To Establish Normative Data For Hand Grip Strength Amongst Elderly

Ashu Kailash Sharma*, Neha Mukkamala, Lata Parmar *****

*PG Student, **Assistant Professor, *** Principal, College of Physiotherapy, Sumandeep Vidyapeeth, Piparia, Vadodara

Abstracts: Background: Hand grip strength is good indicator of hand functions and muscle performance. Differences in HGS could be due to variation in environmental, genetic, nutritional, social and cultural factors. The present study establishes normative values of HGS using dynamometer amongst elderly. Methods: 539 healthy elderly subjects, both gender, ≥ 60 years, were included if GDS ≤ 2 and MMSE >25 from hospital campus and community. Grip strength was measured using JAMAR dynamometer. The elderly were segregated in to age groups 60-69, 70-79, & ≥80. Results: Data were normally distributed. The mean HGS was 21.49 kg and 12.82 kg of right hand and 20.47 kg and 11.99 kg of left hand in males & females respectively. ANOVA showed HGS of right and left to be significantly different within and between groups, indicating influence of age. Dominance and occupation showed no significant impact on HGS. Conclusion: Mean grip strength in this study was significantly less than similar studies done in the west. HGS in males was significantly greater than females. Grip strength decreases with advancing age. Dominance & previous occupation of the elderly did not have impact on grip strength. [Sharma A Natl J Integr Res Med, 2018; 9(6):23-27]

Key Words: Elderly, Hand grip strength, Normative values

Author for correspondence: Neha Mukkamala, Assistant professor,College of Physiotherapy Sumandeep Vidyapeeth, Piparia, Vadodara-391760. E-mail:neha.cop@sumandeepvidyapeethdu.edu.in

Introduction: The human hand has complex functions which include grasping, gripping and manual dexterity. It is a specialized tool playing an important role in everyday life, differentiating humans from primates[1]. The older population is more prone to disease, physical problems and deconditioning[2]. Muscle wasting is a prominent feature of old age and is commonly referred to as sarcopenia[3-9].Reduced activity with age results in reduced muscle mass, strength and endurance[3,4,7,10,11] .M.E.Vidt et al [4] state that muscle strength reductions can exceed the reduction in muscle mass with age. About 25% to 30% of muscle mass loss is seen by the age of 60 & 80 years respectively[5,9]. The actual mechanism of such changes in aging still needs to be understood. Hand grip is said to be an indicator of frailty & disability among the elderly and therefore can be utilized not only for intervention but also for risk identification[2,5-13]. Muscle changes in humans are said to start in the fourth decade of life and some state it can start as early as second decade [3,4,8,12].

Grip strength can be assessed with ease with various devices [6,14]. JAMAR hand held dynamometer (HHD) is considered gold standard for grip strength measurements in clinical practice[1,6,14].

According to WHO, life expectancy is on rise, the "oldest old" i.e. people above 85 constitute 12% of world population of developed world and about 6% of the developing world[15]. Hand impairment can limit capabilities to perform basic activities and thus affect quality of life[5]. Aging population in India need to be guided towards healthy aging.

Good grip strength is an important prerequisite for good upper limb functions. Reference values are very important when it comes to decision making. The aim of the study therefore was to assess the grip strength among elderly individuals in the community.

Material and Methods: This observational study was approved by Sumandeep Vidyapeeth Institutional Ethical Committee. A convenient sampling method was used. Power analysis was done and the sample size calculated was 539. Elderly subjects from the community were recruited after obtaining informed consent. The study included both genders, above age of 60, independent in activities of daily living with sufficient vision, absence of impairment affecting upper limb function, and having Mini Mental State Examination (MMSE) score greater than 25, Geriatric Depression score (GDS) less than 2 on 5-item scale. Subjects having cognitive deficits, neurological diseases, uncontrolled hypertension, and / or cardiovascular conditions were excluded. The right and left grip strength was taken for all the subjects with JAMAR HHD. The subjects sat in a chair without arm rests with shoulder in adduction and neutral rotation, elbow at 90° flexion, forearm in neutral position and wrist in 0- 30^0extension. The procedure was demonstrated to the subjects. The dynamometer was held by subjects on the dominant hand, red peak-hold knob was rotated counter clockwise to

0 and the subject was instructed 'press as hard as you can'. The peak-hold needle recorded the highest force that subject exerted and this was noted and recorded. The red peak hold knob was turned back to 0 again and same procedure was repeated. Total of 3 measurements were taken for each hand and their average analyzed.

Fig-1 JAMAR hand-held dynamometer

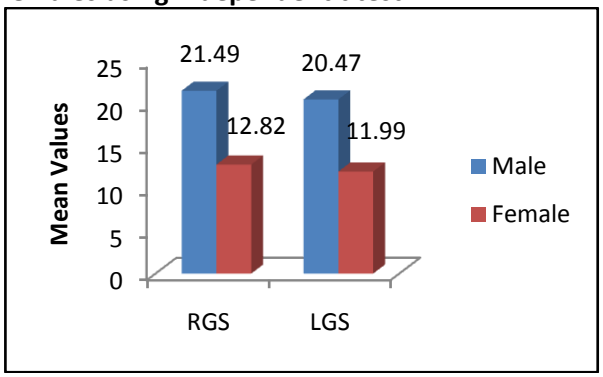
Fig-2 Testing position for hand grip strength

Result: Total number of subjects: 539. Out of which 338 males, 201 females with Mean age: 64.54 years (60-82 years) and Mean MMSE: 26.86 (1.67). Mean Right Grip Strength (RGS) (kg): 18.26 (7.06) Mean Left Grip Strength (LGS) (kg): 17.31 (6.95) The data was normally distributed at 95% Confidence Interval.

Table 1- Mean and SD of age and body mass index (BMI) in males and females

Variable	Males (N=338)		Females (N=201)		
	Mean age (SD)	Standard error	Mean age (SD)	Standard error	p-value
Age	64.50 (5.34)	0.290	64.63 (5.53)	0.390	0.789
BMI	22.53 (2.57)	0.14	22.22 (2.79)	0.19	0.190

Graph 1- Mean RGS and LGS in males and females using Independent t test.



Graph 2- Mean RGS and LGS in different age groups of elderly. (p<0.001)

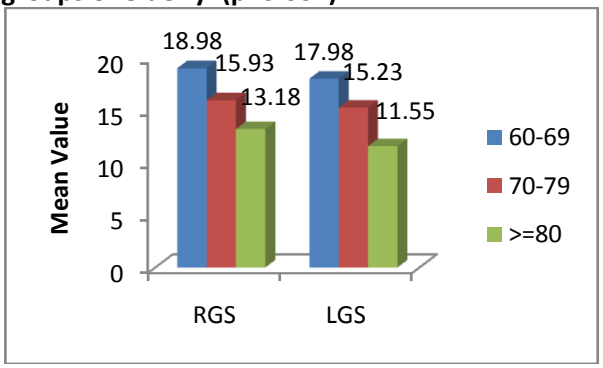


Table 2- Impact of hand dominance on HGS using Independent t-test

	Dominance	n	Mean (SD)	std.error mean	p-value
RGS	Right	449	18.50 (7.16)	.33	0.72
	Left	90	17.04 (6.37)	.67	
LGS	Right	449	17.09 (6.95)	.32	0.116
	Left	90	18.35 (6.85)	.72	

Table 3:- Impact of different occupations on HGS using ANOVA

		Sum of squares	Mean square	p-value
Right grip strength mean	Between groups	274.792	91.597	0.319
	within groups	26513.122	49.557	
	total	26787.915		
Left grip strength mean	Between groups	357.064	119.021	0.60
	within groups	25597.156	47.845	
	total	25954.221		

Discussion: 65.6% of Chinese and 45.4% of Indian health burden by 2030 is projected to be borne by older adults[16]. Taekema et al states that poor hand grip in the "oldest old" predicts accelerated dependency in ADL's and cognitive decline[7]. Several studies confirm grip strength is an indicator of physical functioning that decreases with age. The present study aimed to establish normative data of HGS among community dwelling elderly population ≥ 60 years.

The mean HGS of the whole population in the present study was 18.26 (7.06) kg and 17.31 (6.95) kg on right and left side. Median was 17.33 & 17 on right and left respectively and the values were normally distributed. Mean strength of female subjects in one study was in range of 20-36 kg with mean of 27.5 (4) kg[5]. Liu & Chu[17] found average HGS of both genders 25.6(7.8) kg and 23.8 (7.3) kg in right and left resp.

The present study grouped the subjects in to 60-69, 70-79 & ≥80 years. The results (graph 2) are well in agreement with literature stating reduction in grip strength as age advances[6,8,14,17]. There were 62.7% males & 37.9 % females and significant difference was seen in the HGS of both right and left hands between the genders (graph 1). According to Massy Westropp et al[12] grip strength is greater in males across all ages, it peaks at 40 years after which it starts to decline for both genders.

Comparison shows that men have greater muscle area, mass and strength than women. When corrected for muscle area, the difference in strength between men and women remains significant[9]. Several other authors too report the values of grip strength of males as significantly greater than females in all the groups[1,2,8,9,12,17,18,20]. According to Jansen et al.[8] males were stronger than females, but with increasing age, gender differences decreased. Hand strength of women aged 65-70 ranged from 60% to 67% of the men's values. However, in > 85 age group the ratio between women's hand strength and men ranged from76.9% to 90%. The results of this study lend credibility to the assumption that men experience a larger percent of strength loss than women which is also supported by majority of the studies[8].

However, strength of males & females in this study is significantly lesser than the various studies reviewed[1.12]. Massy Westropp et al (2011)[12]- 60 to 69 age group males' RGS 40(8.3) and LGS 38(8) kg; females RGS 24(5.3) and LGS 23(5)kg. 70 + men RGS 33(7.8) and LGS 32(7.5) kg; females 70 + RGS 20(5.8) and LGS 19(5.5) kg.

Maninder Kaur[11] studied HGS amongst the rural & urban Jat females (40-70 years), the age group 61-65 had mean of 16.84 & 13.68 kg of right & left hand resp. The age group 66-70 had mean of 14.66 & 11.58 kg of right & left hand resp.

Hand grip of 60 years and above is said to show almost 20% of decline from the peak values. Accordingly the author found the rural females to have higher mean grip strength compared to urban females (kg) right hand 20.35 vs. 18.87 and left hand 17.05 vs. 15.68, this was similar to that reported by Ngee Wei Lam et al[2] explaining the probability of mid life occupations of manual tasks such as farming & rubber tapping to be the cause of the same in their population.

Indian studies apparently seem to be compatible with the mean HGS of the present study. However HGS values of various groups of the present study are also significantly lesser in both genders compared to Malaysian population study by Ngee Wei Lam[2].

R.W. Bohannon et al[19] in a meta analysis consolidated the results of normative data of hand grip strength for all age groups between 20 years to 75+. The mean ranges with confidence intervals have been given for the age group 60 – 64, 65 – 69, 70-75 and 75 +.

The author states that if the grip strength of a patient is lesser than the lower limits of CI it is to be considered as impaired. The author has listed the limitations of the Meta analysis.

Sara Zuboff [20] has given norms of all age groups, accordingly there will be difference in grip strength of males vs. females, right & left hand i.e. dominant & non dominant and age, however the grip strength will also be affected by the position of the wrist, elbow and shoulder.

In elderly males in the age groups the categorization is done as weak (W), normal (N) & strong(S) as follows[20]:
60-64 <30.2 (W); >30.2 – 48 (N); &>48 (S)
65-69<28.2 (W);>28.2 – 44(N); &>44 (S)
70- 99<21.3(W); >21.3- 35.1 (N); &>35.1(S)
In elderly females[20]:

60-64 <17.2 (W);>17.2 – 31 (N);&>31(S)
65-69<15.4 (W);>15.4 – 27.2(N);&>27.2(S)
70- 99<14.7(W); >14.7- 24.5 (N); &>24.5(S)

Some studies demonstrate dominant HGS to be higher than the non-dominant[1]. The dominant hand is said to be 10% stronger than the non dominant[6,9,21,22]. Although, according to some, this may not be true for all working populations[6,12,17,21]. This 10% rule was first described in 1950's[21]. Inspite of humans not showing large morphological differences between right and left sides, in 34%, the dominant hand was stronger and in 54% it had better control than non-dominant hand[22]. According to Armstrong and Oldham [21] no significant difference was observed between the dominant & non dominant hands. Therefore, the 10% rule is questioned and probably applicable to right handed people as left handed show no significant difference between sides. This has been based on descriptive statistics rather than inferential. The author further quotes studies which show difference of 6% between the dominant and non dominant and also states that in the said study the differences although significant did not approach 10%[21] ,which is also supported by H C Roberts et al[6].
Jansen et al.[8] defined hand dominance by the preference of the participant to use the hand for writing and to throw a ball, handedness is a nuanced concept and might include not only hand preference but also skillfulness[8]. The present study did not confirm significant difference when the dominant & non dominant hands were compared (table 2). Also the data with regards the influence of the occupation was not found to make significant difference in the HGS (table 3). Authors Liu and Chu [17] and another study [13] state previous occupations with its physical demands influenced the handgrip strength.

Conclusions: The HGS in present study is compatible to the Indian studies, however when compared to reference values to the Malaysian & western population, the HGS is significantly lesser in both males & females In agreement to the literature the males HGS is significantly greater than females across the age groups. The present study did not confirm significant difference when the dominant & non dominant hands were compared. In the elderly influence of occupation was also found to be insignificant

Acknowledgment: The authors are grateful to the trust 'Sumandeep Vidyapeeth' for all the support provided

References:

1. Walankar P, Verma C. Mehta A. Study of hand grip strength in Indian population. International Journal of Health Sciences and Research. 2016; 6 (11):162-166.
2. Lam N W, Goh H T, Kamaruzzman S B, Chin A V, Poi P J, Tan M P. Normative data for hand grip strength and key pinch strength, stratified by age and gender for a multiethnic Asian population. Singapore Med J.2016 ; 57 (10): 578-584.
3. Nair KS. Aging muscle 1-5. Am J Clin Nutr. 2005; 81: 953–63.
4. Vidt M E, Daly M, Miller M E, Davis C C, Marsh A P, Saul K R. Characterizing upper limb volume and strength in older adults: A comparison with young adults. Journal of biomechanics. 2012; 45: 334-341.
5. Buckley C, Stokes M, Samuel D. Muscle strength, functional endurance, and health-related quality of life in active older female golfers. Aging Clin Exp Res.2018 Jul;30(7):811-818.
6. Roberts H C, Denison H J, Martin H J, Patel H P, Syddall H, Cooper C et al. A review of the measurement of grip strength in clinical and epidemiological studies: towards a standardized approach. Age and Ageing. 2011;40:423–429.
7. Taekema D G, Gussekloo J, Maier A B, Westendorp R G, De Craen A J. Handgrip strength as a predictor of functional, psychological and social health. A prospective population-based study among the oldest old. Age and Ageing. 2010; 39:331–337.
8. Jansen C W, Niebuhr B R, Coussirat D J, Hawthorne D, Moreno L, Phillip M. Hand force of men and women over 65 years of age as measured by maximum pinch and grip force. Journal of Aging and Physical Activity. 2008; 16: 24-41.
9. Hyatt R H, Whitelaw M N, Bhat A, Scott S, Maxwell J D. Association of Muscle Strength with Functional Status of Elderly People.Age and Ageing. 1990;19:330-336.
10. Norman K, Stobaus N, Gonzalez M C, Schulzke J D, Pirlich M. Hand grip strength : outcome predictor and marker of nutritional status. Clinical Nutrition. 2011; 30:135-142.

11. Kaur M. Age related changes in hand grip strength among rural and urban Haryanvi jat females. Journal of comparative human biology. 2009; (60): 441-450.
12. Massy-Westropp N M, Gill T K, Taylor A W, Bohannon R W, Hill C L. Hand Grip Strength: age and gender stratified normative data in a population-based study. BMC Research Notes. 2011; 4:127.
13. Josty I C, Tyler M P,Shewell P C, Roberts A H. Grip and pinch strength variations in different types of workers. Journal of Hand Surgery (British and European Volume 1997); 22 B (2): 266-269.
14. Vermeulen J, Neyens J C ,Spreeuwenberg M D, Rossum E V, Hewson D J , De Witte L P. Measuring Grip Strength in Older Adults: Comparing the grip-ball with the Jamar dynamometer. Journal of Geriatric Physical Therapy. 2015;38 (3):148–153.
15. Global health and ageing. World Health Organization. [Internet, cited July 7, 2018]. Available from http://www.who.int/ageing/publications/global_health.pdf.
16. Chatterji S, Kowal P, Mathers C, Naidoo N, Verdes E, Smith J P et al. The health of aging populations in China and India. Health affairs.2008; 27(4):1052-1063.
17. Liu K P, Chu M M. Grip strength and physical demand of previous occupation in a well-functioning cohort of Chinese older adults. Perceptual and Motor Skills.2006;103:14-20.
18. Desrosiers J, Bravo G, Rejean H,Dutil E. Normative data for grip strength of elderly men and women.The American Journal of Occupational Therapy.1995 ; 49 (7) : 637-643.
19. Bohannon R W, Peolsson A, Massy-Westtrop M, Desrosiers J, Bear-Lehman J. Reference values for adult grip strength measured with a Jamar dynamometer: a descriptive meta-analysis. Physiotherapy. 2006; 92: 11-15.
20. Zuboff S. Hand grip strength norms. [Internet, cited July 7, 2018]. Available from https://www.prohealthcareproducts.com/blog/hand-grip-strength-norms/.
21. Armstrong CA. Oldham J A.A comparison of dominant and non-dominant hand strengths. Journal of Hand Surgery (British and European Volume, 1999) 24B: 4: 421–425.
22. Noguchi T, Demura S, Aoki H. Superiority of the dominant and non-dominant hands in static strength and controlled force exertion. Perceptual and Motor Skills. 2009 ; 109 : 339-346.

Conflict of interest: None

Funding: None

Cite this Article as: Sharma A K, Mukkamala N Parmar L. To Establish Normative Data Fo Hand Grip Strength Amongst Elderly. Natl Integr Res Med 2018; 9(6):23-27