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Estimation of Stature Through Measurements of Hand and Foot Among Female Jats of Delhi

Preeti Jain, Sunita Roy and Surinder Nath

Department of Anthropology, University of Delhi, Delhi 110 007, India

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ABSTRACT An attempt has been made in the present study to formulate means of stature reconstruction using non conventional body dimensions, *i.e.* hand and food length among Jat females of Delhi. Data for the present study comprises of 200 Jat females ranging in age from 17 to 20 years. Each subject was measured for hand length, foot length and stature following the standard techniques. Both hand length and foot length have been used to compute multiplication factors as a ratio of these dimensions to stature. The mean multiplication factors for hand length and foot length, *i.e.* 8.66 and 6.59, respectively could be used to estimate stature of Jat females with reasonable accuracy.

INTRODUCTION

Estimation of stature from skeletal material is an important aspect of personal identification (Stewart, 1997; Krogman and Iscan, 1986).

Thomas Dwight (1894) described two methods for estimation of stature from skeletonized remains, *i.e.* (I) Anatomical, and (II) Mathematical. The anatomical method involves in simply putting the bones together, in reproducing the curves of the spine, in making due allowance for the soft parts, and measuring the length. This method is applicable when the whole skeleton is available for examination. The mathematical method, on the other hand, is based on the proportion of the long bones to the height of an individual. This method is applicable even if a single bone is available. The mathematical method can be used in two ways, *i.e.* either by formulating prediction equations or by computing multiplication factors for reconstruction of stature. Multiplication factor is simply obtained as proportion of a particular bone dimension to stature.

In India due to the mode of disposal of dead bodies, skeletal, populations are hardly available for such a purpose. This poses a problem to forensic anthropologists to formulate means of stature estimation through long bone lengths. Thus alternatively, percutaneous measurements of limb bones have been used to formulate regression equations for prediction of stature (Allbrook, 1961).

Most of the studies on this aspect involves measurement on percutaneous length of upper and lower limb bones of certain living populations of India (Athwale, 1963; Patel et al., 1964; Joshi et al., 1964, 1965; Kolte and Bansal, 1974; Duggal and Nath, 1986; Nath et al., 1988; 1990; Anand and Nath, 1990; Nath and Krishan, 1990). But the present study differs from these studies as it involves non conventional body measurements like hand length and foot length for formulating means of stature estimation among a living community, *i.e.* Jat females of Delhi.

MATERIAL AND METHODS

Date for the present study comprises of 200 Jat females of Delhi ranging in age from 17 to 20 years. Each subject was measured for the following measurements pertaining to hand, foot and stature as per the techniques recommended by Martin and Saller (1959) and Nath (1993).

1. Stature (S): It is obtained as a projective distance from the standing surface to the highest point (*Vertex*) on the head when the subject is standing in the standard arm hanging position, using anthropometer rod.

2. Hand Length (HL): It is obtained as a distance between the proximal bracelet crease and the distal most point of the middle finger, when the left hand is fully stretched with the fingers together and palm facing upwards, using sliding caliper.

3. Foot Length (FL): It is obtained as a distance between the distal most point (*Acropodion*) on the tip of the longest toe and the most posterior point on the heel of the foot (*Pternion*), when

the left foot is fully stretched with entire weight upon the left foot, using rod compass.

Data on female Jats have been analyzed for computation of multiplication factors for estimation of stature from hand and foot lengths.

RESULTS AND DISCUSSION

Table 1 presents the mean values and standard deviations of the hand length and foot length, along with stature. It depicts that average height of the female Jats of Delhi is 156.45 cm. Mean foot length (23.69) is sufficiently greater than hand length (16.24).

Table 1: Mean and S.D. for hand and foot lengths and stature among Jat females of Delhi (n=200)

S.No.	*Measurements*	*Mean (cm)*	*S.D.*
1	Hand length (HL)	16.24	0.83
2	Foot length (FL)	23.69	1.12
3	Stature (S)	156.45	5.54

Table 2 exhibits the mean multiplication factors for two non conventional measurements of female Jats of Delhi. M.F. for hand length (8.66) is found to be greater than foot length (6.59).

Table 2: Multiplication factors (M.F.) for non conventional measurements among Jat females of Delhi (n=200)

S.No.	*Measurements*	*M.F. (Mean)*
1	Hang length (HL)	8.66
2	Foot length (FL)	6.59

A careful observation of table 3 reveals that the M.F. for hand and foot lengths exhibit wide variations in different population groups. But in case of hand length a few population group reveals common M.F. *e.g.* Rajput females of H.P. (Kaur, 1996) and Punjabi females of Delhi (Rajni, 1988) reveal 9.12 as a common M.F., Brahmin females and Rajput males of Garhwal (Anand, 1990) exhibit 9.08 as the common M.F., Rajput females of Dehradun (Garg, 1987) and Jat females of Rajasthan (Nath, 1997) reveal 9.10 as the common M.F. for hand length. Excepting these six population groups the remaining populations show variation in the M.F. for hand length. In case of foot length the multiplication factors are variable for all the populations reported so far.

Table 3: Multiplication factors for hand length and foot length of different Indian populations

S. No.	*Population Area*	*Sex*	*Author*	*Multiplication factors*	
				Hand length	*Foot length*
1	Munda W. Bengal	M	Duggal, 1985	8.65	6.24
2	Munda W. Bengal	F	Dugga, 1985	8.94	6.26
3	Lodha W. Bengal	M	Duggal, 1985	9.05	6.45
4	Lodha W. Bengal	F	Duggal, 1985	9.13	6.32
5	Brahmin Ranikhet, U.P.	M	Tiwary, 1986	9.15	7.43
6	Rajput Ranikhet, U.P.	M	Tiwary, 1986	9.14	7.46
7	Rajput Dehradun, U.P.	M	Garg, 1987	9.16	6.66
8	Rajput Dehradun, U.P.	F	Garg, 1987	9.10	7.28
9	Punjabi Delhi	F	Rajni, 1988	9.12	6.67
10	Brahmin Garhwal, U.P.	M	Anand, 1990	9.81	6.18
11	Brahmin Garhwal, U.P.	F	Anand, 1990	9.08	6.79
12	Rajput Garhwal, U.P.	M	Anand, 1990	9.08	6.42
13	Rajput Garhwal, U.P.	F	Anand, 1990	9.39	7.13
14	Hindu Baniya Delhi	F	Nath & Krishan, 1990	9.11	6.64
15	Rajput Himachal Pradesh	M	Kaur, 1996	9.07	6.57
16	Rajput Himachal Pradesh	F	Kaur, 1996	9.12	6.71
17	Jat Rajasthan	M	Nath, 1997	9.04	6.60
18	Jat Rajasthan	F	Nath, 1997	9.10	6.68
19	Sikh Delhi	F	Kaur & Nath, 1997	9.18	–
20	Rajput Srinagar, U.P.	M	Nath et al., 1998	9.25	6.87
21	Rajput Srinagar, U.P.	F	Nath et al., 1998	9.37	6.73
22	Brahmin Srinagar, U.P.	M	Nath et al., 1998	9.36	6.64
23	Brahmin Srinagar, U.P.	F	Nath et al., 1998	9.33	6.68
24	Warli Maharashtra	M	Jain et al., 1998	9.06	6.49
25	Jat Delhi	F	Present Study	8.66	6.59

The M.F. for hand length among males vary

from a minimum of 8.65 among Mundas of West Bengal (Duggal, 1985) to a maximum of 9.81 among Brahmins of Garhwal (Anand, 1990) whereas among females it varies from a minimum of 8.94 among Mundas of West Bengal (Duggal, 1985) to a maximum of 9.39 among Rajputs of Garhwal (Anand, 1990)

However the Jat females of Delhi are (present study) are closest to the Munda males West Bengal (Anand, 1985) with M.F. as 8.66 which happens to be the lowest value of M.F. for females.

In case of M.F. for foot length the values range among males from a minimum of 6.18 among Brahmins of Garhwal (Anand, 1990) to 7.46 among Rajputs of Ranikhet (Tiwary, 1986). While among females it ranges between a minimum of 6.24 among Mundas of West Bengal (Duggal, 1985) and 7.28 among Rajputs of Dehradun (Garg, 1987). The Jat females of Delhi with M.F. as 6.59 are closest to Jat males of Rajasthan (Nath, 1997) and Rajput males of Himachal Pradesh (Kaur, 1996).

The foregoing analysis clearly indicates that owing to the variations observed in the M.F. for hand length and foot length for different population groups of India, it would not be appropriate to have a common set of multiplication factors for hand and foot lengths for the entire country. It would not be also appropriate to pool the males and females of different population groups because significant sex differences have been reported by various researches. It may thus be emphasized that multiplication factors are not only population specific but they are sex specific too.

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