



## Relationship Between Hand Length and Stature in Adult Bangladeshi Medical Students

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### Abstract

**Background:** Among ancestry, age, sex and stature, the main four components of anthropometry, stature is considered one of the most important parameters. Anthropometry is an individual tool to estimate the stature of the living individuals. These parameters are used by Anatomists, Forensic experts and Anthropologists to build up the biological profile of a human. Identification of an individual is important in almost all spheres of life. Stature is one of the most important and useful anthropometric parameters to determine the physical identity of an individual. The aim of this study was to evaluate the relationship between hand length and stature in adult Bangladeshi medical students. **Material & Methods:** This was a descriptive study carried out in Department of Anatomy, Sylhet MAG Osmani Medical College, Sylhet, Bangladesh from July 2019 to June 2020. In the present study, anthropometric measurements were done in 240 adult Bangladeshi medical students. **Results:** All the anthropometric measurements of male participants showed positive and statistically significant correlation with stature ( $p < 0.05$ ). All the anthropometric measurements of female participants showed positive and statistically significant correlation with stature ( $p < 0.05$ ). Stature was estimated from hand anthropometry through linear regression equation. All the results indicate the effectiveness of the formulated equation, evaluated by the test of significance ( $p < 0.05$ ). **Conclusions:** That present study has generated some baseline data on the stature and hand measurements of Bangladeshi medical students. The data will be helpful in establishing a standard set of anthropometric measurements for the Bangladeshi population. These formulae can be finalized for the population by using the results of the present study and getting inputs from further larger studies.

**Keywords:-** Stature, Hand length, Anthropometry, Ergonomics, Human adaptation

## INTRODUCTION

Ancestry, sex, age and stature of human are known as the 'Big Four' parameters of anthropometry. These parameters are used by

Anatomists, Forensic experts and Anthropologists to build up the biological profile of a human. Identification of an individual is important in almost all spheres of

life. Stature is one of the most important and useful anthropometric parameters to determine the physical identity of an individual. The term 'anthropometry' comes from the actual ancient Greek term 'anthropo' which means 'human' and 'metron' which means 'measure'.<sup>[1]</sup> Different institutes and individuals have defined anthropometry in various ways. Anthropometry procedure manual's 2004 edition defined anthropometry as the study of the human body in terms of the dimensions of bone, muscle and adipose (fat) tissue. Whereas, Krishan and Sharma in 2006 defined anthropometry as a series of systematized measuring techniques that express quantitatively the dimensions of human body and skeleton.<sup>[2]</sup> The field of anthropometry encompasses variety of measurements. Weight, stature (standing length), recumbent length, skinfold thickness, circumferences of head, waist, limb etc., limb lengths and breadths of shoulder, wrist etc. are examples of anthropometric measures.<sup>[3,4]</sup> An individual's anthropometry influences his interaction with his workstation. A mismatch between anthropometry and workstation may increase the physical stresses on the body as the individual may be forced to assume awkward postures to accommodate to the workstation design.<sup>[5]</sup> By standing in any major junction of any major city on earth, one can easily marvel at the range of human physical diversity: short, tall, thin, fat, long-legged, stumpy; native wit provides the face validity for the study of anthropometric variation and its application. The implication of the knowledge of anthropometry in everyday life goes a long way back in history of human civilization.<sup>[6]</sup> The ideas of biological difference between human populations are of great

antiquity as well. The attempts of establishing an anthropometric index of human body have been dated back in the eighteenth century.<sup>[7]</sup> During that period of time, anthropometry was used as a determination of healthy or strong physique by means of stature, whose application featured in the assessment of the physical quality of slaves to the America and of recruits to the armies of Europe and North America. This concept then evolved and only became quantitatively formalized in the nineteenth century. In the early nineteenth century, anthropometry was used in the creation and validation of racial typologies.<sup>[8,9]</sup> Prior to innovations that could identify variation at microscopic levels, including physiological, biochemical, endocrinological and genetic ones, morphology was the prime means of classification of nature.<sup>[1]</sup> It is no surprise that anthropometric methods have changed little since the nineteenth century.<sup>[10]</sup> However, the meaning and interpretation of anthropometric variation has changed with new understandings of how human variation is generated and maintained. Recent studies have demonstrated the applications of anthropometry to include the prediction of who will be benefited from interventions, identifying social and economic inequity and evaluating responses to interventions.<sup>[1]</sup>

## Objective of the study

### General Objective:

- To assess the correlation between hand length and stature of an individual.

### Specific Objectives:

- To measure stature by direct physical method.

- To measure hand length of both hands by direct physical method.

## MATERIAL AND METHODS

This was a descriptive study carried out in Department of Anatomy, Sylhet MAG Osmani Medical College, Sylhet, Bangladesh from July 2019 to June 2020. In the present study, anthropometric measurements were done in 240 adult Bangladeshi medical students of SOMC (120 males and 120 females) within the age group of 18 to 23 years. The stature was also measured physically. The mean values and the standard deviations were calculated for each variable. Correlation of the physically measured variables with the stature was also assessed and Regressions co-efficient and constant were calculated for estimating stature through regression equation. The effectiveness of using the regression equation in these calculations was tested by test of significance.

### Inclusion criteria

- Both male and female medical students within 18 to 23 years of age.
- Normal hand function.
- Bangladeshi origin.

### Exclusion Criteria

- Students with any deformities of the hands and fingers.
- Students with any physical disabilities, skeletal defects and past history of diseases affecting bones and joints.
- Students who are on any form of hormonal medications.

### Data Collection Tool

Data was collected by using pre-designed data collection sheet prepared for the study. The data collection sheet was pre-tested and face validated by consulting with experts.

### Procedure of data collection

At first each subject was greeted politely. Being convinced about inclusion and exclusion criteria each subject was approached for voluntary participation. For this, a short briefing on the objectives of the present study was given and the subject was convinced to give a voluntary informed consent on the specific consent form. For taking measurements, the subject was asked to wear light cloths, put off shoes and remove ornaments from hands and fingers. Hand length was measured by using a digital slide calipers and stature was measured by a standard stadiometer. All the results were taken in centimeters (cm). Anthropometric measurements were taken from both hands.



**Photograph 1:** Hand anthropometric measurements. HL.

Stature was measured on a stadiometer. The participant stood with the heels together and the heels, buttocks, and upper part of the back touching the scale, head in the Frankfurt plane.



The participant was instructed to take a deep breath while the stadiometer head board was lowered onto the head ensuring the hair is compressed. To take the hand measurements, the subject placed their hands on a flat horizontal surface in an abducted position of the thumb and in the extended position of the other fingers. Every subject was measured twice, and the mean value was used to compromise measurement error. If the two primary measurements did not match within 0.4 cm, then both data were rejected and again two measurements were taken. Moreover, to avoid inter-observer error, all the measurements were taken by one observer. The measurements were taken at a fixed time to eliminate diurnal variation. All data were recorded in data collection form. The length of each hand was measured using a Vernier calipers. The subject was asked to place hand on a table with palm directed upwards, the fingers is in apposition and the thumb abducted. The measurement was taken from the middle of the distal wrist crease to the tip of the middle finger following Jasua and Singh (2004). This measurement was recorded in centimeters

### **Ethical Consideration**

This thesis work was done after the approval of the protocol by the ethical committee of Sylhet MAG Osmani Medical College, Sylhet, Bangladesh. Study was conducted as per guideline of the ethical committee.

### **Data Processing and Analysis**

Data were processed and analyzed using computer software program SPSS (Statistical

package for social sciences) version 23. The quantitative data was presented as mean and standard deviation (SD). Pearson's correlation coefficient test was performed to measure the relationships between the variables. Prediction of stature from different hand dimensions was done by simple linear regression test. For all analysis level of significance was set at 0.05 and  $p$  -value  $<0.05$  was considered significance.

### **RESULTS**

In the present study, anthropometric measurements were done in 240 adult Bangladeshi medical student of Sylhet MAG Osmani medical college, Sylhet who belonged to 18-23 years of age group. Among them, 120 were male and 120 were female. They were studied for measurement of stature and length of hand. The findings of the study have been shown briefly as follows:

The mean values and the standard deviations were calculated for each variable. These have been listed in tables and their frequency distributions, which were also determined, have been displayed in graphs.

Correlation of the physically measured variables with the stature were also assessed which have been displayed by scatter diagram.

Regressions co-efficient and constant were calculated for estimating stature through regression equation from hand and finger dimensions which have been listed in the table.

The effectiveness of using the regression equation in these calculations were tested by test of significance which has been tabulated.

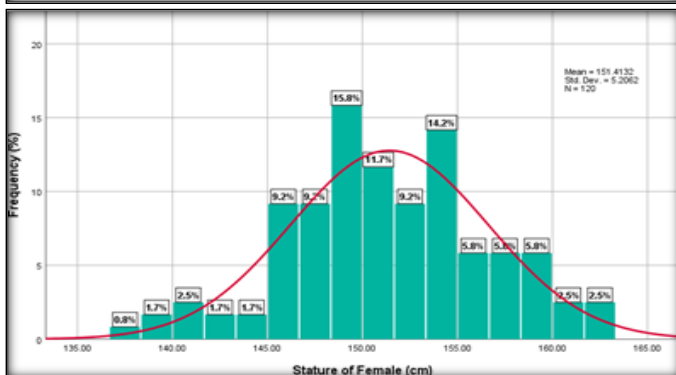
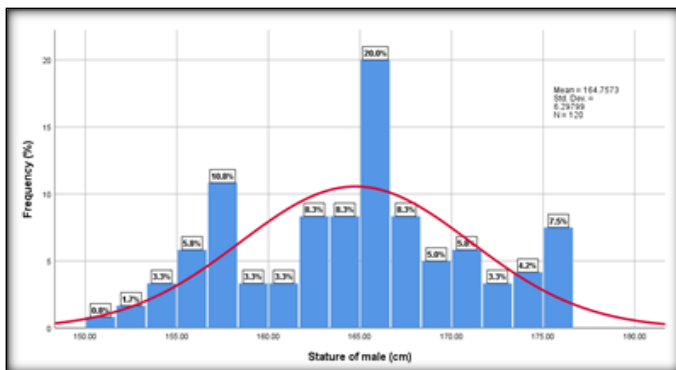
**Table 1:** Stature and hand length in male and female medical students N= 240 (Male=120, Female=120)

Variable	Side	Sex	Range		Mean ( $\pm$ SD)
			Minimum	Maximum	
Stature (cm)		Male	151.0	176.2	164.76 ( $\pm$ 6.30)
		Female	138.0	162.0	151.41 ( $\pm$ 5.20)
Hand Length (cm)	Right	Male	16.4	19.7	18.38( $\pm$ 0.89)
		Female	14.8	17.9	16.95( $\pm$ 0.75)
	Left	Male	16.3	19.7	18.38 ( $\pm$ 0.89)
		Female	14.7	17.9	16.95 ( $\pm$ 0.75)

**Table 2:** Correlation, constant and regression coefficient between stature and hand length in male and female students.

Variable	Side	Sex	Constant	B	Correlation with stature	
					r	p - value
Hand Length (cm)	Right	Male	41.84	6.69	0.94	<0.001*
		Female	36.98	6.75	0.97	
	Left	Male	42.10	6.67	0.94	
		Female	37.10	6.73	0.97	

\* = Significant at the 0.05 level, B = Regression co-efficient, r = Pearson's correlation coefficient

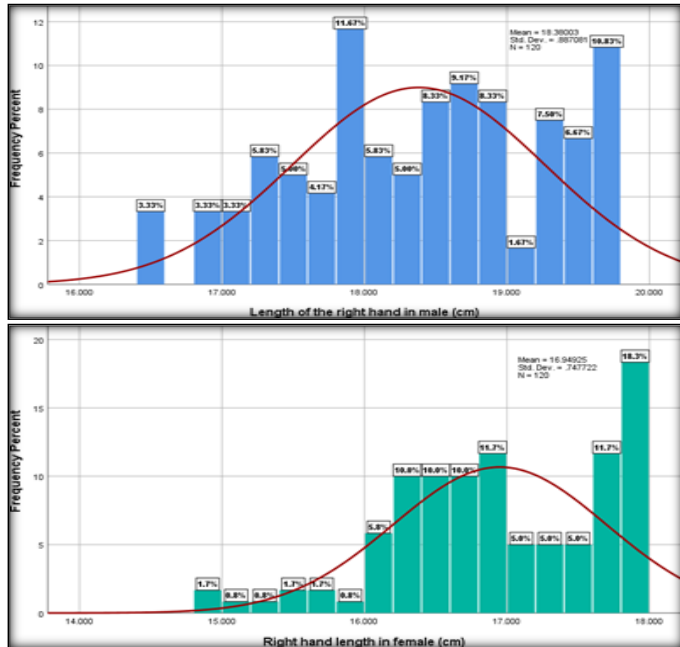


**Figure 1:** Histogram showing the frequency distribution of stature

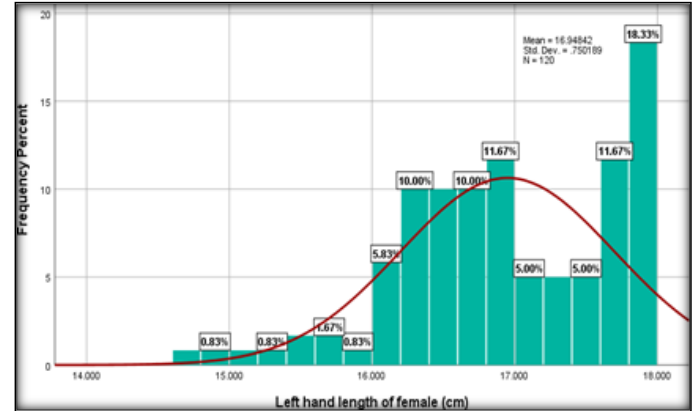
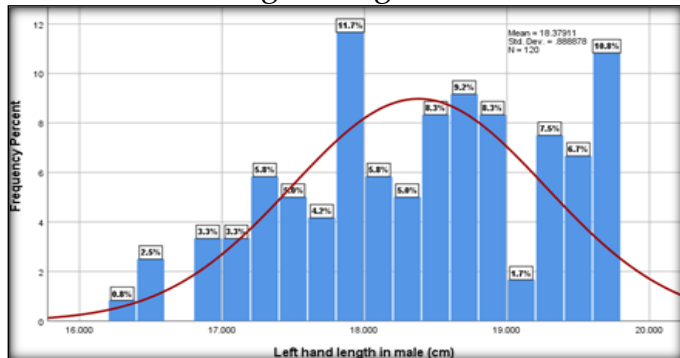
**Stature**  
 The stature of male students aging 18-23 years age ranged from 151 cm to 176.2 cm. More than 76% of the respondents possessed stature between 155 cm to 170 cm [Figure 1A]. Besides, the stature of 120 female students ranged from 138 cm to 162 cm. More than 86% of the respondents had stature between 145 cm to 160 cm [Figure 1B].

**Hand length**  
 The length of right hand of 120 male students aging from 18-23 years ranged from 16.41 cm to 19.7 cm. More than 73% of the respondents measured between 17 cm to 19 cm as shown in figure A. Moreover, the length of right hand of 120 female students of 18-23 years ranged from

14.8 cm to 17.9cm. More than 90% of the respondents were found between 16 cm to 18 cm as shown in [Figure B].



**Figure 2:** Histogram showing the frequency distribution of length of right hand

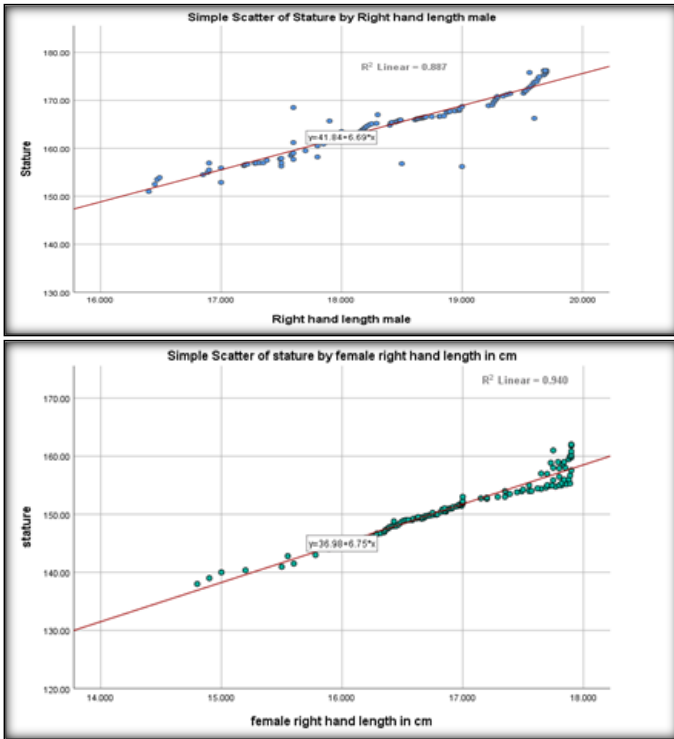


**Figure 3:** Histogram showing the frequency distribution of length of left hand

The length of left hand of 120 male students ranged from 16.3cm to 19.7 cm. More than 73% of the respondents possessed between 17 cm to 19 cm as shown in figure A. Also, the length of left hand of 120 female students ranged from 14.7 cm to 17.9 cm. More than 90% of the respondents measured between 16 cm to 18 cm as shown in [Figure B].

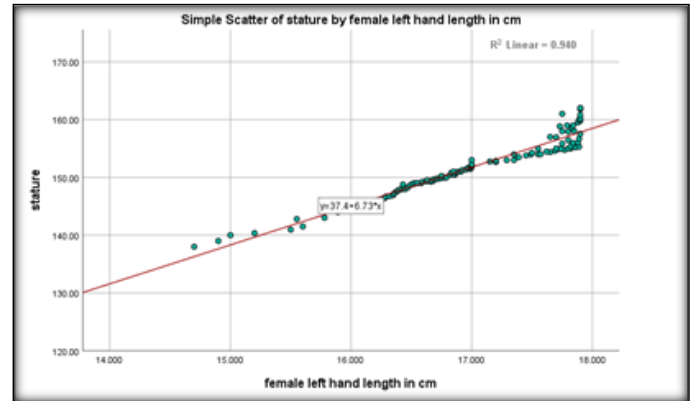
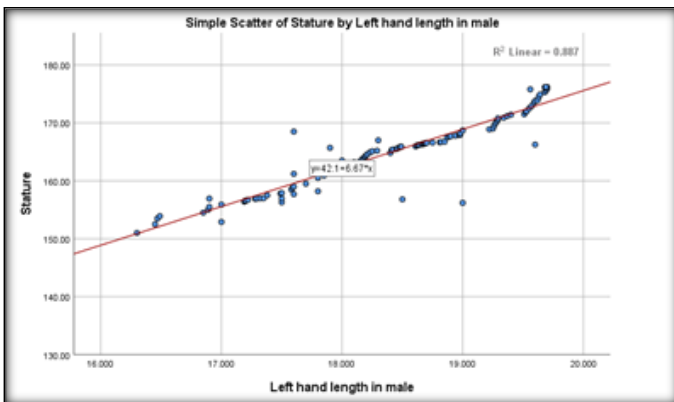
**Correlation between stature and hand length:**

The length of the right hand showed a significant positive correlation with the stature in both male ( $r = 0.94, p < 0.001$ ) and female ( $r = 0.97, p < 0.001$ ) students. The constant and regression co-efficient values regarding length of right hand are 41.84 and 6.69 respectively in case of male and are 36.98 and 6.75 respectively in case of female for estimating the stature.



**Figure 4:** Scatter diagram showing correlation between stature and right-hand length

The length of the left hand showed a significant positive correlation with the stature in both male ( $r = 0.94$ ,  $p < 0.001$ ) and female ( $r = 0.97$ ,  $p < 0.001$ ) students. The constant and regression co-efficient values regarding length of left hand are 42.10 and 6.67 respectively in case of male and are 37.40 and 6.73 respectively in case of female for estimating the stature.



**Figure 5:** Scatter diagram showing correlation between the stature and left-hand length

## DISCUSSION

The present study was conducted on different hand dimensions of two hundred and forty Bangladeshi students of Sylhet MAG Osmani Medical College, Sylhet, Bangladesh. The age ranged from 18 to 23 years of age. The subjects were asked about their origin and only those who are Bangladeshi by origin were selected. Ossification of all the bones of hand is completed by the age of 17 years. At this age the hand assumes its adult dimensions and shape. The hand length was measured by direct physical methods. The study was designed to get values of the variables for the Bangladeshi adult male and female medical students of the age groups under consideration, to observe the possible correlation of them with the stature. Regression co-efficient and constant of all the physical variables for estimating the stature was estimated.

The present study was compared with the adult people of Gujarat, West Bengal, Rajasthan, Hong Kong, Turkey, Iran, Thailand, Philippines, Sri-Lanka, India, America, Canada, Egypt, Korea, Taiwan, Nigeria,

Greece, China, Japan and Nepal. Both similarity and dissimilarity have been found by comparing with the mean values.

According to the present study, in male students the mean length of right hand was 18.38 ( $\pm 0.89$ ) cm and the mean length of left hand was 18.38 ( $\pm 0.89$ ) cm. In female students the mean length of right hand was 16.95 ( $\pm 0.75$ ) cm and the mean length of left hand was 16.95 ( $\pm 0.75$ ) cm. Hossain et al,<sup>[11]</sup> described that mean length of right hand of Christian Garo tribal Bangladeshi female was 16.39  $\pm$  0.72 cm and that of left hand was 16.33  $\pm$  0.67 cm which was almost similar to the length of hand of Bangladeshi female students. Patel et al,<sup>[12]</sup> mentioned that mean length of right hand of Gujarati male was 18.89  $\pm$  1.12 cm and mean length of left hand was 18.86  $\pm$  1.12 cm which was approximately similar to that of Bangladeshi male students. The study also mentioned that mean length of right hand of Gujarati female was 17.11  $\pm$  1.03 cm and mean length of left hand of Gujarati female 17.11  $\pm$  1.03 cm which was higher than the length of Bangladeshi female students.

Fallahi and Jadidian,<sup>[13]</sup> mentioned that mean length of dominant hand of athlete was 21.24 $\pm$ 1.47 cm and that of non-athlete was 20.38 $\pm$ 0.86 cm among Iranian people. But the present study figures out that both Bangladeshi male and female students owned smaller hand length than Iranian people. Jasuja and Singh conducted study on Jat Sikhs and observed that mean length of right hand of Panjabi male was 19.80 $\pm$  0.73 cm and that of left hand was 19.793  $\pm$ 0.76 cm. However, as shown in the current study Bangladeshi male have shorter hand length than Jat Sikhs.<sup>[14]</sup>

Khan stated that mean length of hand of adult Bangladeshi male was 18.48  $\pm$ 1.25 cm and that of female was 16.55 $\pm$  2.1 cm which was similar to that of current study.<sup>[15]</sup> Jervas et al,<sup>[16]</sup> stated that mean length of right hand of Nigerian male was 20.07 $\pm$ 1.54 cm and that of female was 18.77 $\pm$ 1.12 cm which is longer than Bangladeshi students. Mohan et al,<sup>[17]</sup> observed that mean hand length of dominant side of adult male in central region of Peninsular Malaysia was 18.80  $\pm$  1.25 cm and that of non-dominant side was 18.82  $\pm$  1.26 cm which is slightly larger than Bangladeshi male. They also observed that mean hand length of dominant side of adult female was 17.4  $\pm$  1.25 cm and that of non-dominant side was 17.33  $\pm$  1.48 cm which is larger than Bangladeshi female.

Mohammad,<sup>[18]</sup> mentioned that mean length of right hand of Jordanian male was 17.84 $\pm$  0.64 cm and that of left hand was 17.31 $\pm$  0.86 cm. He also stated that mean length of right hand of Jordanian female was 16.24 $\pm$  0.54 cm and that of left hand was 16.18 $\pm$  0.49 cm. So, both male and female Bangladeshi has larger hand length than Jordanians. Laila et al,<sup>[19]</sup> observed that the mean length of right hand was 16.39 $\pm$  0.79 cm and that of left hand was 16.34 $\pm$  0.80 cm in Bengali adult Muslim females which is similar to the current study. Lin, Wang and Wang mentioned that the mean length of the hand was 18.3 cm in Chinese male and 17.1 cm in Chinese female. Bangladeshi male possesses almost similar hand length as per present study and female possess smaller hand length.

### Limitations of the study

In this study time was limited to take large sample. The assessment of the exclusion





criteria was based totally on the information gathered through verbal inquiry. This might have failed to identify some subjects who could have revealed some exclusion criteria on more sophisticated screening. There was no better indicator for determination of age than information gathered through verbal inquiry. Sometimes subjects feel difficult to maintain the longstanding posture during the measurement that causes some dropout. Due to lack of non-contact methods for measuring the variables there was a possibility of transmission of diseases. As the sample size was large, the physical method of measurements was time consuming.

### CONCLUSIONS

That present study has generated some baseline data on the stature and hand measurements of Bangladeshi medical students. The data will be helpful in

establishing a standard set of anthropometric measurements for the Bangladeshi population. These formulae can be finalized for the population by using the results of the present study and getting inputs from further larger studies. The measurement of hand dimensions and its correlation with the stature would be useful in the field of anatomy, anthropology, archeology, ergonomics, sports science and nutritional science. There is further scope for studying variables and indices that have not been covered in this study. Separate studies may be done on population of different age groups, socio-economic status and different regions of Bangladesh. The most modern technologies should be used to ensure accurate measurements and proper utilization of time. Similar studies on different ethnic groups of Bangladesh like Manipuri, Khashia, Santhal, Rakhine etc. may be done to get a complete anthropometric picture of the country.

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