

**FOOT ANTHROPOMETRY OF ADULT BANGLADESHI MALE MEDICAL STUDENTS****M TANVEER HOSSAIN PARASH <sup>\*1</sup>, HUMAIRA NAUSHABA<sup>2</sup> AND SADIA CHOUDHURY SHIMMI<sup>1</sup>**<sup>1</sup>*Department of Biomedical Science & Therapeutics, Faculty of Medicine & Health Sciences, Universiti Malaysia Sabah, Malaysia.*<sup>2</sup>*Department of Anatomy, Sir Salimullah Medical College, Dhaka, Bangladesh.***ABSTRACT**

Anthropometrical data are required for developing a standard for a product, identifying a victim of a crime or accident, studying a civilization and also for treating patients. There is a paucity of anthropometric data of foot of adult Bangladeshi male. This study was carried out on 120 male students of Sir Salimullah Medical College, Dhaka. Foot length, foot width, heel breadth, instep and ball circumference of right and left foot, measured by slide caliper and flexible measuring tape, were 25.30 ( $\pm$  1.24) cm and 25.32 ( $\pm$  1.22) cm, 9.83 ( $\pm$  0.64) cm and 9.85 ( $\pm$  0.66) cm., 5.78 ( $\pm$  0.67) cm and 5.64 ( $\pm$  0.66) cm, 24.22 ( $\pm$  1.38) cm and 24.08 ( $\pm$  1.37) cm and 24.59 ( $\pm$  1.48) cm and 24.40 ( $\pm$  1.50) cm respectively. This study would provide the direction to construct baseline data of foot anthropometry of Bangladeshi people of different age groups and sexes.

**KEYWORDS:** Anthropometry, Foot length, Foot width, Instep and Circumference**M TANVEER HOSSAIN PARASH**

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## INTRODUCTION

Anthropometry is a scientific specialization concerned with the application of measurement to appraise human size, shape, proportion, composition, maturation and gross function.<sup>1</sup>Anthropometrical data are used in anatomy, ergonomics, forensic science, plastic surgery, radiology, podiatry, archeology, anthropology, nutrition and their applied aspects. Reliable anthropometric data are necessary for a target population to design a product for that population. Otherwise, the product may not be suitable for the user.<sup>2</sup>Every individual differs from the other in all of his measurable characteristics. Even he is also asymmetrical with the opposite side of the body.<sup>3</sup>It is necessary to develop a standard to satisfy a wide range of consumers. Developing standards will enable choice of footwear sizes applicable to individual and group needs.<sup>4</sup>Stature can be estimated accurately from foot measurements.<sup>5</sup>Stature estimation from incomplete skeletal and decomposing human remains will enable forensic scientists to solve crimes in the absence of complete evidence<sup>6</sup>, and the anthropologist and archeologist to analyze events occurred in remote past. Foot anthropometry is the practicable alternative to estimate stature in field survey for nutritional screening, surveillance, and monitoring. In the production of shoes and stockings standardization of size is an important concern. This would prevent the unwanted effects of improper shoes sizes.<sup>7</sup>There is a paucity of anthropometric data of foot of adult Bangladeshi male. With this background and rationale, the present study was an attempt to establish a standard normal data regarding the group under focus.

## MATERIALS AND METHODS

This descriptive study was carried out in the Department of Anatomy, Sir Salimullah Medical College, Dhaka from July 2010 to June 2011. It was done within a fixed period, from 10 am to 2 pm, to avoid the possible diurnal variation. 120 male Bengali students of 3<sup>rd</sup> and 4<sup>th</sup> year were included in the study by simple random sampling who aged between 20-25 years. The ossification of all the bones of the foot is completed by the age of 20 years.<sup>8</sup>Therefore, the foot

achieves its adult and fixed measurements at this age. The subjects belonged to same economic and nutritional status. Students of mixed ethnicity and having any congenital or acquired foot deformities affecting measurements of foot were excluded from the study. The information regarding the inclusion and exclusion criteria were obtained from the subjects directly by questionnaire and by physical observation. Ethical clearance was obtained from the Institutional Ethics Committee of Sir Salimullah Medical College, Dhaka. At the beginning of the study, each subject was greeted politely. Then he was informed about the total plan of the study and its implication and the entire spectrum of benefits and the potential risks of it. Written consent was taken from the subject. The subject was requested to sit in a relaxed position putting the same weight on the both foot after taking off the shoes and the stockings. The ankle was perpendicular to the foot. The foot length was measured by placing the fixed jaw of the caliper on pternion (most backward and prominent posterior point of the heel), and the sliding jaw was fixed on acropodion (most distal tip of the medial malleolous). The caliper was kept parallel to the long axis of the foot (Figure 1).<sup>9</sup>The sliding and fixed jaws of the caliper were placed respectively on metatarsal-tibiale and metatarsal-fibulare of the foot to measure the foot width. The caliper was kept perpendicular to the long axis of the foot.(Figure 2).<sup>9</sup>The sliding and fixed jaws of the caliper were placed respectively on the medial and lateral surface of the heel from behind to measure the heel breadth (Figure 3). The jaws were kept at 45<sup>o</sup> angles to the platform on which the foot was placed.<sup>10</sup>Ball circumference of the foot was measured at the ball of the foot which corresponds with the metatarsal-tibiale and metatarsal-fibulare of the foot at a plane perpendicular to the long axis of the foot using the flexible measuring tape (Figure 4).<sup>11</sup>Instep circumference of the foot was measured at the halfway between the ankle joint and the ball of the foot in a plane perpendicular to the long axis of the foot using the flexible measuring tape (Figure 5).<sup>11</sup>After measuring both feet, the data were analyzed with the help of SPSS version 16.0 for Windows program keeping in view the objective of the study. Two-sample Z-test was performed to compare between means.



Figure 1 Figure 2

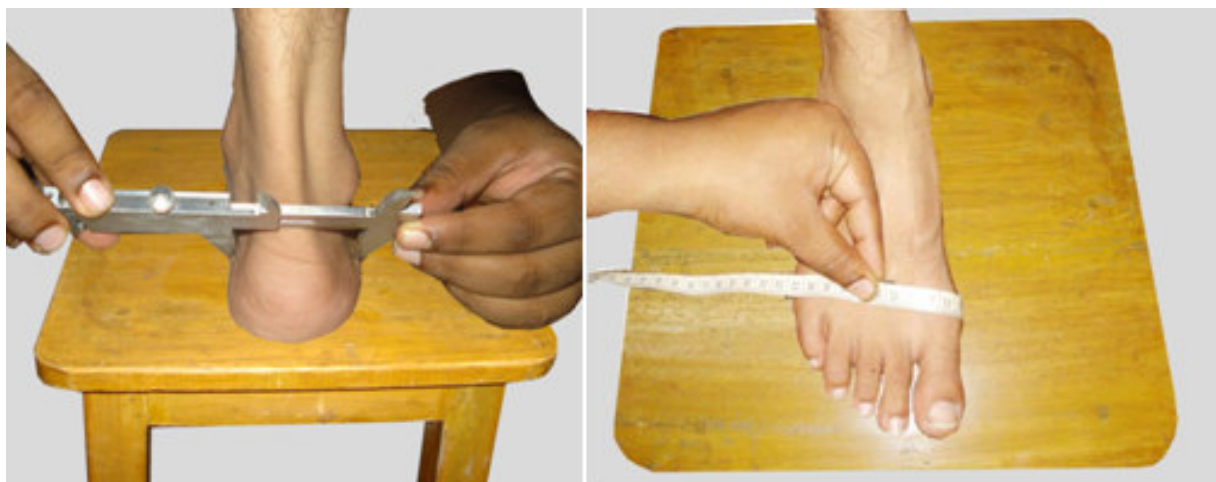


Figure 3 Figure 4



Figure 5

**Here Figure**

- 1: Procedure for measuring foot length<sup>12,13</sup>
- 2: Procedure for measuring foot width<sup>13</sup>
- 3: Procedure for measuring heel breadth
- 4: Procedure for measuring instep circumference
- 5: Procedure for measuring ball circumference

## RESULTS

**Table 1**  
**Various physically measured foot dimensions (n=120)**

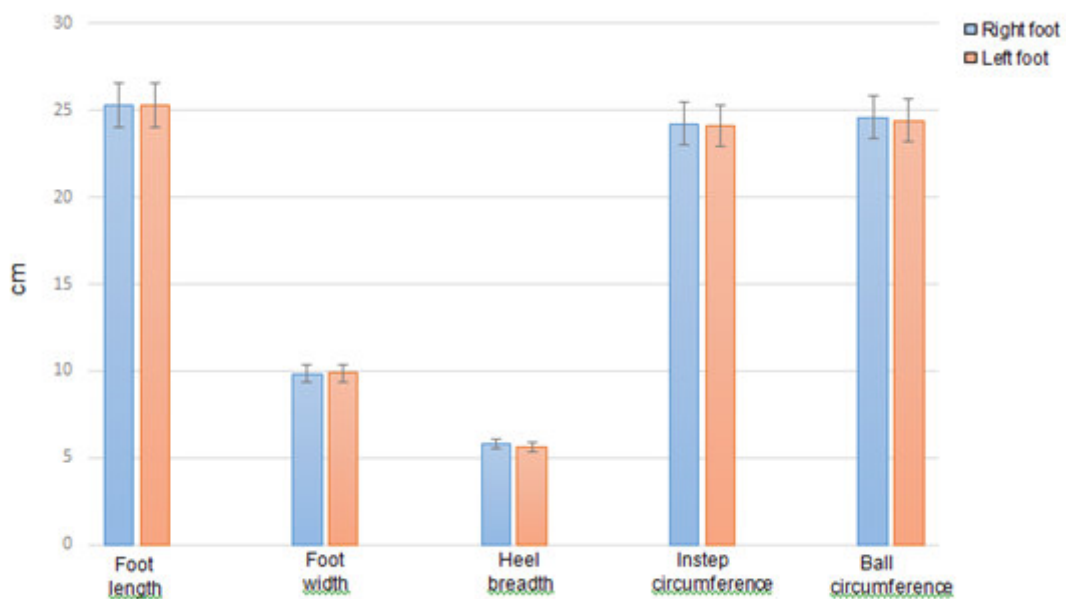
Variables		Measurement		
		Range (cm)	Mean (cm)	±SD
Foot length	Right	22.83-27.85	25.30	1.24
	Left	22.93-27.75	25.32	1.22
Foot width	Right	8.31-11.72	9.83	0.64
	Left	8.07-11.70	9.86	0.66
Heel breadth	Right	4.51-7.88	5.78	0.68
	Left	4.30-7.21	5.65	0.66
Instep circumference	Right	20.80-28.00	24.22	1.38
	Left	21.80-27.20	24.08	1.37
Ball circumference	Right	20.10-28.50	24.59	1.48
	Left	20.90-28.80	24.40	1.50

**Table 2**  
**Difference between right and left foot dimensions (n=120)**

Variables	Differences between right and left side		Significance of difference (p-value)
	Mean (cm)	SD (±)	
Foot length	- 0.01	0.39	0.100 <sup>NS</sup>
Foot width	- 0.02	0.36	0.250 <sup>NS</sup>
Heel breadth	0.13	0.37	1.435 <sup>NS</sup>
Instep Circumference	0.14	0.50	0.721 <sup>NS</sup>
Ball Circumference	0.19	0.65	0.921 <sup>NS</sup>

NS= Non-significant at 5% level of significance on two-sample Z-test.

**Graph 1**  
**Bar diagram showing right and left foot dimensions**



## DISCUSSIONS

The present study compared with the adult male of Gujarat, West Bengal, Rajasthan, Hong Kong, Turkey, Iran, Thailand, Srilanka, America, Korea, and similarity, dissimilarity have been found by comparing with the mean values. The foot length of the adult male of Thailand, West Bengal, and Gujarat were similar to that of the present study.<sup>3,9,14</sup> The food habit (plenty of carbohydrates and less protein) of Thai, Bengali and Gujjar Indian people and that of people of Bangladesh are similar. But the foot width of Thai and Gujjar Indians were higher than that of the present study. The Bengali Indian had a similar foot width. In the present study the foot length. So, we can draw an inference that same nutritional status may be the reason for this similarity and the change of foot length was more correlated with the change in stature than that of foot width. The mean foot length, foot width, heel breadth, instep circumference and ball circumference of Koreans, Iranians, Americans, and Lankans were higher than that of this present study population.<sup>5,7,10,15,16</sup> The Hong Kong Chinese male had higher mean stature and body weight but similar mean foot length, foot width, and ball circumference in respect to the present study population.<sup>15,17</sup> The Korean, Hong Kong Chinese, Iranian, American, and Srilankan are different from the study population in race and genetic composition. The Korean and the Hong Kong Chinese are Mongolian,

The Turkish are Caucasian, The Iranian are Aryan, The Srilankan are Sinhalese, and the American are the Hispanic by race. However, the study population belongs to a mixture of Austric, Indo-Aryan, Mongolian and Dravidian group. The Caucasian, Aryan, Sinhalese and the Hispanics have greater body dimensions than the Austro-Indo-Aryan-Mongolio-Dravidian group. This racial variation predisposes to genetic variation. This may be the reason for this dissimilarity. Unlike other population, the Hong Kong Chinese did not show dissimilarity in foot length, foot width, and ball circumferences. The mean stature and foot length of the Rajbanshi<sup>1</sup>Indians were lower than that of the present study.<sup>6</sup> The people of these regions are vegetarians. So they lack the protein in their food habit, and this may be the reason for the low dimensions.<sup>18</sup> The mean foot width of the Rajbanshi and Kabui Indians were similar to that of this study population.

## CONCLUSION

This study was an attempt to construct baseline data on different dimensions of the foot of adult Bangladeshi male medical students. The sample size is too small to represent the mentioned group of population in Bangladesh. However, this study would provide the direction to construct baseline data of foot anthropometry of Bangladeshi people of different age groups and sexes.

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