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Original Article

Determination of Stature by Using Index and Ring Finger Lengths in Bangladeshi Adult Population

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Abstract

Background: *Anthropometric measurements vary in different races, sex and age groups. Estimation of stature is crucial task in the field of forensic medicine and anthropology in identifying the individual especially when body is decomposed, destroyed or certain body parts of unknown remain in mass disasters or from disposed of in gutters or waste dumps. Stature is one of the various parameters of identification. However few studies were conducted using finger lengths for estimation of stature. The purpose of present study to evaluate utility of index and ring finger lengths in estimation of stature.* ***Methods****: A cross sectional observational analytical study was conducted on 200 participants where 100 were adult males and 100were females. Ages between 25 to 45 years were selected by convenience sampling technique for the study in the Department of Anatomy of Chittagong Medical College (CMC), Chattogram. Sex differences were tested by using unpaired student's t-test. Correlations between stature and finger lengths were assessed. Multiplication factors (MF) were calculated for estimating the stature.* ***Results:*** *The present study showed significant ($p<0.001$) positive correlation between the stature and finger lengths in both genders. We found some multiplication factors which were helpful for estimation of stature from respective measurements.* ***Conclusion:*** *According to result, this study has implication in mass disaster or in criminal cases for nearly accurate estimation of the stature of an unknown individual.*

Key words: *Stature, Anthropometry, Finger lengths, Correlation.*

Introduction: Personal identification determines the individuality of a person. Basic and major component of anthropological research is the estimation of stature which is useful for identification of an individual and is of immense importance to medico legal experts. When complete body is found stature estimation is easy. But in case where only some parts of the body are available, the determination of stature of the individual is difficult[1]. In that cases finger prints, DNA determination mostly used to establish identity. Stature also plays a role in identification of an individual in mutilated or fragmented bodies. Anybody part can help in estimation of stature[2]. Fixing the identity of a person especially in case of mass disasters or natural climates like floods, earthquake, tsunami or in cases of explosion, plane crash etc. is very difficult. Even more difficult is to identify face when body is disintegrated[3,4]. Stature prediction occupies relatively a central position in anthropometric research. Anthropometric technique commonly used by anthropologist and adopted by medical scientists has been employed to estimate of stature for over a hundred years[5]. The height of an individual when it can be estimated directly, as in bedridden, old or frail patients who have limb and or vertebral column deformity; an indirect estimation can

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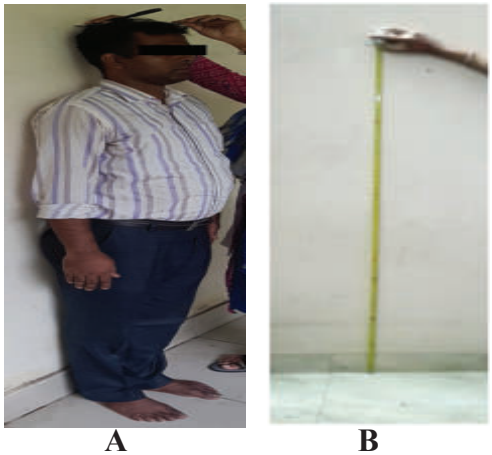
be achieved by correlating the height with other skeletal parameters[6]. Many previous studies have shown the correlation of stature with different body parts such as lower limb, arm span, upper limb[7-9]. A study where estimation of stature was done by using the measurements of foot and shoe[10]. In recent years, crimes against adolescents have been increasing, and as the methods have become diverse and cruel, research on the estimation of stature is needed[11].
No single anthropometric formula is suitable to draw complete anthropometric picture in Bangladesh[12]. For this reason, different formulae are required for calculating stature and different bones or body parts for identification of different populations.

Materials and Methods

The study was a cross- sectional observational analytical study. It was conducted from January 2018 to January 2019 on 200 adult healthy Bangladeshi populations comprising of 100 males and 100 females. Ten percent of extra (total 110+110=220) male and female were taken to mitigate the dropping out of the subjects. Participants were selected from Chittagong Medical College and Hospital (CMCH) Chattogram. All the measurements were taken during a particular time of the day(from 9AM to 4PM) to avoid diurnal variations[13]. Data analyses were carried out in the department of Anatomy, CMC, Chattogram, Bangladesh. Physical measurements were inserted in data collection sheet after taking their informed approval. Stature was measured as a vertical distance from vertex to the floor after the individual were instructed to stand erect and barefooted in anatomical position with the head in Frankfort horizontal plane[14]. Arms were hung freely by the sides with the palm facing towards the thighs and heels together so that, his or her heels, buttocks, shoulders and the head touched the wall to measure the stature (Figure-1)[14].



A B

Figure-1: Measurement of stature: A. Placing the steel plate against the head and wall. B. Measuring the stature from the marked point on the wall to the floor by using steel tape.

Left index finger length was measured by Vernier caliper as distance between midpoints of the proximal crease to the tip of the index finger, palm facing upward on a horizontal plane[15]. (Figure-2)

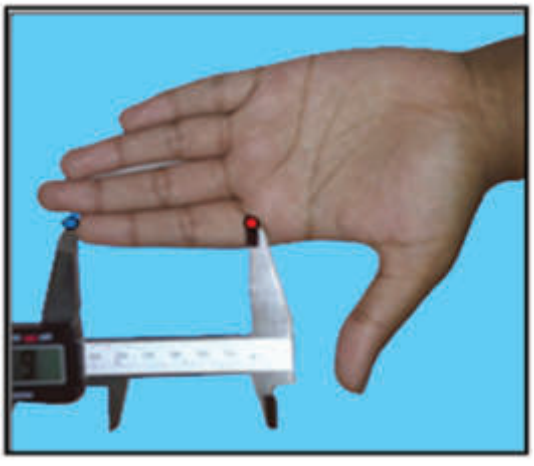


Figure-2: Procedure of measurement of index finger length

Left ring finger length was measured by Vernier caliper as distance between midpoints of the proximal crease to the tip of the ring finger, palm facing upward on a horizontal plane[2]. (Figure-3)

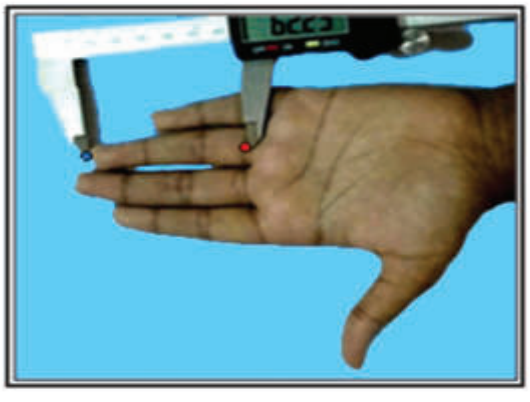


Figure-3: Procedure of measurement of ring finger length

Calculation 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 factors were used for estimating the stature from the index

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and ring finger lengths.
So, multiplication factor (MF) for estimating the stature from each of the selected finger lengthswere calculated by using the following formulae[16,17].

$$MF = \frac{\text{Stature}}{\text{Finger lengths}}$$

Statistical Analysis: Results were prepared on the basis of collected data. Data was expressed as mean ± SD (Standard deviation). Unpaired t-test was done to analyze the difference between males and females for all variables. Pearson's correlation co-efficient were calculated to measure the strength of correlation between stature and finger lengths. P-value less than 0.05 ($p<0.05$) was considered as significant. All statistical analyses were performed by using SPSS-22 and MS Excel.

Results

Table-1: Comparison of different variable between males and females (n=200)

Variable (cm)	Male (n =100)	Female (n =100)	P value
S	165.78±7.14	155.47±4.98	<0.001**
LIFL	7.04±0.38	6.68±0.62	<0.001**
LRFL	7.19±0.49	6.60±0.66	<0.001**

S: Stature, LIFL: Left index finger length, LRFL: Left ring finger length, **: Statistically significant test ($p<0.001$).
Table-1 shows the descriptive statistics of left index and ring finger lengths along with stature of adult males and females.

Table-2: Correlation coefficients of index and ring finger lengths with stature among males and females (n=200)

Variable (cm)	Male (n =100)			Female (n =100)		
	r	P Value	MMF	r	P Value	MMF
LIFL	+ 0.403	< 0.001**	23.60± 1.44	+ 0.316	< 0.001**	23.43± 2.00
LRFL	+ 0.323	< 0.001**	23.13± 1.57	+ 0.341	< 0.001**	23.77 ± 2.13

LIFL: Left index finger length, LRFL: Left ring finger length, r: Correlation coefficient, **: Statistically significant test ($p<0.001$). MMF: Mean multiplication factors.

Table-2 represents correlation coefficient values (r) of the stature with the left index and ring finger lengths which were shown by using scatter diagrams in Figure 4-7.

Multiplication factor was derived for estimation stature from left index and ring finger lengths. If we multiply these measurements by respective multiplication factor, the approximate stature of an individual can be obtained.

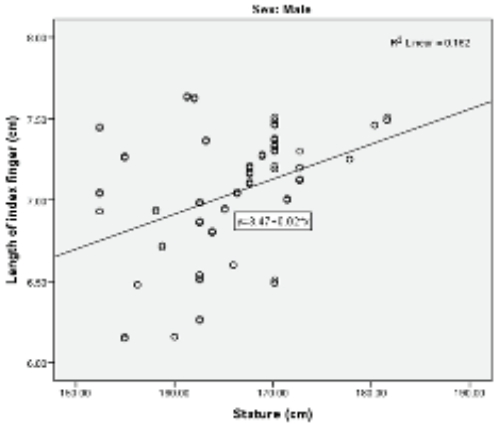

Figure-4: Scatter diagram with regression analysis showing significant positive correlation (r=+0.403, R2=0.162,p=<0.001) of the stature with left index finger length in males.

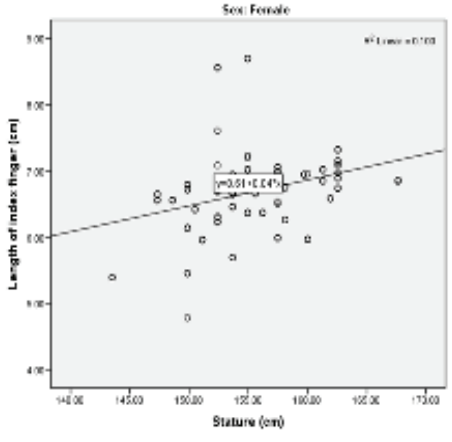

Figure-5: Scatter diagram with regression analysis showing significant positive correlation (r=+0.316, R2 =0.100, p=0.001) of the stature with left index finger length in females.

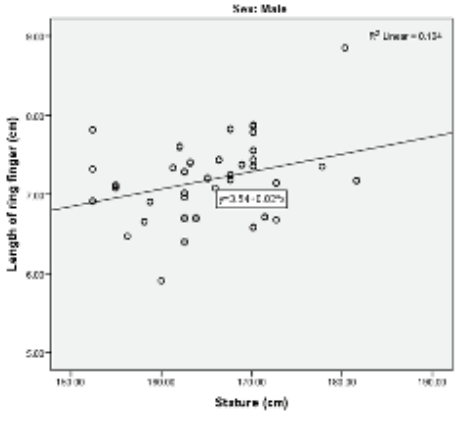

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Figure-6: Scatter plot with regression line showing significant positive correlation (r=+0.323, R2 =0.104, p<0.001) of the stature with left ring finger length in males.

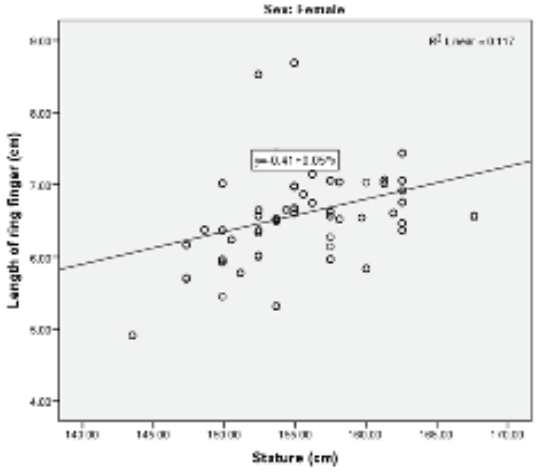

Figure-7: Scatter plot with regression line showing significant positive correlation (r=+0.341, R2 =0.117, p<0.001) of the stature with left ring finger length in females.

Discussion

Anthropometric measurements can help in the determination of primary indicators of stature. In the present study, males showed higher mean values in stature including length of index and ring fingers than females and difference in these measurements were found to be statistically significant (p<0.001). Hence our findings revealed a clear pattern of sexual dimorphism with females, which were agreement with many other studies conducted on different populations of Korea, Malaysia, Iran and eastern India[11,18-20]. These statistically significant differences might be due to the early pubertal growth spurt in girls that stops early and under the influence of estrogen, which causes early fusion of epiphysis[21]. In males, the growth spurt occurs comparatively later. They continue to grow for a longer period under the influence of testosterone[21].

Various studies have showed that index and ring finger lengths are relatively useful predictor of the stature[17,22]. In current study, the correlation coefficient between the stature and finger lengths were found positively correlated in both genders. Raju GM et al. has concluded that index and ring fingers length can be efficiently used for estimation of stature after conducting a study among the population of Karnataka state[22], India. According to their study, estimation of stature from the right index finger (RIF) in females was more significant but in case of males it was right ring fingers (RRF) which showed greater value of significance[22]. Kumar L et al., also found statistically significant correlation between stature and index finger length among males and females of Uttarakhand population of India[23]. Susselema et al., showed a significant relationship between stature and finger lengths[24]. A study done by Krishan et al., and found that index and ring fingers length were significantly correlated with stature[25]. Tayegi et al., studied the subjects from Delhi and revealed that there was a positive correlation between finger lengths and the stature. He also suggested that index finger was the best for the prediction of stature both males and females[3].

In our study, we have formulated multiplication factor for estimation of stature from index and ring finger lengths. The results indicate that if index and ring fingers are known, stature can be predicted.

Conclusion

This study provides anthropometric correlation of fingers length with stature of Bangladeshi adult population. The result of the present study revealed that there was a relationship between stature and the index and ring finger lengths. Correlations of the stature with each of the selected finger lengths of the left side were assessed and it was positively correlated. In addition to the medico-legal investigation it may be helpful for the clinician in plastic and reconstructive surgery, anatomist, archeologist and anthropologist.

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