data gathered was from an area population surrounding University of Malaya Medical Centre (UMMC) and may not be a representation of the whole country. However having considered that UMMC is tertiary centre for medical referral and education, most of our subjects are from different parts of the country and may roughly reflect the population of the whole country.

CONCLUSION

Data collected and established for Caucasian population are not applicable in the Malaysian population. The availability of local normative values is important for normal references and serves as point for objective achievements in patient rehabilitation. Although in this study we have established the values representing our population, a larger series of hand grip strength data in different regions of this country is required to establish a representation of the whole country. Other than sex, hand dominance and age; weight and height must also be considered when establishing the normal value of grip strength.

In addition to Mathiowetz's recommendation[4] to improve the reliability and validity of hand strength evaluations, we agree with that the following recommendations should be made:

(1) Standardized positioning and instruction should be followed;
(2) The average of at least three trials should be used (as in our case 6 grips and taking the average for the highest 3;
(3) Standard dynamometer (or any other measuring device) should be used for all data collection;
(4) Scores obtained should not only be compared to the appropriate age and sex categories for interpretation but also height, weight and hand dominance;
(5) The calibration of the dynamometer should be checked regularly;
(6) The same test instrument should be used for pre- and post testing.

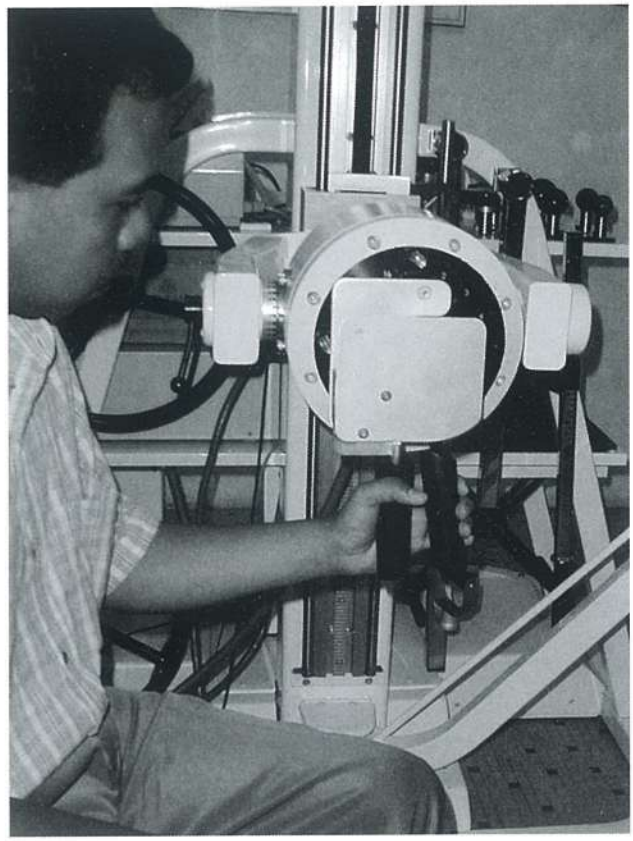

Figure 1. The subject is tested seating down with the left hand tested. Note that the arm is flexed at 90° and with the wrist in neutral position. A strict protocol of grip testing was adhered to.

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