
A Study on Assessment of Hand Grip Strength in Medical Laboratory Technicians

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ABSTRACT

Measuring grip strength is an important part of hand injury evaluation. Hands undergo many physiological and anatomical changes with aging, though these effects on hand function are still poorly understood. The aim was to assess the hand grip strength among medical laboratory technicians in India. The cross sectional study was carried out among 108 medical laboratory technicians in the age group of 20 to 50 years and 38 subjects as control group from Mumbai and Kolkata. Hand grip strength has been measured with the help of using Jamar Hand Grip Dynamometer. The results indicated that there is an increase of hand grip strength up to the age of 40 years and 35 years in males and females respectively. Thereafter there is a gradual decline in the strength for the medical laboratory technicians. The primary factor for this is aging, and consequent decline of muscle mass. The other contributing factors are lack of body activity, improper work schedule and inappropriate design of tools, etc. There was a significant difference in the means of handgrip strength between males and females in all age groups. The dominant hand shows greater handgrip strength than the non dominant hand in both males and females and the difference was highly significant ($p < 0.05$). There was a positive significant correlation between age and grip strength in the dominant hand ($p < 0.05$).

Key words: Hand grip strength, medical laboratory technicians, muscle strength, aging, dominant and non-dominant hand

INTRODUCTION

Hand grip strength is an easily obtainable measure of physical health and muscle function [1]. Grip strength determines the handedness of an individual [2]. It may be used as a predictor of physical functioning [3], for assessment of upper limb impairment [4] and evaluation of nutritional status [5] and also in injury prevention and rehabilitation [6]. Handgrip strength is a physiological variable that is affected by a number of factors including age, gender and body size [2]. Moreover, grip strength is also influenced by the health status and level of physical activity of a person [7]. The type of occupation appears to have a specific correlation to the degree of strength exhibited [8], and a recent study in the Chinese population [9] has found a correlation between grip strength and anthropometric factors such as forearm circumference, body height, and weight. In fact, the grip strength was reported to be higher in the dominant hand with right

handed subjects, but no such significant differences between sides could be documented for left-handed persons [10].

Handgrip plays a major role in medical laboratories. Laboratory procedures are highly repetitive and involve a variety of risk factors. Various studies have shown that the key risk factors in medical laboratories are awkward postures, repetition and excessive force [11]. They perform multiple tasks including: pipetting, microscopy, microtomy, working on cell counters, biosafety cabinets and cryostats where handgrip is extensively used. The medical laboratory technicians require a significant amount of upper body muscle due to specificity in their nature of work. Laboratory procedures are hand intensive jobs. It is known that laboratory workers often suffer from upper-limb disorders [11]. Literature has reported that the leading cause for upper limb musculoskeletal disorders was usually excessive force [12] and it was found that the power grip was the major reason of the upper limb musculoskeletal disorders [13].

Literature considering the association of morphological and anthropometric characteristics with the handgrip strength in various professions especially athletic populations have been extensively studied [14]. But, the information related to the assessment of hand grip strength and its correlation with age has not been considered among medical laboratory technicians. In the present study, an attempt has been made to estimate the handgrip strength of medical laboratory technicians in relation to different age groups. Another aim was to compare the hand grip strength of the medical laboratory technicians with the control group.

MATERIAL AND METHODS

Study design and population

The present cross-sectional study is based on randomly selected 108 Indian medical laboratory technicians (58 males and 50 females), aged 20-50 years, and of various hospitals based medical laboratories of Mumbai and Kolkata, India. The inclusion criteria were as follows: any laboratory technician, of either sex, having work experience 1 year and above. Exclusion criteria were any history of inflammatory disease or traumatic event to the upper extremity requiring medical management or leading to restrictions of daily activity. A written consent was obtained from all the subjects prior to the study. All the subjects were explained the detailed procedure of the study. The study was approved by the local ethics committee. Physiological parameters studied in the experimental group (n=108) were compared with the control group (n=38) selected for the study.

Study protocol

All surveys and hand strength assessments were administered by a single researcher. Each subject was given a paper survey and interviewed face to face to obtain demographic information, hand dominance (i.e., the writing hand), and medical history. Grip strength was measured with a Jamar hand dynamometer. For each of the strength assessments, subjects

were seated with the shoulder adducted and neutrally rotated, elbow flexed at 90° with the forearm in neutral position, and wrists between 0° and 30° of flexion and between 0° and 15° of ulnar deviation as given by the American Society of Hand Therapy [15]. Each test was performed two consecutive times at 1-minute intervals to reduce measurement error. Handgrip dynamometer was calibrated before each assessment. Also hand grip strength of the experimental group (n=108) was compared with the control group (n=38) selected for the study.

Data analysis

Descriptive statistics (mean and standard deviation) were performed for all direct measurements and derived variables. An independent sample t-test and Pearson’s correlation coefficient test was used to find the statistically significant differences between experimental and control group and to see the correlation between the age and hand grip strength. Data was analyzed using the SPSS ver. 16.0. A p-value of <0.05 was used to indicate statistical significance.

RESULTS

Descriptive statistics of anthropometric variables and the employment characteristics in Indian medical laboratory technicians are shown in Table 1 (N=108)

Table 1: Demographic and occupational characteristics of medical laboratory technicians

Variables	Males (n=58)		Females (n=50)	
	Mean	SD	Mean	SD
Age	31.55	7.8	28.42	6.5
Height	167.88	7.5	152.81	11.7
Weight	63.06	8.7	52.41	11.3
Hand dominance (Right Handed) (%)	98.27%		98%	
Work experience	8.24	6.2	5.40	5.2
Working hours	8.65	0.4	8.46	0.3

The 108 subjects (58 males and 50 females), aged 20-50 years, were divided into 7 age groups each representing (6-9) % of the total number of participants. All the subjects were right handed. The average age, height and weight for males and females are as follows: 31.55±7.8years and 28.42±6.5years; 167.88±7.5cm and 152.81±11.7cm and 63.06±8.7kg and 52.41±11.3kg respectively. All of the technicians were right handed showing their right handed dominance (98.27% for males and 98% for females). The average work experience for males (8.24±6.2) years was comparatively more than the females (5.40±5.2) years. The average working hours for both males and females were almost same ranging from 8.65±0.4 to 8.46±0.3 hrs (Table 1).

The baseline characteristics of the experimental group (n=108) were being compared with that of control group (n=38). The anthropometric characteristics of medical laboratory technicians (experimental group) and the control group are listed in Table 2.

Table 2: Anthropometric characteristics of Medical Laboratory Technicians (n=108) (Experimental Group) and Control Group (n=38)

Variables	Medical Lab Technicians (M ±SD)	Control Group (M ±SD)	t test score	p value
Age (yr)	30.41 ±8.82	30.26 ±3.12	-1.826	0.076
Height (cm)	163.04 ±9.50	162.75 ±4.35	-1.824	0.077
Weight* (kg)	58.49 ±11.54	60.28 ±6.26	-4.291	0.000

The average age of medical laboratory technicians and control group were 30.41±8.82 years and 30.26±3.12 years respectively. Whereas average height of both the groups were 163.04 ±9.50cms and 162.75±4.35cms respectively however the average weight of medical laboratory technicians and control group were 58.49±11.54kg and 60.28±6.26kg respectively. The independent sample t test shows that there were no significant differences in age and height of both the groups (p>0.05) whereas significant difference was found in the case of weight in both the groups (p<0.05) as shown in Table 2.

In this study the hand grip strength of both the hands for both the groups (experimental and control) were obtained using hand grip dynamometer.

Table 3: Comparison of Hand Grip Strength (HGS) of Medical Laboratory Technicians (n=108) with Control Group (n=38)

Subjects	Right (kgf)		Left (kgf)	
	M±SD	Range	M±SD	Range
Medical Laboratory Technicians	21.27 ±8.7	4-42	19.46 ±7.4	2-44
Control Group	17.12 ±3.57	7.71-23.59	16.97 ±3.6	9.07-23.13
Probability (p)	0.844		0.375	

*Significance level p < 0.05

The above Table 3 shows that the average handgrip strength of the right hand (21.27 ±8.7 kgf) and left hand (19.46 ±7.4 kgf) for medical laboratory technicians was more when compared with the average handgrip strength of the right hand (17.12 ±3.57 kgf) and left hand (16.97 ±3.6 kgf) for control group but no statistical significance was found (p>0.05).

There is a significant difference in the means of handgrip strength between males and females in all age groups (p< 0.05) except in the age group 45-49 years. The results also show that the peak of handgrip strength in males was around 25-39 years and gradually declines thereafter, as for females it was at an earlier age around 25-35 years (Table 4).

Table 4: Relationship of age and Handgrip strength (kgf) among males and females in medical laboratory technicians

Age Group Years	Males		Females		Statistical Analysis	
	Mean	SD	Mean	SD	t-value	p-value
20-24	25.25	7.27	13.78	5.52	4.564	.000*
25-29	27.06	4.65	13.88	3.90	8.847	.000*
30-34	28.4	4.5	14.4	2.60	5.959	.000*
35-39	29.11	6.9	14	3.34	4.470	.001*
40-44	27	7.18	12.5	5.25	3.205	.013*
45-49	26.8	3.34	12.2	-	1.309	.261

The correlation analysis shows that in case of both males and females, a negative correlation was found between the age and hand grip strength after the age of 40s. However onset of negative correlation in case of females appears before the male counterparts (Table 5).

Table 5: Relationship of Hand Grip Strength among different age groups

Age Groups	Hand Grip Strength (MALES) (M) R value (p values)					
	20-24	25-29	30-34	35-39	40-44	45-49
20-24 (12)	1	-.116 (.76)	.146 (.81)	-.150 (.70)	-.122(.82)	-.187 (.76)
25-29 (15)	-.166 (.76)	1	.866 (.33)	.132 (.80)	.597 (.40)	.961 (.17)
30-34 (5)	.146 (.81)	.866 (.33)	1	-.087 (.89)	.929 (.07)	-.993 (.07)
35-39 (9)	-.150 (.70)	.132 (.80)	-.087 (.89)	1	.744(.09)	.787 (.11)
40-44 (6)	-.122 (.81)	.597 (.40)	.929 (.07)	.744 (.09)	1	.701(.18)
45-49 (5)	-.187 (.76)	.961 (.17)	-.993 (.07)	.787 (.11)	.701(.18)	1
Hand Grip Strength (FEMALES) (F)						
20-24 (14)	1	.425 (.12)	-.396 (.51)	.670 (.21)	.517 (.48)	-
25-29 (18)	.425 (.12)	1	-.383 (.52)	.535 (.35)	.232 (.76)	-
30-34 (5)	-.396 (.51)	-.383 (.52)	1	-.717 (.17)	-.98(.01)*	-
35-39 (5)	.670 (.21)	.535 (.35)	-.717 (.17)	1	.821 (.17)	-
40-44 (4)	.517 (.48)	.232 (.76)	-.986(.01)*	.821(.17)	1	-
45-49 (1)	-	-	-	-	-	1

*Significance level $p < 0.05$

There is a highly significant difference between the dominant and non-dominant hands in both males and females ($p < 0.05$). In the present study, it was found that on average, grip strength in the dominant hand was stronger than the non-dominant hand. Correlating age with handgrip strength revealed a significant positive correlation with hand dominance ($r=0.224, p=0.026$). This indicates that hand dominance found to have significant correlation with age.

DISCUSSION

Grip strength has long been thought of as a possible predictor of overall body strength but scant scientific data exists [16]. Hence, this study aimed at assessment of handgrip strength of

the laboratory technicians. The results showed that the hand grip strength of both the hands was more in medical laboratory technicians in comparison to control group and no statistical significant difference was found ($p > 0.05$). This finding of the present study contradicts the previous study reported by Mirbod *et al.* (1999) [17] where it says that there was significant decrease in the handgrip strength in metal industrial workers who used hand held grinders when compared with the validation or control group, in a 4 year follow up study. In the present study, utilization of hand grip was much less and it was more of pinch oriented tasks. Since they were involved in various types of activities at a time, so mostly they do not follow a static position for longer period of time. Hence the hand grip activity was not static in nature. They had to move from one workplace to another to follow up the various tests. Therefore there was a work-rest pattern involved in the hand grip activities.

The present study also indicated that there is a significant difference in the means of handgrip strength between males and females in all age groups ($p < 0.05$) except in the age group 45-49 years. There is an increase of hand grip strength up to the age of 40 years and 35 years in males and females respectively. Thereafter there is a gradual decline in the strength for the medical laboratory technicians. The primary factor for this is aging, and consequent decline of muscle mass. The other contributing factors are lack of regular exercise programme, repetitive tasks, poor posture while working, improper work schedule and inappropriate design of tools. The findings of the present study is in agreement with Hamza *et al.* 2013 [18] and Shim *et al.* 2013 [19] where it was reported that in case of males there is a decline in the strength level after the age of 40 years and in case of females, it was at the age of 30 years. Similar results were also presented by Kallman *et al.* in 1990 [20] who found that grip strength peaked between the ages of 25-35 years and then showed an accelerated decline. They explained this by the decline in muscle mass with advancing age [20].

Unlike the almost universal agreement regarding grip and gender there is a disagreement whether grip strength differs in the two hands. The present study found that the dominant hand shows greater handgrip strength than the non-dominant in both males and females. It was also found that hand dominance strength level showed a positive significant correlation with age. This could be due to the fact that majority of the technicians were in the younger age group, so that might be a contributing factor to show a positive association.

CONCLUSION

The normative values of handgrip strength among the medical laboratory technicians age group of 20-50 years was found to be between (25.25-29.11 kgf) in males and, (12.5-14.4 kgf) in females. There is a gradual decline in the handgrip strength after the age of 40 in case of males and in case of females, it was around 35 years. This might be due to repetitive work, awkward posture, inadequate physical activity and many others. Handgrip strength assessment should be included in the comprehensive geriatric assessment and considered as an indicator of

upper limb function in rehabilitation programs. So, with the findings of the study, it may be concluded that occupation or work style may be an important determinants of hand grip strength, which further, is an indicator of possible upper extremity disorders. The findings of the present study will be useful for clinical and research purposes and would help in designing an appropriate work schedule for the medical laboratory technicians.

RELEVANCE

Objective measurements of hand strength are an important component of hand injury evaluation. As the grip strength is widely used in laboratory activities like in pipeting, cell counting, using automated machines, and working with cryostats and microtome machine. Therefore there is a need to assess the hand strength among laboratory technicians. The findings of the present study will be useful for clinical and research purposes and would help in designing an appropriate work schedule for the medical laboratory technicians.

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