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Original Article

Hand Grip Strength between Adult Female Bangladeshi Garment Workers and Housewives

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ABSTRACT

Background: Hand grip strength (HGS) is an important indicator of upper limb function and is influenced by anthropometric characteristics, age, and occupational activities. Limited data exist on HGS among Bangladeshi women, particularly garment workers and housewives. **Objective:** To compare hand grip strength between adult female garment workers and housewives in Bangladesh, and to examine correlations between HGS and selected anthropometric factors. **Methods & Materials:** This cross-sectional descriptive study included 210 women (105 garment workers and 105 housewives) aged 18–45 years. Hand length, hand width, BMI, and grip strength (right and left) were measured using standard techniques. Data were analyzed using unpaired t-tests and Pearson's correlation. **Results:** Housewives had slightly larger hand dimensions, with a significant difference only in left hand length ($p < 0.05$). Garment workers demonstrated marginally higher grip strength (right: 19.16 ± 4.52 kg; left: 17.96 ± 4.21 kg) compared to housewives (right: 18.27 ± 4.00 kg; left: 17.43 ± 4.11 kg), though differences were not statistically significant ($p > 0.05$). Age, BMI, and hand length showed weak, nonsignificant correlations with HGS in both groups. Hand width showed a significant positive correlation with grip strength among garment workers for both hands (right: $r = 0.26$, $p < 0.01$; left: $r = 0.24$, $p < 0.05$). **Conclusion:** Although housewives had slightly larger hand dimensions, garment workers showed marginally higher grip strength. Hand width was the only anthropometric factor significantly associated with HGS, and only among garment workers. Larger, multicenter studies are recommended to better understand occupational influences on hand function in Bangladeshi women.

Keywords: *Hand grip strength, hand dimensions, garment workers, housewives, anthropometry, Bangladesh, BMI, age.*

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INTRODUCTION

The human hand, located beyond the wrist, consists of three main parts — the carpus (8 bones), metacarpus (5 bones), and digits (14 phalanges) — which work together to enable movement and dexterity [1]. The hand may be affected by congenital or acquired conditions, and even minor injuries can lead to stiffness and loss of function. Proper management of such conditions requires a sound understanding of hand anatomy, as the fingers allow fine grip and coordination through complex nervous control [2].

Hand grip strength (HGS) is an important indicator of upper limb function, overall physical strength, and handedness. It plays a key role in performing daily activities. Anthropometric studies have shown that grip strength is positively correlated with height, weight, body mass index (BMI), and hand dimensions such as length, width, and perimeter [3]. HGS is influenced by several factors, including age, sex, nutritional status, muscle strength, fatigue, and time of day. It is also affected by hand dominance; Dopsaj et al. (2009) confirmed that males exhibit greater grip strength than females in both dominant and non-dominant hands [4]. Furthermore, hand dimensions have been utilized in determining the sex of an individual [5].

In Bangladesh, the readymade garment (RMG) sector employs approximately 4.4 million workers, of whom about 58% are women, making them vital contributors to the national economy. Studying the hand grip strength of female garment workers may reveal associations between hand measurements and strength. Since their occupational activities differ from those of housewives, variations in hand dimensions and grip strength are expected, as these factors are closely related to the physical demands of daily work [6]. Globally, women's HGS is influenced by age, occupational physical activity, muscle mass, and body composition. For example, in an Australian cohort of adult women aged 28–49 years from the Geelong Osteoporosis Study, the mean HGS was approximately 28 kg, declining with age. Higher appendicular lean mass (ALM) and lower fat mass were associated with stronger HGS [7].

Low HGS is linked to decreased physical efficiency, delayed recovery, malnutrition, type 2 diabetes, cardiovascular diseases, and higher mortality rates [8]. Given that the hand is frequently used and vulnerable to injury, assessing grip strength is essential for evaluating and improving hand function. However, there is limited data on hand grip strength among female garment workers and virtually none among housewives in Bangladesh. Therefore, this study aims to compare hand grip strength between adult female garment workers and housewives and to explore the correlations between hand dimensions and grip strength. The findings will be valuable for anatomists, medical researchers, forensic experts, physiotherapists, occupational therapists, and others involved in hand function assessment and rehabilitation.

METHODS & MATERIALS

Study Design, Setting, and Population:

This cross-sectional descriptive study was conducted in the Department of Anatomy, Rajshahi Medical College, Rajshahi, Bangladesh, from July 2023 to June 2024. The study included adult female garment workers and housewives aged 18–45 years residing in Bangladesh. Data were collected from garment workers in Savar and Gazipur (Dhaka Division) and from housewives in Dhaka, Sirajganj, and Rajshahi districts.

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Inclusion Criteria:

- Females aged 18–45 years.
- Garment workers employed for at least one year.
- Housewives not dependent on maid servants for daily chores.
- Participants who provided written informed consent.

Exclusion Criteria:

- Presence of musculoskeletal, neurological, or inflammatory joint disorders.
- Congenital anomalies of the upper limb.
- Pregnancy.

Sample Size and Data Collection Tools:

A total of 210 participants were included in the study, comprising 105 garment workers and 105 housewives. Data were collected using a semi-structured questionnaire and standardized instruments, including a Camry electronic handgrip dynamometer, measuring tape, and digital weighing scale.

Study Procedure:

After obtaining ethical approval from the Institutional Review Board (IRB) of Rajshahi Medical College, participants were recruited according to inclusion and exclusion criteria. Written informed consent was obtained from each participant prior to data collection.

Anthropometric and hand measurements were taken using standard techniques:

- **Hand length:** Measured from the tip of the middle finger to the distal wrist crease.
- **Hand width:** Distance between the radial side of the 2nd digit and the ulnar side of the 5th digit.
- **Hand grip strength:** Assessed using a dynamometer while the participant was seated with the elbow flexed at 90°. Three trials were conducted for each hand with a 1-minute rest between trials, and the average value was recorded.
- **Body Mass Index (BMI):** Calculated as weight (kg) divided by height squared (m^2).

Statistical Analysis:

Data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Qualitative variables were expressed as frequencies and percentages, while quantitative variables were presented as mean ± standard deviation (SD). An unpaired t-test was applied to compare hand measurements and ratios between groups. Pearson's correlation coefficient was used to assess relationships between hand grip strength and age, BMI, hand length, and width. A p-value < 0.05 was considered statistically significant.

Ethical Considerations:

Ethical clearance was obtained from the Institutional Review Board (IRB) of Rajshahi Medical College. The study was conducted in accordance with the Declaration of Helsinki. Participants were informed about the purpose, benefits, and potential risks of the study, and their right to withdraw at any stage without penalty. Only those who provided written informed consent were included.

RESULTS

The study findings are presented according to participant demographics, anthropometric characteristics, hand and palmar dimensions, and hand grip strength measurements. Age and body mass index (BMI) distributions were first assessed to understand the general profile of the participants in both groups. Subsequently, detailed measurements of hand length, width, palmar length, and palmar width were recorded for the right and left hands, along with hand grip strength. Comparative analyses between garment workers and housewives were performed to identify statistically significant differences. Finally, correlations between hand grip strength and age, BMI, and hand dimensions were examined to explore potential factors influencing grip strength among adult Bangladeshi women.

Table 1 presents the age distribution of the respondents in both the garment worker and housewife groups. In the garment worker group, nearly half of the respondents (49.5%) were aged 26–35 years, followed by 32.4% in the 18–25 years range, and 18.1% in the 36–45 years range. Among housewives, the largest proportion (50.5%) also fell within the 26–35 years range, while 28.6% were aged 36–45 years and 21.0% were in the 18–25 years range. The mean age of the garment workers was 29.10 ± 6.43 years (range 18–45), slightly younger than that of the housewives, which was 32.40 ± 6.59 years (range 18–45).

Table I

Distribution of Respondents by Age (n = 105 in each group).

Age (years)	Garment Workers, n (%)	Housewives, n (%)
18–25	34 (32.4)	22 (21.0)
26–35	52 (49.5)	53 (50.5)
36–45	19 (18.1)	30 (28.6)
Total	105 (100.0)	105 (100.0)
Mean ± SD (range)	29.10 ± 6.43 (18–45)	32.40 ± 6.59 (18–45)

Figure 1 shows the distribution of the respondents according to BMI. It revealed that among the garment workers, 62 (59.00%) were BMI within normal range, 6 (5.70%) were underweight, 29 (27.60%) were overweight and remaining 8 (7.60%) were obese. On the other hand, among the housewives, 56 (53.30%) were BMI within normal range, 7 (6.70%) were underweight, 31 (29.50%) were overweight and 31 (29.50%) were obese. The mean BMI of the garment workers was 24.29 ± 4.32 kg/m2 and housewives was 24.76 ± 5.12 kg/m2.

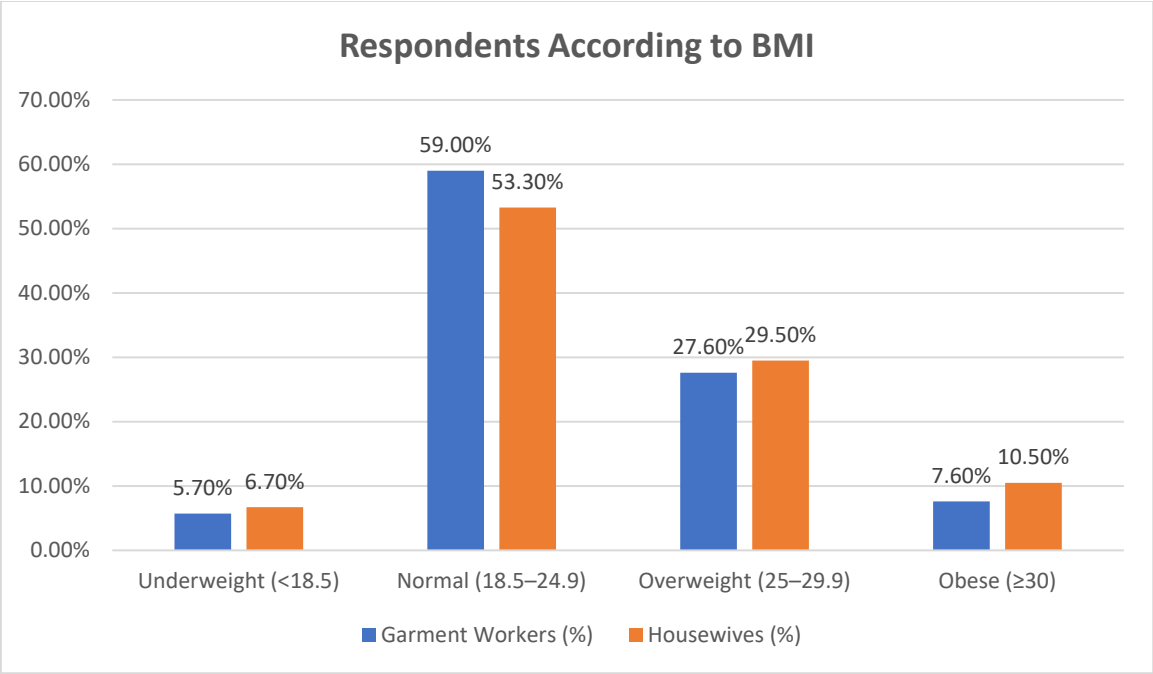

Figure 2 Distribution of Respondents According to BMI (n = 105 in each group).

Table II shows the comparison showed that housewives had slightly larger hand and palmar dimensions than garment workers. The differences were statistically significant for the left-hand length ($p < 0.05$). The mean hand grip strength was slightly higher in garment workers than housewives for both right (19.16 vs. 18.27 kg) and left hands (17.96 vs. 17.43 kg), but the differences were not statistically significant ($p > 0.05$).

Table II
Comparison of Hand Dimensions and Hand Grip Strength Between Adult Female Bangladeshi Garment Workers and Housewives (n = 105 each group).

Variable	Hand	Garment Workers (Mean ± SD)	Housewives (Mean ± SD)	t-value	p-value
Hand length	Right	16.87 ± 0.90	17.05 ± 0.80	1.58	>0.05
	Left	16.78 ± 0.86	17.06 ± 0.77	2.50	<0.05*
Hand width	Right	7.74 ± 0.52	7.83 ± 0.50	1.25	>0.05
	Left	7.71 ± 0.56	7.84 ± 0.52	1.76	>0.05
Hand grip strength (kg)	Right	19.16 ± 4.52	18.27 ± 4.00	1.50	>0.05
	Left	17.96 ± 4.21	17.43 ± 4.11	0.93	>0.05

*Data analyzed by unpaired t-test; values expressed as mean ± SD; *p<0.05 statistically significant.*

Table III shows hand grip strength in garment workers showed nonsignificant negative correlation with age and nonsignificant positive correlation with BMI and hand length. However, hand width was significantly positively correlated with grip strength for both right ($r = 0.26$, $p < 0.01$) and left hands ($r = 0.24$, $p < 0.05$), indicating that wider hands are associated with stronger grip.

Table III
Correlation of Hand Grip Strength with Age, BMI, and Hand Dimensions in Adult Female Bangladeshi Garment Workers (n = 105).

Variable	Hand	r	p-value
Age	Right	-0.11	>0.05
	Left	-0.09	>0.05
BMI	Right	0.11	>0.05
	Left	0.12	>0.05
Hand length	Right	0.09	>0.05
	Left	0.12	>0.05
Hand width	Right	0.26	<0.01*
	Left	0.24	<0.05*

**p<0.05 statistically significant.*

Table IV shows in housewives, hand grip strength showed a significant negative correlation with age for the left hand ($r = -0.22$, $p < 0.05$), while correlations with age for the right hand, BMI, hand length, and hand width were all nonsignificant.

Table IV
Correlation of Hand Grip Strength with Age, BMI, and Hand Dimensions in Adult Female Bangladeshi Housewives (n = 105).

Variable	Hand	r	p-value
Age	Right	-0.16	>0.05
	Left	-0.22	<0.05*
BMI	Right	0.05	>0.05
	Left	0.03	>0.05
Hand length	Right	0.12	>0.05
	Left	0.08	>0.05
Hand width	Right	0.14	>0.05
	Left	0.03	>0.05

**p<0.05 statistically significant.*

DISCUSSION

In this study, most participants in both groups were aged 26–35 years, with mean ages of 29.1 ± 6.43 years for garment workers and 32.4 ± 6.59 years for housewives. These findings are comparable to previous studies conducted among similar populations [9], although lower mean ages have been documented in other settings [10–12]. Regarding nutritional status, 59.0% of garment workers and 53.3% of housewives were within the normal BMI range, while overweight and obesity were also common. The mean BMI values of 24.29 ± 4.32 kg/m² for garment workers and 24.76 ± 5.12 kg/m² for housewives closely resemble those reported in earlier studies [9,12], but differ from others that have shown either higher [11,13] or lower values [14]. These variations may reflect differences in demographic characteristics, socioeconomic conditions, and lifestyle factors across populations [15].

Hand dimensions showed slightly greater mean values in housewives than in garment workers. The mean hand length measured 16.87 cm (right) and 16.78 cm (left) among garment workers, and 17.05 cm (right) and 17.06 cm (left) among housewives. A statistically significant difference was observed only for left hand length ($p < 0.05$), indicating marginally larger hand size in housewives. Hand width also showed slightly higher mean values in housewives, consistent with trends observed in earlier research [16–20], although no significant differences were noted ($p > 0.05$).

Hand grip strength (HGS) was slightly higher in garment workers than in housewives for both hands; however, these differences were not statistically significant ($p > 0.05$). The mean HGS values for garment workers were 19.16 kg (right) and 17.96 kg (left), compared to 18.27 kg (right) and 17.43 kg (left) for housewives. These results align with studies reporting no significant differences in grip strength between occupational groups [23,24], although some studies have documented significantly higher HGS in specific occupational categories [25–27]. Differences across studies may be attributed to variations in hand dominance, physical workload, BMI, age, and nutritional status.

Correlation analyses revealed a negative but nonsignificant association between age and HGS across both groups (garment workers: $r = –0.11$ right, –0.09 left; housewives: $r = –0.16$ right). A significant negative correlation emerged only for the left hand in housewives ($r = –0.22$, $p < 0.05$). These findings are similar to previous studies showing reduced grip strength with increasing age [28], though some studies report differing trends [17]. BMI showed a positive but nonsignificant relationship with HGS in both groups, consistent with certain earlier findings [15,21,29], yet contrasting with other studies reporting stronger associations [17,20,25,30].

Hand length demonstrated a positive but nonsignificant association with grip strength, which corresponds with previous findings suggesting a role of hand size in grip performance [19,31], though the significance varies across studies [9]. Notably, hand width showed a significant positive correlation with grip strength among garment workers for both hands ($r = 0.26$ right, $p < 0.01$; $r = 0.24$ left, $p < 0.05$), indicating that wider hands may contribute to greater gripping ability. This outcome aligns with some earlier studies [9], although other research has reported inconsistent findings [17,18,31].

Overall, the study suggests that hand dimensions, BMI, and age contribute to variations in hand grip strength among adult Bangladeshi women, but their effects differ between occupational groups. The slightly higher grip strength in garment workers may reflect the repetitive and physically demanding nature of factory work, whereas the marginally larger hand dimensions observed in housewives may relate to lifestyle or household activities.

CONCLUSION

This study compared hand grip strength and hand dimensions between adult female Bangladeshi garment workers and housewives and examined factors associated with grip strength. Although housewives exhibited slightly larger hand dimensions—significant only for left hand length—garment workers showed marginally higher hand grip strength, but the differences were not statistically significant. Grip strength demonstrated weak and mostly nonsignificant correlations with age, BMI, and hand length in both groups, whereas hand width showed a significant positive association with grip strength among garment workers only. Future studies with larger and more diverse populations may further clarify the impact of occupational and lifestyle factors on women's hand functionality in Bangladesh.

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