

Prediction of Stature From Hand Length and Breadth – An Anthropometric Study on Christian Garo tribal Bangladeshi females

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Abstract:

Context: *Body physique is influenced to a greater extent by climatic, hereditary, nutritional and racial factors. Since in Bangladesh variegated ethnic groups inhabit in different conditions, no single anthropometric formula is suitable. The stature prediction occupies relatively a central position in the anthropometric research. And estimation of stature of an individual from the mutilated or amputated limbs has obvious significance in the personal identification in the events of murders, accidents or natural disasters. The present study was undertaken to measure the stature, as well as some length and breadth of hand and to determine whether there is any correlation between the stature and the hand variables. And to estimate using respective multiplication factors the stature from these variables and to assess the effectiveness of the above estimations by comparing the 'estimated' values with the 'measured' values.*

Methods: *The study was carried out with a total number of 100 Christian Garo adult females aged between 25 to 45 years. Hand length and breadth along with their stature were measured directly from the subjects by using anthropometric sliding, spreading calipers and measuring tape. The data were then statistically analyzed by computation to find out its normative value. Multiplication factors were estimated for estimating stature and comparison were made between measured and estimated stature using paired "t" test.*

Result: *The mean normal values of the hand measurements (right and left hand length were 16.39 ± 0.72 cm and 16.33 ± 0.67 cm respectively and breadth of right and left hand were 7.22 ± 0.38 cm and 7.18 ± 0.3 cm respectively) and the stature (152.79 ± 5.62 cm) were found. The multiplication factors were estimated for the same hand measurements with the stature. Significant positive correlation was found in case of hand length with the stature. There was positive correlation ($r=0.17$, $p=0.09$ and $r=0.15$, $p=0.12$) between the stature and breadth of the right and left hand (Figure 3.21) but the result did not reach any statistically significant level.*

Key words: *Anthropology, correlation, multiplication factor, stature*

Introduction

There is a long record of discussion on the issue of human variation in anthropometric research. Anthropologists observe and compare the relationship between body segments to highlight

variations between ethnic origins¹. Yet, when health risk is defined in terms of body size, Western Caucasian standards have, by default, become the international standard. Although by far the most long-term data available on health risks are from Caucasian subjects, there is mounting evidence that these Western standards may not be applicable to all². They may, for instance, be too generous for people of Asian origin or too stringent for Polynesian adults. It is therefore agreed that different formulae will be required for calculating stature from different segments in different populations. The indigenous hill tribe is one of the main attractions in Bangladesh. These tribal people differ noticeably from the rest of the population of Bangladesh in terms of their

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appearance, language, religion and social organization. The tribes tend to intermingle and could be distinguished from one another more by differences in their dialect, dress, and customs³.

The People:

The Garo (Mendi) Adivasi, a distinguished matriarchal community of Bangladesh living in the north-eastern parts of the country especially in Gazipur, Mymensingh, Netrokona, Tangail, Sherpur, Jamalpur and some in Sylhet districts close to the Indian border⁴. According to the Census report in 1991⁵, there are 64,280 Garos who live in Bangladesh. Almost all the Garo are bi-lingual because they have to speak Bengali in addition to their Garo language. Garos have their own language, which is called 'Achchik Katha'. The traditional Garo religion is 'Sangsharek', which is almost abolished. Over the years, most of the Garo have been converted to Christianity and a few into Islam⁶. The mass populations of the villages are literate. With the introduction of formal schooling, Garo took the opportunity to be educated which has influenced and changed Garo in their lifestyle.

Methods:

The study was basically observational, cross-sectional and descriptive in nature. The study was carried out on 100 Christian Garo adult females at different locations of Dhaka city and Mymensingh district. 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 touched the wall. The arms were hung freely by the sides with the palm facing the thighs⁷. After asking the subject to take a deep breath and holding it, a measuring scale (steel plate) was placed against the head and wall to determine maximum height on the wall, and this was marked. The subject was then told to breathe and to step away from the wall. The height was then measured from the floor to the mark on the wall with steel tape which represents the stature in centimeters to the nearest 0.1 centimetres⁸. The length of hand was measured as the straight distance from the distal wrist crease to the most forwardly projecting point on the middle finger. A manual sliding caliper was used to measure the hand length (Figure 1). Breadth

of the hand was measured as the width of the hand from the lateral surface of metacarpal II to the medial surface of metacarpal V (Figure 2). The hand was placed on a table with the fingers together and the thumb out to the side with a sliding caliper the breadth of the hand was measured at the level of the knuckles⁹.

Calculations of multiplication factor:

Each multiplication factor is the ratio of the stature to the respective physical measurements. A mean multiplication factor was then calculated for each measurement. These mean multiplication factor were used for estimating the stature from those variables.

According to Lal and Lala¹⁰ multiplication factor is

$$M.F = \frac{\text{Stature}}{\text{Hand variables (e.g. length)}}$$

Statistical analyses of data

Results were prepared on the basis of collected data and their distributions, central tendencies and standard deviations (SD) were calculated using a computer based programme (SPSS version-11.5 & MS Excel). Regression analysis were done. Mathematical relationships between sets of two measurements were calculated as multiplication factors (i.e., ratios between the two). Using the paired t test, the measured values were compared with the corresponding values estimated (using the corresponding multiplication factors) from other relevant measurements.

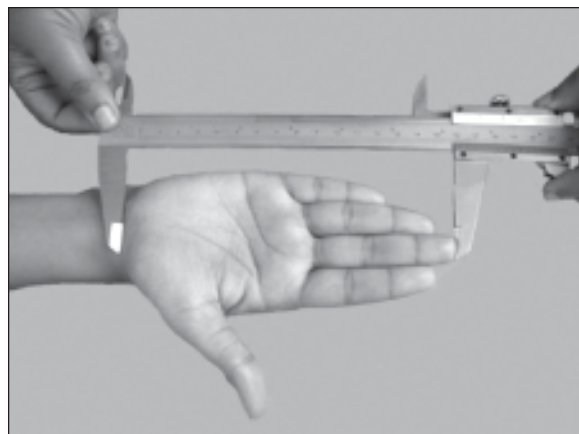


Fig: 1 : Procedure for measuring the length of hand by using manual sliding caliper.

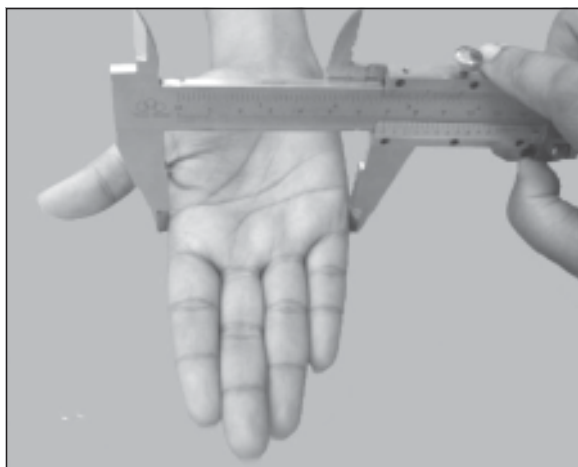


Fig.-2: Procedure for measuring the breadth of hand using manual slide caliper.

Results:

The mean values of the stature, hand length and hand breadth were found. The mean (\pm SD) of the stature was found 152.79 ± 5.62 cm (Table 1). The length of the right hand of subjects varied from 14.70 to 17.94 centimeters, as shown in Table 1. In more than 80% of the subjects, the length of the right hand was between 15.00 and 16.99 centimetres

(Figure 3). The length of the left hand of these subjects varied from 14.80 to 18.23 centimeters, as shown in Table 1. In more than 80% of the subjects, length of the left hand was between 15.00 and 16.99 centimetres (Figure 4). The length of the right and left hand showed significant positive correlation ($r=0.51$, $p=0.000$ and $r=0.49$, $p=0.000$) with the stature (Figure 7 and 8).

The breadth of the right hand of these subjects varied from 6.31 to 8.06 centimeters, as shown in Table 1. In more than 70% of the subjects, the breadth of the right hand was between 6.50 and 7.49 centimetres (Figure 5). The breadth of the left hand of these subjects varied from 6.26 to 8.04 centimeters, as shown in Table 1. In more than 70% of the subjects, breadth of the left hand was between 6.50 and 7.49 centimetres (Figure 6) There was positive correlation ($r=0.17$, $p=0.09$ and $r=0.15$, $p=0.12$) between the stature and breadth of the right and left hand (Figure 9 and 10) but the result did not reach any statistically significant level.

The multiplication factor (M.F.) regarding the breadth of right and left hand for estimating stature is mentioned in Table 1

Table-I
Stature and different , their descriptive statistics, multiplication factors and correlation with stature

Variable	Range (cm)	Mean (cm) \pm SD	Mean multiplication factor	Significance of correlation (p value)
Stature	137.00-168.50	152.79 ± 5.62	—	0.00(S)
Length of hand				
Right	14.70-17.94	16.39 ± 0.72	9.33	0.00 (S)
Left	14.80-18.23	16.33 ± 0.67	9.37	0.00 (S)
Breadth of hand				
Right	6.31-8.06	7.22 ± 0.38	21.22	0.09 (NS)
Left	6.26-8.04	7.18 ± 0.37	21.35	0.12 (NS)

n :100 for each variable

S: significant at 5% level in regression analysis

NS: Non significant

In this study, each hand variables was multiplied by mean multiplication factor and then estimated stature was obtained and then calculating the mean for 100 estimated values. This is shown in Table 2

Table-II

Comparison between the 'measured' stature and the stature 'estimated' from hand length and breadth

Measurement from which the stature was estimated	Measured stature (cm)	Estimated Stature (cm) †		Significance of difference (p value)	
	Mean ± SD	Range	Mean ± SD		
Length of hand	152.79±5.62	Right	137.15-167.38	152.96 ± 6.70	0.88(NS)
Left		138.68-170.82	153.05 ± 6.31	0.75(NS)	
Breadth of hand		Right	133.90-171.03	153.21±8.03	0.70(NS)
Left		133.65-171.65	153.23±8.00	0.68(NS)	

†The mean estimated stature against each hand variable was obtained by multiplying each individual value for that variable by the respective mean multiplication factor (as shown in table 3.1) and then calculating the mean for that.

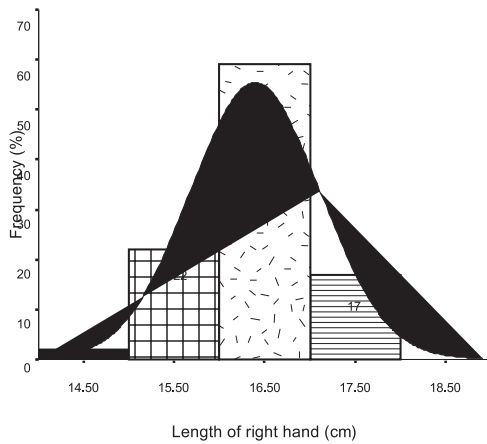


Fig-3: Frequency curve showing the frequency distribution of the length of the right hand.

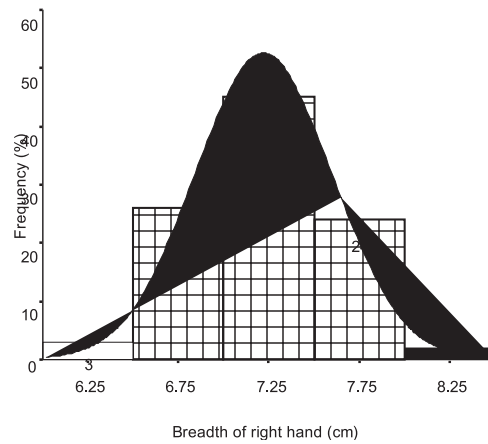


Fig-5: Frequency curve showing the frequency distribution of the breadth of the right hand.

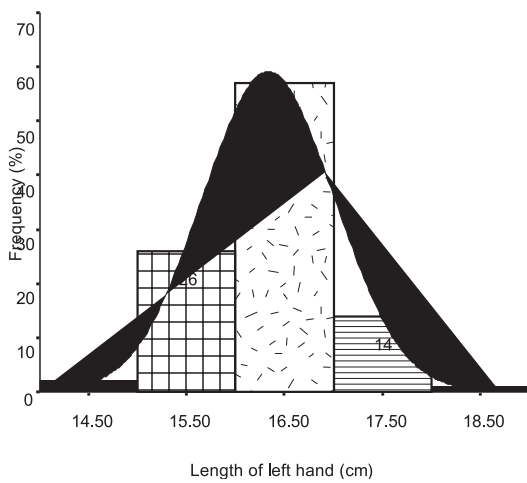


Fig-4: Frequency curve showing the frequency distribution of the length of the left hand

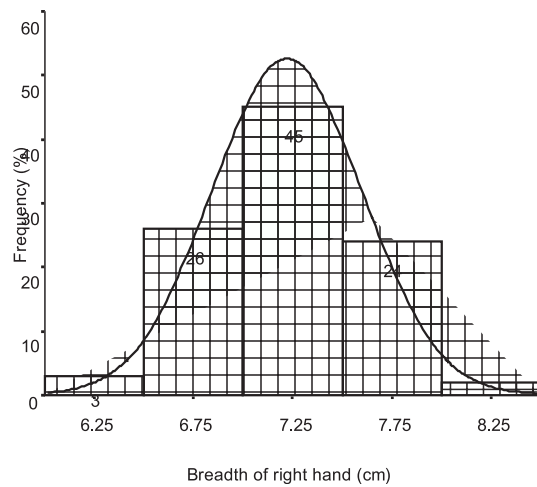


Fig-6: Frequency curve showing the frequency distribution of the breadth of the left hand

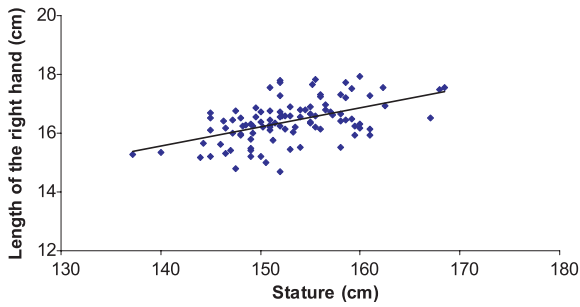


Fig-7: Scatter diagram with regression analysis showing positive correlation ($r=0.51$) between the stature and length of the right hand

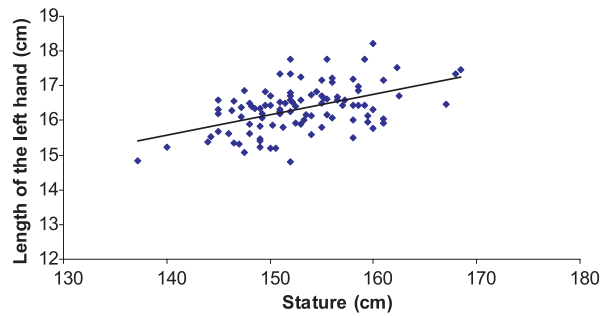


Fig-8: Scatter diagram with regression analysis showing positive correlation ($r=0.49$) between the stature and length of the left hand

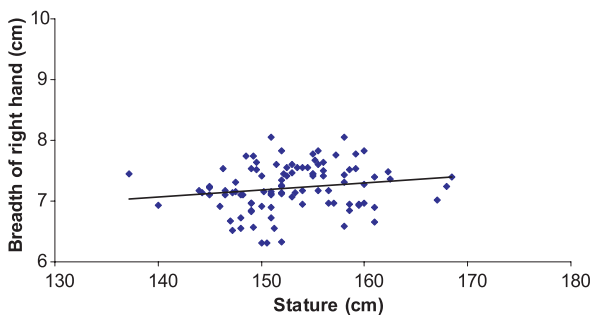


Fig-9: Scatter diagram with regression analysis showing positive correlation ($r=0.17$) between the stature and breadth of right hand

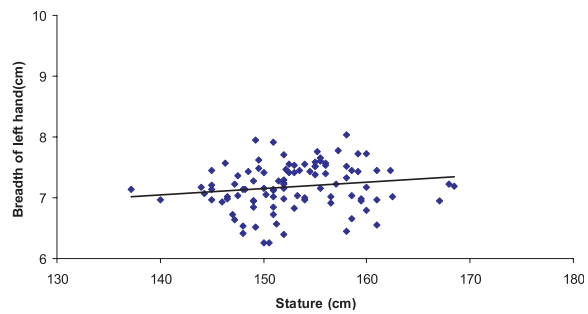


Fig-10: Scatter diagram with regression analysis showing positive correlation ($r=0.19$) between the stature and breadth of the left hand.

Discussion:

Although no statistical analysis could be done between the results of the present study and those of other studies, some observations may be worth mentioning. As the Garo tribe belongs to the Mongoloid race, some similarities are expected to exist with the other ethnic groups of Mongoloid race and some dissimilarity may be expected with other races. In the present study, the mean stature of the Garo females was found as 152.79 (± 5.62) centimetres. The mean stature of the Japanese and Chinese¹¹ females has been found somewhat closer to this value. The urban Bengali females¹² and the females of some Indian ethnic groups like South Indians¹³ appears to show a higher mean stature than the Garo females. However, rural Bengali females¹⁴ and Indians like Santhals of West Bengal¹⁵ had lower value than the Garo female population. Higher mean stature was also be noted in the Caucasian females of Mexican¹⁶

origin. It should be noted that the highest mean stature was found in the Negroid adult females like the Somali in Ethiopia¹. The mean length of right hand was 16.39 and left hand was 16.33 centimetres and the average value was 16.36 centimetres in the present study. Similar value was reported in Bengali adult females¹². Higher value was also found in Punjabi females¹⁷, Mangalore females and other Indian females¹⁸, while Nigerian females²⁰ belong to Negroid race, showed higher value. In the present study, the mean breadth of right hand was 7.22 and left hand was 7.18 centimetres. Average value was 7.20 centimetres. Smaller value was reported in Bengali adult females¹² and in Indian females¹⁸. Higher value was only found in Nigerian females¹⁹ of Negroid race and in Turks²⁰ females of Caucasoid race. From the above view it may be suggested that variation is not only present in between races or ethnic groups but also present among individual races or ethnic groups. While in question of correlation of stature and between hand length and

breadth, it was found that hand lengths have significant positive correlation with stature. On the other hand, hand breadth found to have non significant correlation with stature.

Conclusion:

Though the sample size was small and the convenience sampling had to be applied due to time constrains as well as because the study was done on such a group of people where a sampling frame could not be constructed, results of the present study will provide a baseline information, regarding some variables of a particular population (defined for the present study as Christian adult Garo females. It could lead to the development of a standard for such data on various subgroups of the population (and the population as a whole). Some amount of comparisons made with other population could contribute to the understanding of the relative status of our Garo population in the context of the anthropometric variations around the world. Significant correlations, as detected in the study between some of the measurements and their implications in the development of proper multiplication factors to be useful in estimating one measurement from another. This should encourage others in taking up further research in the field. The similar study might be done on the tribals like Chakma, Marma, Santhals, Tipra, Murong and others, while relationship of stature with other parameters (lower limb dimensions etc) of the body could also be considered.

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