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Original Article

Correlation of Handgrip Strength and Body Mass Index of Adult Healthy Females of the Slum Area in Dhaka City

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Corresponding Author*Abstract**

Background: Handgrip strength is used as an indicator of overall physical strength. On the other hand, Body Mass Index (BMI) is a simple and convenient method to measure someone's physical status. Therefore, BMI may affect the handgrip strength and very few studies especially in Bangladesh have shown the correlation of BMI with handgrip strength.

Objective: The aim of present research was to test the correlation between the handgrip strength and BMI of adult healthy females of the slum area in Dhaka city. **Materials and Methods:** In the present research, 100 adult females aged between 18 to 45 years, residing in different slums in Dhaka city of Bangladesh were the participants. BMI was calculated from participant's height and weight. The dominant handgrip strength was measured using a digital handgrip dynamometer. The associations of the dominant handgrip strength with the height, weight and BMI were tested using Pearson's correlation coefficient test. **Results:** The Correlation coefficient of the dominant handgrip strength (DHGS) with the height ($r = 0.400$) and weight ($r = 0.412$) of 100 Bangladeshi slum females reach up to positive and strong significant level (< 0.01). There is also a positive and significant correlation (< 0.05) with the dominant handgrip strength with BMI ($r = 0.303$). **Conclusion:** The finding of present research support that, the dominant handgrip strength was positively associated with BMI of slum females.

Key words: Handgrip strength, Handgrip dynamometer, Body Mass Index, Slum females.

Introduction

Handgrip strength is usually used to assess the overall general strength of the body to determine the working capacity and nutritional status.¹ The power of hand grip is result of forceful flexion of all finger joints with the 'maximum voluntary force' that the subject is able to 'exert under normal biokinetic conditions', which uses several muscles in hand and forearm.² Moreover, the integrity and proper fitness of the musculoskeletal system of the upper limb, important issue to carry out daily activities and hand gripping strength.³ BMI (Body Mass Index) is an important index to measure someone's nutritional status and the handgrip strength is a good predictor of an individual's nutritional status. In addition, it is established that the handgrip strength is strongly related to height, weight, Body Mass Index (BMI), physical activity.⁴ Smith et al⁵ have found a

direct correlation in handgrip strength and overall body strength upon very old and oldest females. It is reported that handgrip strength is also important in determining the efficacy of different treatment strategies of hand and hand rehabilitation.⁴

According to a report from the Bangladesh Bureau of Statistics (BBS), labor force participation for women is 36% in compared to 82.5% for men. However, the size of female labor force increased 4.6%, while male labor force increased by 1%.⁶ Now besides the male, the females also give the big hand to support their family economically. Thus, female laborer is a great source of working manpower of Bangladesh in many industries, construction works, field works and even in household works. For their low economic condition they live in slum area of Dhaka city. Here, they are suffering for

unhealthy living condition in every phase of their life. Maximum slum females have no education and they do various type of work according to her capability. They work in garments, industries, construction sites, cook in hotels, as a housemaid in various house. In addition, they work for long hours from morning to evening and besides the outside jobs they have to do all the household works too. Some of the family is run by the female's income. But still, they are not aware of their health issues. Moreover, some of the female's nutritional status is below average, they do not take balance diet as daily requirement. Thus, their health issues are often neglected. The poor nutritional status and weak physical condition as the main reason of high rate of daily absence in work. However, wellbeing and proper fitness of musculoskeletal system is one of the important factors to carry out daily activities⁸ and laborers require more physical strength to perform their daily work efficiently. Thus, without adequate handgrip and forearm strength, the works do not meet its desired success. Since, females of the slum areas in Dhaka city are the important source of work force in Bangladesh. But there are few researches in Bangladesh, which enrolled among the slum females. Therefore, this research was initiated to test the hypothesis that there is a correlation between the handgrip strength and BMI of adult healthy females of the slum area in Dhaka city.

Materials and Methods

The research was cross-sectional and carried out on 100 adult's Bangladeshi females aged between 18 to 45 years, residing different slum areas at Mirpur in Dhaka city. The research was conducted from March 2019 to February 2020. All measurements were taken during a particular time (3 pm to 6 pm) of the day to prevent diurnal variations. Data analysis was carried out in the Department of Anatomy, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. In the present research, right-handed participant was selected. Participants with the history and physical features of any congenital anomaly, genetic disorder, neurological disorder, endocrine disorder, autoimmune disorder, trauma, surgery, musculoskeletal impairment that can affect the hand

anthropometry was excluded from the current research. The ethical clearance was obtained from Institutional Review Board of BSMMU.

To measure the height participant was requested to be barefooted and remove any hair ornaments, jewelry, buns, or braids from the top of the head. The participant was asked to stand with her heel together, toes apart and her back as straight as possible. So that, her heels, buttocks, shoulders and the head touched the wall to measure the stature. The participant's head was positioned in the Frankfort horizontal plane and the arms were hung freely by the sides with the palm facing towards the thighs. Then, a steel plate was placed against the head and wall to determine maximum height or stature on the wall, and this was marked by black eye pencil. The participant was then told to step away from the wall. The stature was then measured from the floor to the marked point on the wall with a measuring steel tape. To measure the weight participant was requested to be barefooted and to wear light cloths, then asked to stand upon a portable weight machine. Then, the weight was recorded in kilograms. Then, Body Mass Index (BMI) was calculated as body weight measured in kilogram divided by square of body height measured in meter. It was calculated using the formula: $BMI = \text{weight (kg)} / \text{height (m)}^2$

The handgrip strength of dominant hand was measured using a standard adjustable digital handgrip dynamometer (Camry, Model no. EH 101). Before taking the measurement, the participant was asked to stand comfortably with the shoulder adducted and neutrally rotated and elbow in full extension. After taking a deep breath, the participant was requested to hold the handgrip dynamometer freely in dominant hand without any support, and not touching her trunk. Then, the participant was asked to squeeze the handle of dynamometer with maximum strength as hard as possible without moving the body and hold it for 4- 5 seconds. The instrument automatically records the highest measurement in kilogram during the whole procedure and displays that in monitor. After 30 seconds break the participant was again requested to repeat the procedure.

The statistical analysis was performed using SPSS software (version 24.0) and the associations of the dominant handgrip strength with the BMI was tested using Pearson's correlation coefficient test.

Results

Table-I: Work descriptions of the females in the slum areas of Dhaka city

Female participants (n = 100)			
Occupation	Frequency (n)	Occupation	Frequency (n)
Housemaid	45	Garment worker	30
Hotel worker	2	Housewife	9
Construction site worker	2	Cook	5
Hospital cleaner	1	Shopkeeper	4
City corporation worker	1	College student	1

Table I shows work descriptions of the females in the slum areas of Dhaka city of the present research. Among the participants 45% were housemaid, 30% were garment worker and rest were from different occupation. Most of them were illiterate (99%) and a very few were educated (1%).

Table-II: Values of the height, weight, BMI and dominant handgrip strength of females (n =100)

Variables	Range	Mean ($\pm$ SD)
Height of participants (cm)	140.5 - 167.0	149.74 ($\pm$ 4.84)
Weight of participants (kg)	37.50 - 70.50	52.90 ($\pm$ 7.92)
Body Mass Index (kg/m ²)	18.2 - 30.0	23.54 ($\pm$ 2.99)
Dominant handgrip strength (kg)	18.03 – 37.8	25.59 ($\pm$ 3.24)

Table II represents the mean values as well as ranges of the height, weight, BMI and dominant handgrip strength of 100 adult females in slum areas in Dhaka city. The mean height was 149.74 cm, mean weight was 52.90 kg and mean BMI was 23.54. The mean dominant handgrip strength was 25.59 kg.

Table-III: Correlation coefficient of the dominant handgrip strength (DHGS) height, weight, and BMI of Bangladeshi females in the slum areas of Dhaka city

Variable	Correlation coefficient (r)	Significance (p value) of correlation with DHGS
Height of participants (cm)	+0.400	0.004
Weight of participants (kg)	+0.412	0.003
Body Mass Index (kg/m ²)	+0.303	0.032

The Correlation coefficient of the dominant handgrip strength (DHGS) with the height 0.004 and weight 0.003 and they reach up to positive and strong significant level (< 0.01) (Figure 1, 2). There was also a positive and significant correlation (< 0.05) with the dominant handgrip strength with BMI have shown in table III and Figure 3.

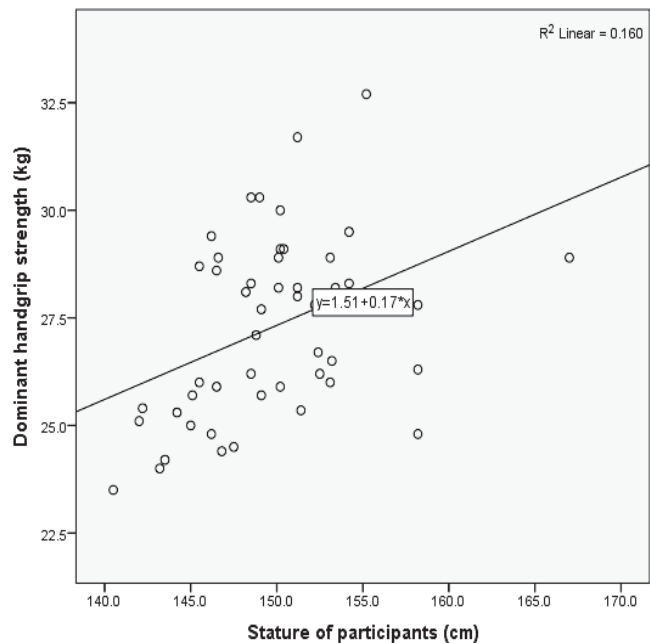


Figure- 1: Significant positive correlation ($r = +0.400$, $r^2 = 0.160$, $p = 0.004$) of the dominant handgrip strength with height of participants

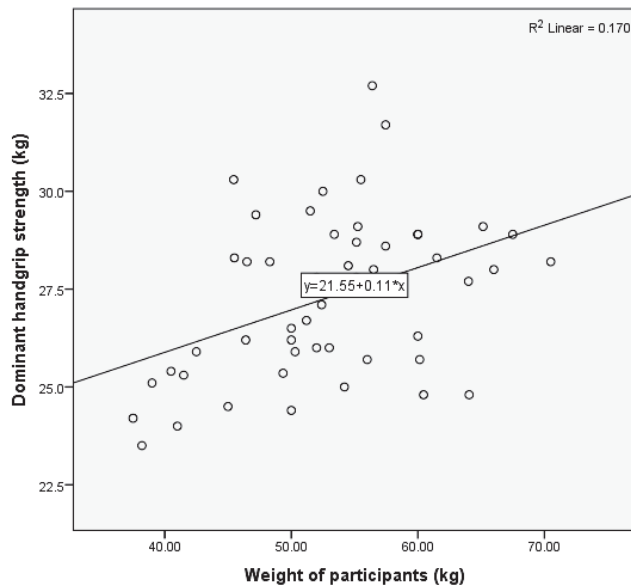


Figure- 2: Significant positive correlation ($r = +0.412$, $r^2 = 0.170$, $p = 0.003$) of the dominant handgrip strength with weight of participants

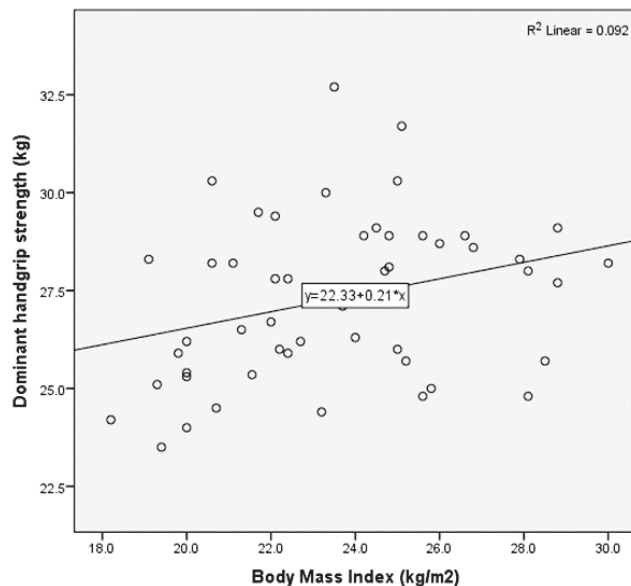


Figure- 3: Significant positive correlation ($r = +0.303$, $r^2 = 0.092$, $p = 0.032$) of the dominant handgrip strength with BMI

Discussion

In present research, the Bangladeshi females in slum areas in Dhaka city were in poor socio-economic condition but healthy. No participant was found to

have low BMI (< 18.00); thus, their mean BMI was 23.54. Here, there was positive significant correlation between the dominant handgrip strength with height, weight and BMI independently. It has been thought that handgrip strength is a possible predictor of overall body strength. Several researchers have shown different findings in association of handgrip strength with stature, weight, and BMI. Some studies have reported positive correlation between height and handgrip strength across adult to elderly population. It has been reported that handgrip strength was positively associated with BMI⁸. Again, evidence has shown in the findings of the previous researches⁹⁻¹⁵ that there were strong correlations between grip strength and weight, height, and BMI as like this present research. So, the greater heights that would lead to longer arms, with greater lever arm for force generation, resulting in an efficient amount of force³. Generally, people with large measurements in their body have a great strength and handgrip strength is an indicator to measure the strength¹¹. Because of, it was established that, physical activity has a strong association with body strength, shape, size, form and measurements of an individual¹⁶. Again, a research conducted by Seoty et al¹⁷ on 254 female garment workers in Dhaka city and found that handgrip strength had a positive association with BMI, height and weight but non-significant. Mitsionis et al¹⁸ however reported association between BMI and dominant handgrip strength in females, which partially support present research. Thus, differing BMI in individuals of the same age and gender could mediate differences in outcome of hand grip strength.

On the other hand, present research finding contrasts with the finding of some researchers¹⁹⁻²¹, they reported that BMI does not influence handgrip strength. Similarly, it was found that handgrip strength is not significantly associated with height and weight of 180 Indian population²². The contradictory findings of the previous researches in association between the handgrip strength and BMI are difficult to

explain, even they could not mention the explanation. Again, a research had conducted in North India on 100 female laborers and 100 sedentary women and result was the dominant handgrip strength was greater in sedentary women than the laborers group; because, the laborers were malnourished (low BMI) and suffered by diseases related to it despite of high physical activities of female laborers²³. But in present research the females in slum areas of Dhaka city, were not in low BMI (<18); here maximum females work regularly and repeatedly using their hand. Many daily activities which involve flexor muscles of forearm and hand, causes increased muscular mass and thus more handgrip strength²⁴. Hence, when the muscle mass is more, the number of muscle fiber and length are also more. Again, a muscle with a large cross sectional area is able to produce maximal force during working²⁵. Therefore, here physical activity and more usage of hands also influences to increase handgrip strength.

The limitation of the present research was its population size. Though it was cross-sectional, participants were not grouped into their works and but it provides a hint of positive correlation between the dominant handgrip strength and BMI of female slums of Dhaka city. This finding may be useful in the process of laborer selection in industries and physical therapy treatment of musculoskeletal disease.

Conclusion

From the result, it could be concluded that the present research support the significant and positive correlation between the BMI and the dominant hand grip strength, which needs advanced evaluation.

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