J. Dhaka National Med. Coll. Hos. 2021; 27 (01): 12-16

Original Article

Estimation of stature from length of the radius and length of the ulna-An anthropometric study on adult Bangladeshi women

Khushruba Rahman Khan[1], Shyamal Chandra Banik[2], Farhana akter[3], Md Razaul Huq[4], Humaira Naushaba[5]

[1]Associate professor(cc), Department of Anatomy, Dhaka National Medical College, Dhaka, [2]Assistant Professor, Department of Physiology, Dhaka National Medical College, Dhaka, [3]Associate professor(cc), Department of Anatomy, Dhaka National Medical College, Dhaka, [4]Assistant Registrar, Department of Skin and VD, Dhaka National Medical College Dhaka, , [5]Professor and Head, Department of Anatomy, Green Life Medical College, Dhaka.

Abstract

Background: The upper limb is unique both structurally and functionally. It is the most movable part and main working tools of human body which is used for maintaining balance, carrying, touching, cognition, holding, gripping and for performing various fine works.

Objectives: To determine the upper limb dimensions of the adult Bangladeshi women.

Methods: This descriptive and analytical study was carried out in the department of Anatomy, Sir Salimullah Medical College, Dhaka from July 2010 to December 2011. The ethical permission was taken from Institutional Ethics Committee (IEC) of SSMC. Total 100 adult Bangladeshi women of 25 to 45 years were studied. Length of radius & ulna were measured directly from the subjects by using anthropometric spreading caliper. Statistical analysis was done by two sample z-test & pearson correlation coefficient test.

Result: The length of both right & left radius and also both right & left ulna showed significant positive correlation with stature.

Conclusion: This study provides the direction to construct baseline data of upper limb anthropometry of adult Bangladeshi women.

Key words: Anthropometry, Hand length, Stature.

Introduction

Anthropometry is the science that deals with the measurement of size, weight and proportion of the human body. This was adapted by medical scientists to estimate the body size for over a hundred years.[1] It is used to assess health, survival of individuals and reflect the economic and social well being of populations. Anthropometric measurements are now regarded as important indicators of an individual's nutritional status. The anthropometric measurements most commonly used for assessing nutritional status are height, body weight, mid-arm circumference.[2] Stature is a component of measurement of body mass index (BMI).[3] Upper limb is the most movable part and main working tools of human body. It is used for maintaining balance, carrying, touching, cognition, holding, gripping and for performing various fine works. Process of measurement of upper limb is called upper limb anthropometry which includes measurement of shoulder, arm, forearm and hand region of human body.[4] In this particular study stature, length of the radius, length of the ulna have been measured. The anthropometric values of upper limb are helpful to anatomists for normative reference. The upper limb normative values are helpful to plastic and reconstructive surgeons for the treatment of congenital and traumatic anomalies.

Materials & Methods

This descriptive analytical study was carried out on 100 adult Bangladeshi women in the Department of Anatomy, Sir Salimullah Medical College (SSMC), Dhaka and was conducted from July 2010 to December 2011. To measure the stature the subject was said to stand with her heel together and her back as straight as possible so that her heels, buttocks, shoulders and the head pressed against the upright position of the

instrument (Stadiometer). The arms were hung freely by the sides with the palm facing the thighs. The subject's head was positioned in the Frankfort horizontal plane, and the head plate was brought in contact with vertex in the mid saggital plane and then readings were taken to the nearest 0.1 cm (Figure-I). Length of forearm (radius) was measured by spreading caliper from behind. The subject was asked to stand erect with her feet together and then she was asked to extend her elbow and reveal a well marked depression to the lateral side of the mid line. This depression contains head of the radius at the lower part. This could be felt to rotate when forearm was pronated and supinated. From this point the caliper was extended down the posterior surface of the forearm to the tip of the most distal point on the styloid process of the radius.[5] The measurement was recorded in centimeters to the nearest 0.5 centimeters (Figure II). Length of ulna was measured by spreading caliper from the level of the tip of the olecranon process to the tip of the most distal point on the styloid process of the ulna and recorded in centimeters to the nearest 0.5 centimeters. The length was obtained in the sitting position with the forearm resting comfortably on a table. The palm faced downwards and the fingers were extended but together. The elbow was bent at 90° to 110°.The proximal end of the ulna was found by palpating along its entire length. The tip of the styloid process was felt at the wrist by palpating down the length of the bone distally, until its end was felt.[6] (Figure III)

Regression formula is used for estimation of the stature from anthropometric measurements of radius & ulna.

Stature = value of constant + regression coefficient x variable.

Value of the constant and the regression coefficient for each variable was calculated using SPSS version 16.0 program.[7]

Data processing and analysis

The data were put into the computer. Then the data were analyzed with the help of SPSS version 16.0 for Windows program keeping in view the objective of the study. Pearson's correlation coefficient test was performed to measure the relationships between the variables and two-sample Z-test was performed to compare between means.

Figure I(A): Procedure for measuring stature (Stadiometer)

Figure I(B): Procedure for measuring stature (Stadiometer)

Figure-II: Procedure for measuring the length of radius using a spreading caliper

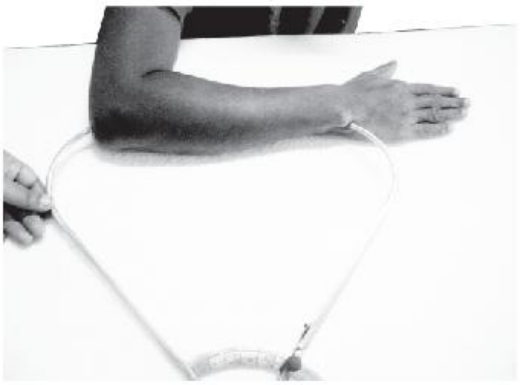

Figure-III: Procedure for measuring the length of the ulna by using the spreading caliper

Result

The mean (±SD) stature was found 149.61±5.07cm. The length of the right radius varied from 19.18 to 23.50 centimeters as shown in Table-I. In more than 75% of the subjects, the length of right radius was between 18.5 and 21.5 cm (Figure-IV). The length of right radius also showed significant positive correlation (r=0.340, p=0.001) with the stature (Table-I). The length of left radius varied from 18.19 to 23.00 centimeters as shown in Table-I. In more than 75% of the subjects, the length of left radius was between 18.5 and 21.5 cm (Figure-V). The length of left radius also showed significant positive correlation (r=0.237, p=0.018) with the stature (Table-I). The length of the right ulna varied from 20.50 to 25.00 centimeters as shown in Table-I. In more than 75% of the subjects, the length of the right ulna was between 21.50 and 24.50 cm (Figure-VI). The length of the right ulna also showed significant positive correlation (r=0.202, p=0.044) with the stature (Table-I). The length of the left ulna varied from 19.48 to 24.50 centimeters as shown in Table-I. In more than 70% of the subjects, length of the left ulna was between 21.50 and 24.50 cm (Figure-VII). The length of the left ulna also showed significant positive correlation (r=0.198, p=0.048) with the stature (Table-I).

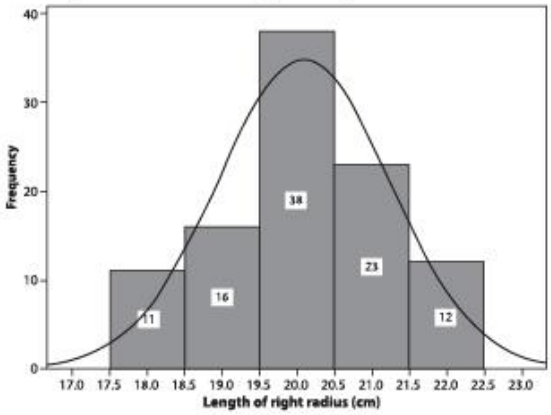

Figure-IV: Histogram showing the frequency distribution of length of right radius (n=100).

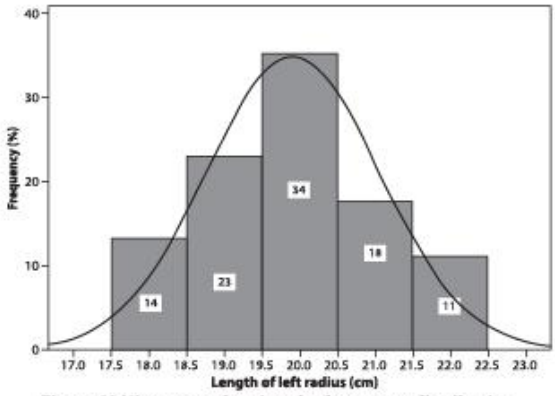

Figure-V: Histogram showing the frequency distribution of length of left radius (n=100).

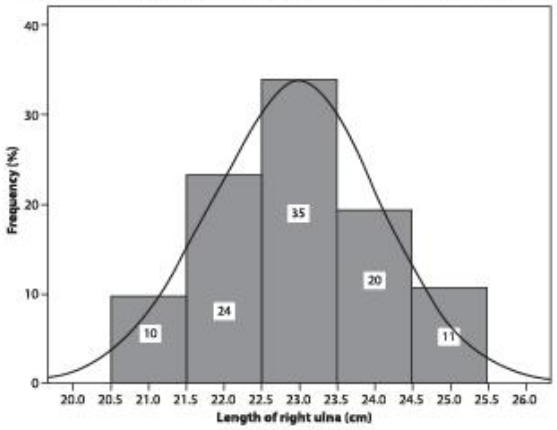

Figure-VI: Histogram showing the frequency distribution of length of right ulna (n=100).

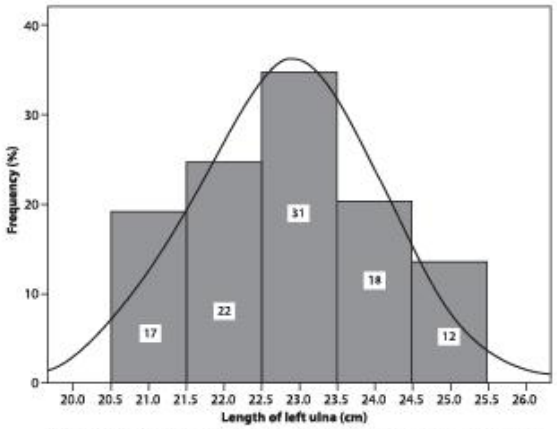

Figure-VII: Histogram showing the frequency distribution of length of left ulna (n=100).

Table-I: Stature and various physically measured upper limb dimensions with corresponding constant and regression co-efficient

Variables		Measurement		Constant	Regression Co-efficient (B)	Correlation with stature	
		Range (cm)	Mean (cm)±SD			R	P
Stature		141 - 160	149.61±5.07				
Length of radius	Right	19.18 - 23.50	21.13±0.98	112.39	1.76	.340*	.001 (S)
	Left	18.19 - 23.00	20.49±1.05	126.09	1.15	.237*	.018 (S)
Length of ulna	Right	20.50 – 25.00	22.45±1.00	126.63	1.02	.202*	.044 (S)
	Left	19.48 – 24.50	21.68±1.04	131.63	0.83	.198*	.048 (S)

** = Correlation is significant at the 0.01 level (2-tailed),* = Correlation is significant at the 0.05 level (2-tailed), S = Significant, NS = Non significant

Table-II: Calculated* stature and their relationships with the measured stature

Variables	Range	Mean ± SD	Significance of difference between calculated stature and physically measured stature (Z-value)
Stature	141.00 – 160.00	149.61 ± 5.07	
Calculated stature (cm)			
Length of right radius	146.15-153.75	149.58 ± 1.72	0.001 (NS)
Length of left radius	144.40-152.87	148.45 ± 1.84	0.008 (NS)
Length of right ulna	147.54-152.13	149.53 ± 1.02	0.018 (NS)
Length of left ulna	147.80-151.96	149.62 ± 0.87	0.018 (NS)

NS= Non-significant at 5% level of significance on two-sample Z-test. n=100 for each variable

* The calculated stature against each variable was obtained by using regression equation (stature= constant+ regression co-efficient x variable)

Table-II shows the range and mean calculated stature (±SD) from physically measured different upper limb variables with their difference with the measured stature with level of significance, significance of difference was tested using the two sample Z test at 95% level of significance (p=0.05). No significant difference was found between the measured and calculated stature from the length of radius, length of ulna (Table-II).

Discussion

The present study was conducted on different upper limb dimensions of one hundred adult Bangladeshi women. The stature, length of radius and length of ulna were measured by direct physical methods. The study was designed to get normative values of the variables for the adult Bangladeshi women, to observe the possible correlation between physical measurements and photographic measurements with the stature. Difference between right & left radius and ulnar dimensions were observed. Regression co-efficient and constant of all the physical variables for estimating the stature were also tried to be estimated from the obtained measurements of the physical and photographic variables. Significance test was done between calculated and observed values. The mean (±SD) stature of the present study was similar to that of India,[8] and Malawian.[9] The food habit (plenty of carbohydrate and less protein) of Malawian, Indian people and that of people of Bangladesh are similar. The result of this study did not coincide with people of Ethopians,[10] Punjab,[11] Jordan,[12] Australian,[13] Indian,[14] South Indian,[15] Malawian,[16] Thailand,[17] North Indian,[18] American[19] where the mean (±SD) value of stature were higher than the result of the present study. The mean length of the radius and length of the ulna of German people[20] coincided with the present study. The mean length of the radius and length of the ulna of South African Whites,[21] American[22] female of same age group were higher than that of the present study.

Conclusion

The present anthropometric study may provide the direction to construct baseline data on different dimensions of upper limb of adult Bangladeshi female. In the present study, the right upper limb dimensions showed variations with the left side but it was statistically non significant. The dependent variables (stature) were calculated using the regression formula from the independent variables showing significant positive correlation. There was no significant difference between the observed and the calculated measurements.

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