

Short Communication

Handgrip strength cut off value estimation in Indian older adults using LASI-1 dataset

Sambaran Mondal¹, Sudipta Banerjee¹, Shankarashis Mukherjee¹

¹Department of Food and Nutrition, West Bengal State University, West Bengal, Kolkata, India.

***Corresponding author:**

Shankarashis Mukherjee, PhD,
Professor and Head,
Department of Food and
Nutrition, West Bengal State
University, Kolkata,
West Bengal, India.

msasish@yahoo.co.in

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ABSTRACT

Objectives: Handgrip strength (HGS) is a well established indicator of sarcopenia. The study tried to report the distribution of HGS among the Indian older adults with a large dataset of LASI-1 and attempted to generate age and sex specified cut-off values following the procedure recommended by Asian Working Group for Sarcopenia.

Materials and Methods: After considering inclusion and exclusion criteria, 40351 healthy individuals aged 45-89 years of both sexes were selected. Arithmetic mean and standard deviation for HGS were found out. HGS cut-off values were generated using the lowest 20th percentile from the study population.

Results: Average HGS was found to be higher in females (21.74 ± 7.447 kg) than males (21.67 ± 7.361 kg). HGS cut-off value of 15.25 kg was generated for Indian older adults of both sexes.

Conclusion: Generated HGS cut-off value of 15.25 kg may be found to effective in early screening of sarcopenia among the Indian older adults.

Keywords: Handgrip strength, HGS cut-off, Indian older adults, Sarcopenia

INTRODUCTION

Sarcopenia can be defined as a continuous and generalised degeneration of muscle strength and skeletal muscle mass, which can be identified through the measurement of handgrip strength (HGS).^[1] Sarcopenia can be categorised as primary sarcopenia, which is associated with ageing and secondary sarcopenia, which results from chronic conditions and diseases such as cancer, arthritis and so on.^[2]

Grip strength is an easy to administer and reliable measurement of maximum voluntary muscle contraction and also serves as an indicator of the overall muscular strength of the human body.^[3] It not only helps in predicting the muscle mass in the body but also provides an indication about the state of nutrition, the occurrence of chronic diseases, quality of life and mortality.^[4-6] Nutritional status plays a crucial role in maintaining optimum HGS by regulating the skeletal muscle mass in the body and any fluctuation in it, in terms of malnutritional state can seriously hamper the HGS and leads to early development of sarcopenia and frailty among the older adults.^[7,8]

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In recent times, HGS has been widely used as a clinical indicator of deprived mobility and low muscle mass.^[9] HGS indicates the presence and function of muscle fibres in the body, which is affected by the distribution of muscle mass, and also helps to identify the early signs of sarcopenia in terms of deprived HGS, especially among older adults and the elderly.^[10]

The European Working Group on Sarcopenia in Older People (EWGSOP2) revised the older definitions (EWGSOP) and terms and set new cutoff values of HGS for indication of lower strength as <27 kg for men and <16 kg for women.^[11] As there is a disparity between European and Asian populations, in terms of ethnicity, body structure, climate and other related factors, the Asian Working Group for Sarcopenia (AWGS) proposed a HGS cutoff of <28 kg for men and <18 kg for women, which indicates lower strength.^[12] However, there is no standardised and specified cutoff values for the Indians.

In Indian context, the Longitudinal Aging Study in India (LASI), Wave 1 depicts a larger health scenario of the older adults and the elderly prevailing in the country in its report; but still there is a dearth of knowledge regarding the sarcopenia and its allied issues.^[13] Few attempts were made to specify cutoff values of HGS for Indian older adults, but most of them lack large sample sizes from the population.^[14,15] In this backdrop, the purpose of the study is to report the distribution of HGS among the Indian older adults and the elderly with age and sex specification and also generate HGS cutoff values for identification of lower muscle strength among them.

MATERIALS AND METHODS

Data

The present study used the dataset of LASI-1, which was conducted nationwide including the Union territories, during 2017–2018 with a multistage, stratified, cluster and area probabilistic random sampling method. The study consisted of 72250 individuals aged 45 years and above of both sexes. Data on several health parameters including the anthropometric assessments along with psychological and social health related parameters were collected using standard procedures and validated questionnaires. Grip strength was measured by LASI, using a handheld dynamometer (Smedley's Hand Dynamometer) of both hands (considering the dominant and non-dominant hands).^[13] The subjects were asked to sit in a chair with armrests to eliminate the influence of gravitational force, and instructed to press the dynamometer as hard as they could for a couple of seconds and then let go, 3 times in both hands and the maximum values were chosen as HGS; the trained health investigators collected two reading of HGS (nearest to 0.5 kg) for both dominant and non-dominant hands performed with a rest of 30 s between the two measurements.^[16] The present study used the calculated average HGS values for analysis.^[17]

Inclusion criteria

From the 72250 individual data, the present study included the data of 40,351 healthy individuals aged between 45 and 89 years of both sexes the other criterion being availability of data on grip strength of both hands.

Exclusion criteria

Individuals aged <45 years and ≥ 90 years were excluded and excluded were those whose data for grip strength of both hands were not available. Individuals suffering from chronic diseases such as Alzheimer's, bone, or joint diseases such as arthritis, osteoporosis and rheumatism, diabetes, lung diseases, heart diseases, stroke and neurological or psychiatric problems were also excluded from the study.

HGS cutoff values for determination of sarcopenia

The EWGSOP recommended for defining the cutoff of HGS, a study should be conducted using the normative population, that is healthy young adults rather than other provided predictive reference populations and the cutoff points will be below 2 standard deviations (SDs) from the mean reference value.^[18] Another approach by AWGS stated that, when normative data is unavailable, cutoff values can be generated using the lowest quartiles or quintiles with sex-wise specification.^[19]

In the Indian context, in the absence of normative data, the study selected a healthy not so aged population and estimate normative data as well as used age and sex specific lowest 20th percentile to generate cutoff values of HGS for older Indian population.

Statistical analysis

All statistical analyses were performed using IBM SPSS Gradepack 29. Average strength (kg) of both hands was calculated. The individuals were categorised sex-wise as men and women and also specified with age groups as 45–49 years, 50–54 years, 55–59 years, 60–64 years, 65–69 years, 70–74 years, 75–79 years, 80–84 years and 85–89 years. Descriptive statistics such as mean and SDs were calculated for all variables. Percentiles of HGS were calculated using HAVERAGE method. The HGS cutoff values for older Indian population were generated using the age- and sex-adjusted lowest 20% quintiles in the study population.

RESULTS

Among the 40351 healthy older Indian individuals, 18833 (46.67%) were males and 21518 (53.33%) were females. The mean age of the males was 59.8 ± 10.36 years (presented in arithmetic mean \pm standard deviation form) and 59.0 ± 10.15 years for females. The anthropometric

Table 1: Anthropometric profile of the healthy individuals included in the study.

Age groups (years)	Sex	n	Anthropometric parameters			
			BH (cm)	BW (cm)	BMI	WC (cm)
45–49	Male	3787	155.1±8.73	54.6±12.75	22.60±4.561	84.2±12.49
	Female	4568	155.4±8.65	54.2±12.30	22.39±4.438	83.7±12.34
50–54	Male	3215	155.5±8.77	54.3±12.53	22.35±4.450	83.8±12.49
	Female	3672	155.2±8.76	54.1±12.26	22.43±4.928	83.7±12.34
55–59	Male	2765	154.9±8.53	53.8±12.36	22.32±4.483	83.6±12.24
	Female	3362	155.1±8.83	53.9±12.15	22.36±4.707	83.6±12.10
60–64	Male	2929	155.3±8.65	54.0±12.48	22.31±4.452	83.5±12.48
	Female	3456	155.4±8.61	54.5±12.77	22.46±4.616	84.0±12.58
65–69	Male	2658	155.1±8.87	54.5±12.65	22.57±4.636	84.0±12.21
	Female	2765	155.0±8.75	53.9±12.56	22.33±4.474	83.7±12.25
70–74	Male	1799	155.5±8.74	54.5±12.39	22.50±4.640	84.1±12.52
	Female	1730	155.4±8.55	55.0±12.59	22.70±4.634	84.3±12.32
75–79	Male	1062	155.1±8.83	53.9±12.83	22.31±4.757	83.5±12.31
	Female	1061	155.4±8.86	53.9±12.36	22.25±4.458	83.6±12.34
80–84	Male	618	154.6±8.59	53.9±11.89	22.53±4.529	84.0±11.77
	Female	605	154.8±8.47	54.5±13.41	22.64±4.840	84.2±13.04
85–89	Male	276	154.8±7.98	53.6±12.25	22.30±4.439	83.9±12.84
	Female	299	156.4±9.08	55.8±13.16	22.71±4.499	84.7±13.11

Data presented as AM±SD. BH: Body height, BW: Body weight, BMI: Body mass index; WC: Waist circumference, AM: Arithmetic mean, SD: Standard deviation

profile of the healthy individuals included in the study with age and sex specifications is shown in Table 1.

The distribution of HGS (kg) in the healthy Indian individuals with age- and sex-wise categorisation is shown in Table 2.

The age- and sex-wise percentile distribution of HGS (kg) in the study population is shown in Table 3.

The age- and sex-wise generated cutoff values of HGS (kg) for the healthy Indian individuals aged 45–89 years are shown in Figure 1.

DISCUSSION

HGS serves as a useful indicator of muscle mass decline and helps in the early detection of sarcopenia.^[2] In the present study, on the basis of the AWGS procedure for determining HGS cutoff values, we propose, a cutoff value of HGS is <15.25 kg for both males and females, for screening, which is an early and relatively easier initial detection of muscle strength deterioration. The value proposed in the present study is similar to the study carried out on Indian older adults by Muhammad *et al.*, where they suggested an HGS cutoff value of 19.5 kg for males and 12.5 kg for females.^[20] The trend continues with female older adults, as another study on Indian adult females reported a value of <16.7 kg; but for males, they reported a relatively higher value of <25.63kg.^[21]

Table 2: The distribution of handgrip strength (kg) in the study population.

Age groups (years)	Male	Female
	HGS (kg)*	HGS (kg)*
45–49	21.9±7.35	21.9±7.53
50–54	21.9±7.67	21.7±7.39
55–59	21.4±7.14	21.5±7.29
60–64	21.6±7.29	22.0±7.45
65–69	21.5±7.28	21.5±7.54
70–74	21.8±7.49	21.9±7.39
75–79	21.5±7.42	21.8±7.51
80–84	21.5±6.92	21.8±7.38
85–89	21.4±7.30	22.3±7.72

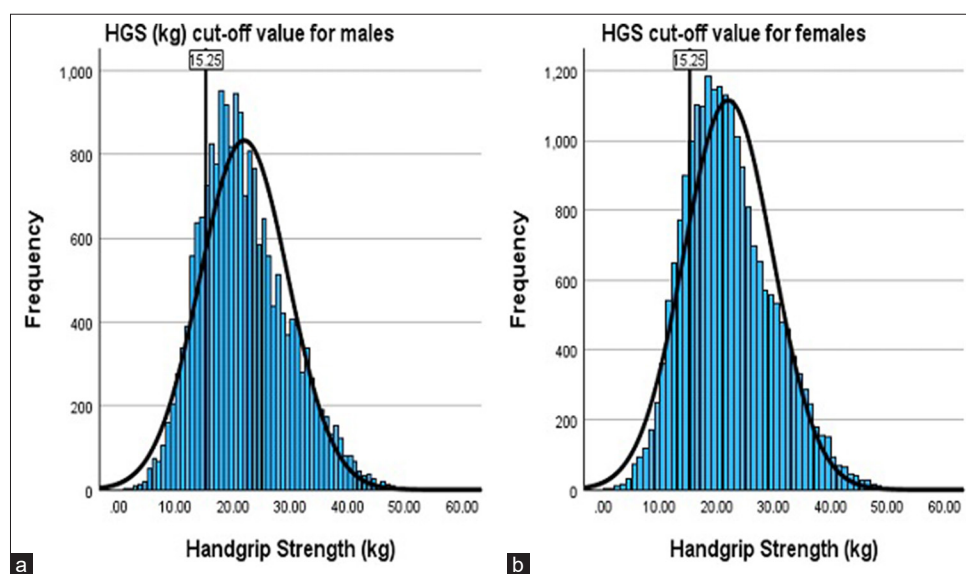
*Presented in AM±SD form. HGS: Handgrip strength, AM: Arithmetic mean, SD: Standard deviation

Looking at the findings from other countries, it is found that the value proposed in the present study has a similarity with a study carried out with older adults of Taiwan; it proposed a value of 19.73 kg.^[22] However, it should also be mentioned that the value proposed in the present study is little less compared to values reported by Chinese (28.5 for males and 18.6 kg for females), Japanese (28 kg for males and 18 kg for females) and Korean (<28.9 kg for males and <16.8 kg

Table 3: Age- and sex-wise percentile distribution of HGS (kg) among the study population.

Age groups (years)	Sex	Percentiles of HGS (kg)						
		10 th	20 th	25 th	50 th	75 th	90 th	95 th
45–49	Male	13.1	15.6	16.6	21.1	26.6	32.3	35.5
	Female	12.7	15.4	16.5	21.1	26.9	32.6	35.4
50–54	Male	12.5	15.3	16.3	20.9	27.0	32.9	35.7
	Female	12.6	15.1	16.1	21.0	26.5	32.0	35.5
55–59	Male	12.8	15.1	16.3	20.6	26.0	31.8	34.5
	Female	12.8	15.3	16.3	20.9	26.0	32.1	34.9
60–64	Male	12.9	15.3	16.5	21.0	26.4	31.9	35.2
	Female	12.9	15.5	16.5	21.3	27.0	32.5	35.4
65–69	Male	12.8	15.0	16.0	20.6	26.3	31.9	34.8
	Female	12.4	15.0	16.0	20.5	26.4	32.4	35.4
70–74	Male	12.5	15.3	16.3	21.3	26.5	32.4	35.8
	Female	12.8	15.4	16.5	21.0	26.8	32.4	35.4
75–79	Male	12.8	14.9	16.0	20.5	26.5	32.5	34.8
	Female	12.9	15.1	16.1	21.0	26.7	32.4	35.6
80–84	Male	13.0	15.3	16.3	21.0	25.9	31.5	34.3
	Female	12.9	15.4	16.4	20.8	26.5	32.4	35.5
85–89	Male	12.8	15.0	15.9	20.1	26.3	32.0	34.9
	Female	12.8	15.3	16.1	22.0	27.9	32.9	35.1

HGS: Handgrip strength

**Figure 1:** Age-specified sex-wise handgrip strength (kg) cutoff values for both Indian (a) males and (b) females (using lowest 20th percentile). HGS: Handgrip strength.

for females) older populations, depicted the prevailing differences in HGS among the Asian populations.^[17,23,24] Our developed cutoff value of HGS of 15.25 kg is quite less than the cutoff provided by AWGS (<28 kg for men and <18 kg for women for Asian population in general) and EWGSOP2 (<27 kg for men and <16 kg for women for Europeans).

Limitations

There are several limitations in the study, such as; the data used in the study are cross-sectional in nature, and the study did not consider the nutritional status or physical performance of the individuals for generation of HGS cutoffs;

also the determination of handedness of the respondents was not mentioned.

Another important drawback is the study consists of Indians varying with respect to ethnicity and age differences.

However, the study can glimpse the HGS cutoff values for older Indian adults with a large dataset and AWGS procedure, which is worthy of first in its category. The study also reveals the need for gold standard HGS cutoff values with global standardisation for older adults.

CONCLUSION

The study is able to provide a cutoff value of 15.25 kg for older Indians from a large dataset following the AWGS procedure and could be the very first such attempt for older Indians. It implies that individuals with measured HGS values of ≤ 15.25 kg run a risk of muscle strength deterioration that may lead to sarcopenia in the long run having serious implications. The outcome of the present work may hence facilitate a screening, that is an early, easy, and cost-effective detection of sarcopenia in terms of HGS values.

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Data availability: The data were freely available in the public domain and can be accessed from IIPS, on subsequent request through <https://www.iipsindia.ac.in/content/LASI-data>.

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