Research Article

ESTIMATION OF STATURE FROM FOREARM LENGTH IN NORTH INDIANS – AN ANTHROPOMETRIC STUDY

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ABSTRACT
Stature is one of the most important and useful anthropometric parameter and its estimation hold a special place in the field of Forensic Anthropometry. The present study was done to estimate the stature of 200 males and 200 females from forearm length of individuals having age group of 17-25, in Department of Anatomy, SGRD Institute of Medical Sciences and Research, Sri Amritsar. All individuals were measured for height and forearm length. The data thus obtained has been subjected to statistical computation for deriving the regression equations. The results obtained concluded that forearm length exhibit highly significant correlation in male and female North Indians.

Key Words: Forearm length, Stature, Anthropology, North Indians, Anthropometry

INTRODUCTION
Stature of an individual is one of the important parameter which contributes greatly to the process of identification even after death. Prediction of stature from long bones is a question which holds central position in anthropology as regards the investigation of different bone finding (Kolte and Bansal, 1974). It has been stated that a variety of factors such as race, gender and nutrition play an important role in determining the height of an individual (Ilayperuma *et al.,* 2010).

The process of stature estimation has undergone a complex course of development involving researchers who have developed different means of achieving the desired goal. Thomas Dwight (1884) suggested the following methods for stature reconstruction i.e. Anatomical Method and Mathematical Method. The anatomical method invariably requires complete skeleton for stature estimation whereas the mathematical method is one workable even with a single bone (Nath *et al.,* 1990). Keeping this in mind in present study attempt has been made to formulate multiplication factors and regression equations for stature estimation among subjects belonging to various regions of North India, using Forearm length.

MATERIALS AND METHODS
The present study was conducted on total of 400 (200 males and 200 females) healthy, asymptomatic subjects in age group of 17- 25 years belonging to various regions of North India. A written valid informed consent was taken from each of the participants. A small group of 20 subjects were taken for measurements each day at fixed time to avoid diurnal variations. The measurements were taken three times to avoid error. The subjects were measured for

•   Stature (S): It is obtained as a distance between floor and the highest point on the head when subject is standing in standard standing position, using anthropometric rod.

•   Forearm length (FL): It is measured from head of radius to tip of styloid process of radius using standard measuring tape.

Complete data has been analyzed using SSPS package (version 17.3) for computation of Multiplication factors (M.F.) and regression equation for estimation of stature from forearm length. The bar diagram was plotted taking measurements on x-axis and number of cases on y-axis.

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In bar diagram
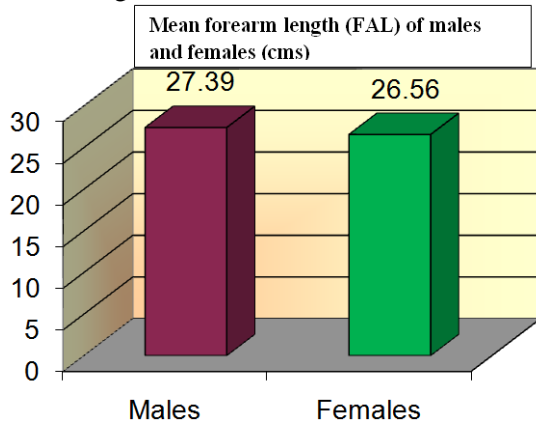
Figure 1: Shows the bar diagram representing the mean ± SD value of forearm length in male and females (cms). Purple colour indicates the mean value of upper arm length in males and green indicates mean upper arm value in female North Indians.
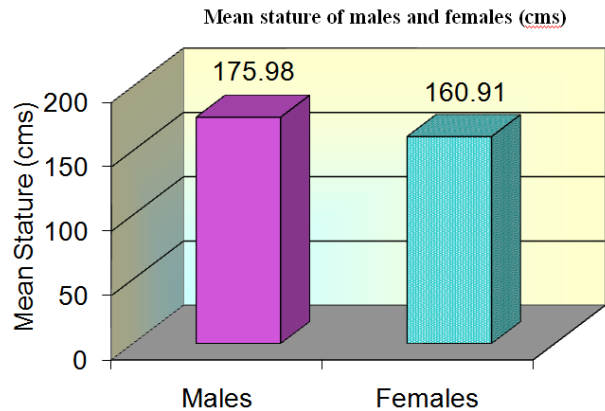
Figure 2: Shows the bar diagram representing the mean ± SD value of stature in male and females (cms). Pink colour indicates the mean value of stature in males and blue indicates mean stature value in female North Indians.

RESULTS

Table 1 presents the mean value of calculated stature and forearm length in North Indian males and females. It was observed that North Indian males exhibit higher values for stature and forearm length compared to North Indian females as summarized in table 1 and figure 1.

Table 2 lists the Multiplication Factor (M.F) for calculating stature and value of regression coefficient 'r' for forearm length. It was observed that males exhibit higher value of Multiplication Factors and 'r' value as compared to North Indian females as depicted by table 2 and figure 2.

Table 3 shows the linear regression equations for estimation of stature from forearm length among male and female North Indians.

Table 1: Mean ± SD and Range of Stature in male and female North Indians (in centimeters)

Subjects	Range	Mean ± SD
Males (n=200)	158-194	175.98 ± 6.76
Females (n= 200)	148-176	160.91 ± 5.75

Table 2: Mean ± SD and Range of upper arm length in male and female North Indians (in centimeters)

Subjects	Range	Mean ± SD
Males (n=200)	22-44.3	27.39± 2.237
Females (n= 200)	22-43.7	26.56± 15.018

Table 3: The multiplication factors (M.F) and regression coefficient (r) derived in study for North Indian males and females

Subjects	Males	Females
M.F	6.425	6.058
'r'	0. 601	0.531

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DISCUSSION

The forensic anthropologists and medical experts generally encounter a complication while dealing with dismembered bodies or those recovered in extremely decomposed or skeletonised form. Thus estimation of stature is an important parameter in medicolegal examination and anthropological studies. Morphology of forearm length helps in estimation of stature therefore the study was carried out to investigate the relationship between stature and forearm length.

Nath and Krishan (1990) conducted a study on Hindu (Baniya) females of Delhi ranging in age group from 15-22 years and calculated mean stature 151.66± 5.67cm and in North Indian females it was 160.91 ± 5.75cm. The mean value of forearm length was 21.21± 1.24cm with 'r' value to be 0.660 whereas in present study it was 26.56± 15.01cm and 'r' value was 0.53. The multiplication factor for calculating stature from forearm length was 7.15 whereas in North Indian females were 6.05.

Nath *et al.,* (1998) conducted a study for reconstruction of stature on basis of percutaneous length of forearm bones among the 199 Munda (110 males and 89 females) of Midnapur district, West Bengal in age group of 18-30 years. The mean value of stature in males was 156.19cm whereas in North Indian males it was 175.98cm. Similarly the mean value of stature in Munda females was 148.64cm whereas in North Indian females were 160.91cm. The mean value of forearm length in Munda males and females was 24.60 cm and 22.85cm respectively and in North Indian females was 27.39cm and 26.56cm respectively.

Jain and Nath (1997) conducted a study on 132 male Brahmins of Kumaon in age range of 17-19 years and calculated the mean value of stature to be 161.3± 6.32cm compared with North Indian males which was 175.98± 6.76 cm. The mean forearm length in Brahmins was 24.61± 2.0cm whereas in present study was 27.39± 2.2cm. The Multiplication factor calculated in Brahmins was 6.50 whereas in North Indian males were 6.42.

Ilayperuma *et al.,* (2010) conducted a study on 258 medical students (140 males and 118 females) of faculty of medicine, university of Ruhana, Galle, Srilanka in age range of 20-23 years. The mean value of stature in males and females was 170.14± 5.22cm and 157.55± 5.75 compared with North Indian males and females 175.98± 6.76cm and 160.91± 5.75cm respectively. The forearm length in Srilankan male and females was 27.56± 1.30 and 25.11± 1.24cm compared with North Indian male and females was 27.39± 2.2cm and 26.56± 15.01cm respectively. The 'r' value was 0.66 and 0.76 in Srilankan and 0.601 and 0.53 respectively for North Indians.

The linear regression equation derived by Ilayperuma, Nanayakkara and Palahepitiya

In males: S= 97.252+ 2.645 (Forearm length)

In females: S= 68.777+ 3.536 (Forearm length)

In present study done on North Indians linear regression equation calculated was

In males: S= 126.28 + 1.815 (Forearm length)

In females: S= 160.37 + 0.020 (Forearm length)

Nath, Garg and Krishan(1991)[6] conducted a study on 160 male Rajputs of tehsil Chakrata, district Dehradun, Uttar Pradesh in age of 16-35 years and calculated mean stature to be 164.4± 9.22cm and in North Indian males it was 170.14± 5.22cm. The mean value of forearm length in Rajputs was 23.8± 1.49 and in North Indian males was 27.39± 2.2cm. The multiplication factor in Rajputs was 6.92 and in North Indians were 6.42 respectively.

CONCLUSION

In conclusion, the present study found that Male North Indians exhibit greater dimensions than the females for the forearm length and the stature. The males exhibit greater mean Multiplication factor for forearm length than North Indian females. Stature and upper arm length are positively and significantly correlated with each other (p<0.001). Linear regression equations were derived for estimation of stature reliably and accurately that would be of immense value in the field of crime detection. The regression equation derived in the study can be used accurately and reliably for estimation of stature in a diverse

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population group. In addition, the multiplication factors derived in the present study are quite handy for use by a lay public like police etc.

ACKNOWLEDGEMENT

Abbreviations Used

M.F – Multiplication Factor;   'r' Value- Correlation Coefficient;   S – Stature N – Number of Cases

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