

An Anthropometric Study of Stature Estimation from Measurements of Hands in Tribals of Udaipur in Rajasthan Using Regression Analysis

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Abstract

Background: Estimation of stature plays an outstanding role in personal identification. It has a significant importance in forensic anthropometry. **Objective:** The present study is an attempt to evaluate a possible correlation between stature of an individual and hand length and hand breadth in tribal population of Udaipur. **Materials and Methods:** The present study was conducted on 200 tribal males and 200 tribal females in age group of 18-32 years. All the measurements were done by using standard anthropometric instruments and standard anthropometric techniques. **Results:** There was a positive but low correlation between height and various hand parameters with increase in height there is increase in the hand parameters but with less relationship for statistical analysis SPSS (Version 17) was used. **Conclusion:** The present study has provided regression equations for various hand parameters hand length and hand breadth.

Keywords: Stature; Hand length; Hand breadth; Regression equation.

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Introduction

Estimation of stature has a significant importance in the field of forensic anthropometry. Estimation of stature of an individual from the skeletal material or from the mutilated or amputated limbs or parts of limbs has obvious significance in personal identification in the events of murders, accidents or natural disasters mainly concerns with the forensic identification analysis. To assess the height of an individual, from measurements of different parts of the body, has always been of immense interest to anatomists, anthropologists and forensic experts.

Prediction of the dimensions of body segments is useful in many areas of modern science. For example, in growth and development the use is made of relationship between body segments in the assessment of normal growth as well as in specific syndromes.

Materials and Methods

The study comprised of 200 tribal Males and 200 Females of Udaipur between age group of 18-32 years. A written valid informed consent was taken from each of the participants. The subjects were apparently healthy and without any physical deformity. All measurements were recorded to the nearest millimeter using standardized anthropometric measuring equipment; stature meter and digital vernier calipers. The data was tabulated, analyzed and subjected to statistical calculations. We analyzed our data using SPSS (Version 17.0).

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Stature: The height of the individual was measured between vertex and the floor, when the person is standing erect, in anatomical position and head in the Frankfort plane.

Hand length: With the help of Vernier Calipers, Hand length was measured as a distance between midpoint of line joining styloid process of radius and ulna and tip of third finger.

Hand breadth: With the help of Vernier Calipers, Hand breadth was measured as a distance between the most prominent point on lateral aspect of second metacarpal and most prominent point on medial aspect of head of fifth metacarpal.

Results

The following observations were calculated after statistical analysis:

Table 1: Descriptive Statistics of Parameters of both Males and Females under Study.

Column	Size	Mean	S.D.	S.E.	Range	Max.	Min.	Median
Female Height	200	1550.41	91.947	6.502	336	1711	1375	1557.5
Female RHL	200	168.112	11.981	0.847	48.14	191.31	143.17	167.5
Female LHL	200	167.853	11.989	0.848	48.13	191.13	143	167.34
Female RHB	200	72.579	7.593	0.537	31.5	88.2	56.7	72.5
Female LHB	200	72.297	7.591	0.537	31.81	88.04	56.23	72.21
Male Height	200	1605.735	82.295	5.819	374	1800	1426	1602
Male RHL	200	172.242	12.436	0.879	48.5	190	141.5	173.65
Male LHL	200	172.039	12.545	0.887	48.7	190	141.3	173.72
Male RHB	200	82.146	6.284	0.444	27.68	98.38	70.7	81.65
Male LHB	200	81.891	6.336	0.448	28.17	98.2	70.03	81.25

Males and Females were highly significant (as shown in **Table 2**).

There was a positive but low correlation between height various hand parameters like hand length and hand breadth in Males and Females. With increase in height, there is increase in the hand parameters but with less relationship (as in **Table 3**).

Linear regression equations predicting stature using various hand parameters in Males and Females. The equations also exhibit standard error of estimate (S.E.E.). The S.E.E. predicts the

Table 1 shows descriptive statistics for various parameters studied in Males and Females. The average stature of Females was 1550.41 ± 91.947 mm and ranged between 1375 and 1711 mm. The hand lengths measured 168 mm (approx.) and hand breadths measured approximately 72 mm. Table also shows descriptive statistics for various parameters studied in Males. The average stature of Males was 1605.735 ± 82.295 mm and ranged between 1426 and 1800 mm. The hand lengths measured 172 mm (approx.) and hand breadths measured approximately 82 mm.

Ho: To assess the statistical difference between observations of right and left sides in Males and Females paired sample *t*-test was performed.

Significant differences between the observations of right and left sides in Males and Females were observed using paired sample *t*-test and thus null hypothesis was rejected. All the parameters in

deviations of estimated stature from the actual stature. It ranged between 92.10 and 92.148 in females. Right Hand Breadth (R.H.B.) in Females exhibited a lower value and gives better reliability in prediction of stature (as in **Table 4**). In Males it ranged between 82.154 and 82.281. A low value indicates greater reliability in the estimated stature. Hand length exhibits a lower value in Males and gives better reliability in prediction of stature (as shown in **Table 4**).

Table 2: Significance between right and left side of both Males and Females (Paired Sample *t*-test).

	Sample	<i>t</i> -value	df	Significance (2-tailed)
Pair 1	Female right hand length – hand length Female left	13.204	199	0.000 **
Pair 2	Female right hand breadth – Female left hand breadth	5.949	199	0.000 **
Pair 3	Male right hand length – Male left hand length	4.424	199	0.000 **
Pair 4	Male right hand breadth – Male left hand breadth	6.150	199	0.000 **

**Highly significant.

Table 3: Correlation between Height and Various Hand Parameters in both Males and Females under study.

Parameters	Pearson correlation	Significance (2-tailed)
Female right hand length	0.026	0.717
Female left hand length	0.027	0.701
Female right hand breadth	0.041	0.569
Female left hand breadth	0.033	0.639
Male right hand length	0.085	0.230
Male left hand length	0.092	0.196
Male right hand breadth	0.086	0.225
Male left hand breadth	0.073	0.303

Table 4: Linear regression Equations for various Parameters studied in both Male and Female.

Female	Male
Height = 1517.100 + 0.198 × RHL ± 92.148	Height = 1508.619 + 0.564 × RHL ± 82.203
Height = 1515.241 + 0.210 × LHL ± 92.144	Height = 1502.008 + 0.603 × LHL ± 82.154
Height = 1514.802 + 0.491 × RHB ± 92.10	Height = 1513.106 + 1.128 × RHB ± 82.197
Height = 1521.182 + 0.404 × LHB ± 92.127	Height = 1527.806 + 0.952 × LHB ± 82.281
Height = 1516.165 + 0.204 × H Length ± 92.146	Height = 1505.215 + 0.584 × H Length ± 82.179
Height = 1517.934 + 0.448 × H Breadth ± 92.115	Height = 1520.343 + 1.041 × H Breadth ± 82.240

Discussion

The following comparisons of various similar studies in a tabulated form in Table 5.

There was positive but low correlation between height and various hand parameters. Previous studies have found that the regression equations using anatomical dimensions of one population do not apply to another. The same was found in our study, where our data differs from data of previous studies of other ethnic groups. We also found that the regression equations of one sex cannot be applied to the other even when estimating stature in same ethnic group. So in this study we derived a separate regression equations to estimate stature from hand

length and hand breadth. From the above facts, it is clear that if either of the measurement (hand length, hand breadth or total height) is known the other can be calculated and this method of stature estimation can be used by law enforcement agencies and forensic scientists. There are a lot of variations in estimating stature from hands among people of different region and race. No such type of study was carried out in Udaipur of Rajasthan. Hence there is a need to conduct more studies among people of different regions so that stature estimation becomes more reliable and there is easily identification of an individual. In this study only healthy individuals are included so the results may not be applicable to the persons having any deformity or any congenital abnormality (as shown in Figs.1-4).

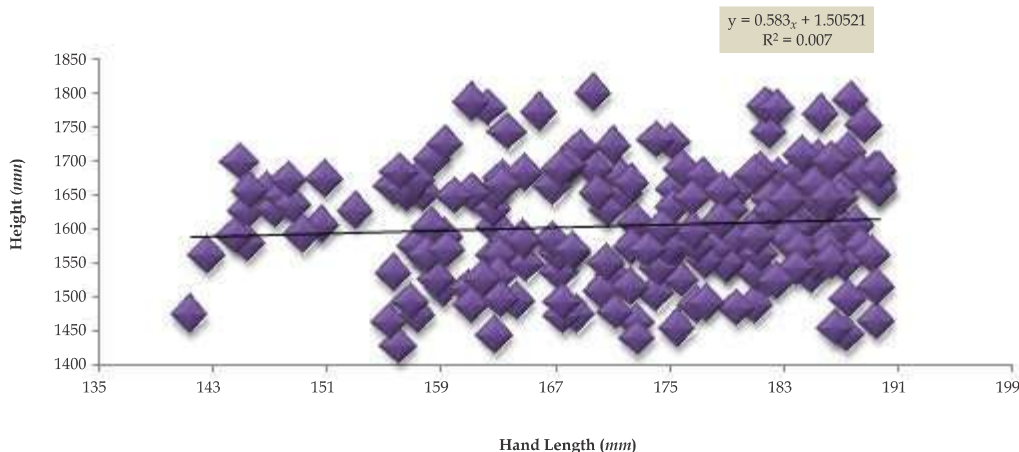


Fig. 1: Correlation between Male Height and Male Hand Length.

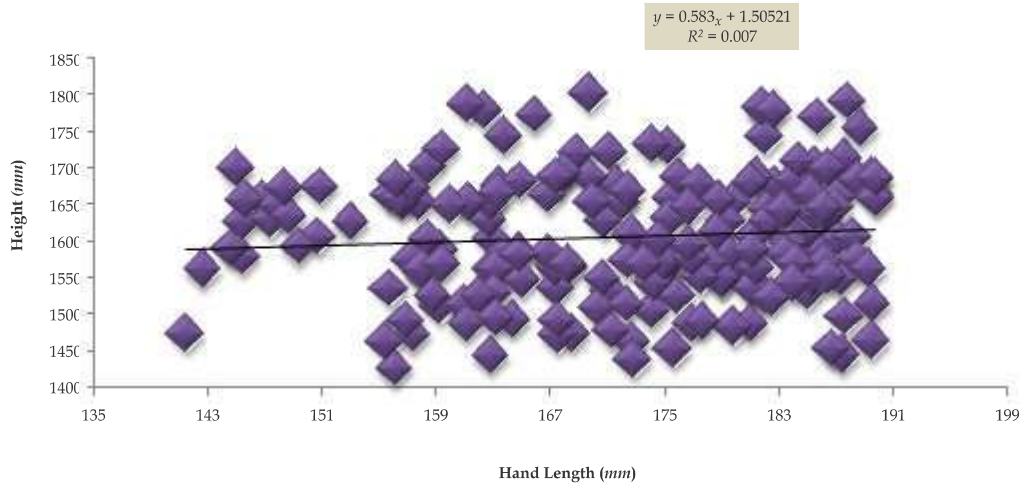


Fig. 2: Correlation between Male Height and Male Hand Breadth.

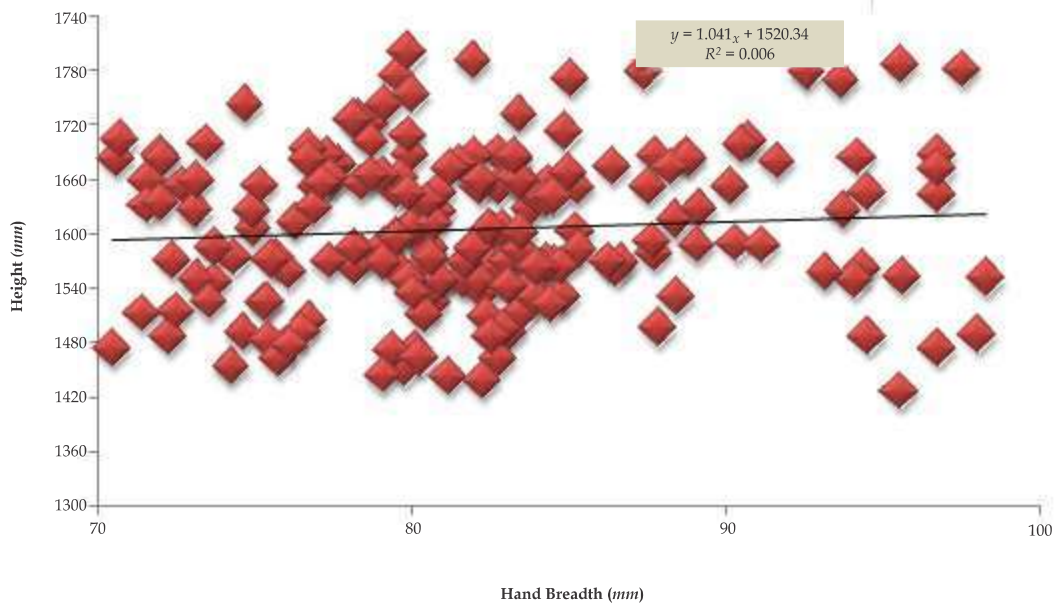


Fig. 3: Correlation between Female Height and Female Hand Length.

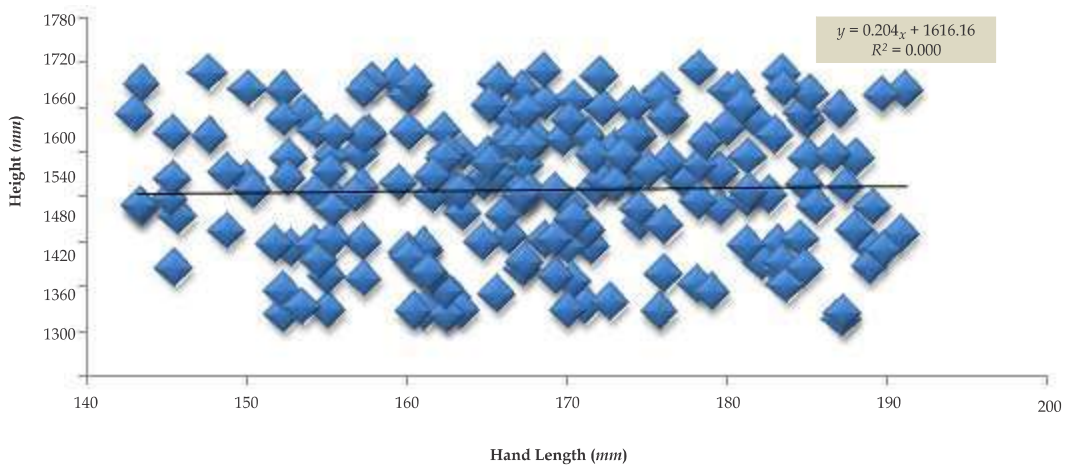


Fig. 4: Correlation between Female Height and Female Hand Length.

Table 5:

Sl. No.	Population	Sex	Area	Author	Year	Regression Equation	S.E.E.	Value of <i>r</i>
1.	Jat sikhs	Male	Punjab	Dr OP Jasuja ³	2004	$H = 69.513 + 5.223 \times$ Hand Length (R)	4.003	0.502(R)
2.	Jat sikhs	Male	Punjab	Dr OP Jasuja ³	2004	$H = 84.742 + 4.491 \times$ Hand Length (L)	4.003	0.452(L)
3.	Turks	Male	Adana, Turkey	Sultan G Sanli ³	2005	$H = 439.52 + 3.29 \times$ Hand Length	42.66	0.722
4.	Rajputs	Male	Himachal	Kewal Krishan ⁴	2007	$H = 88.243 + 4.39 \times$ Hand Length	5.17	0.304
5.	North Indians	Male	Mangalore	Prateek Rastogi ⁵	2008	$H = 81.343 + 4.78 \times$ Hand Length	5	0.659
6.	South Indians	Male	Mangalore	Prateek Rastogi ⁵	2008	$H = 69.006 + 5.469 \times$ Hand Length	4.85	0.731
7.	Medical Students	Male	Galle, Srilanka	I. Ilayperuma ²	2009	$H = 103.732 + 3.930 \times$ Hand Length	5.22	0.58
8.	Tribals	Male	Udaipur	Charu Taneja	2014	$H = 1505.215 + 0.584 \times$ Hand Length	82.179	.083
9.	Tribals	Female	Udaipur	Charu Taneja	2014	$H = 1517.934 + 0.448 \times$ Hand Breadth	92.115	0.037
10.	Tribals	Female	Udaipur	Charu Taneja	2014	$H = 1517.934 + 0.448 \times$ Hand Breadth	92.115	0.037
11.	Jat sikhs	Male	Punjab	Dr OP Jasuja ³	2004	$H = 69.513 + 5.223 \times$ Hand Length (R)	4.003	0.502(R)
12.	Jat sikhs	Male	Punjab	Dr OP Jasuja ³	2004	$H = 84.742 + 4.491 \times$ Hand Length (L)	4.003	0.452(L)
13.	Turks	Male	Adana, Turkey	Sultan G Sanli ⁶	2005	$H = 439.52 + 3.29 \times$ Hand Length	42.66	0.722
14.	Rajputs	Male	Himachal	Kewal Krishan ⁴	2007	$H = 88.243 + 4.39 \times$ Hand Length	5.17	0.304
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17.	Medical Students	Male	Galle, Srilanka	I. Ilayperuma ²	2009	$H = 103.732 + 3.930 \times$ Hand Length	5.22	0.58
18.	Tribals	Male	Udaipur	Charu Taneja	2014	$H = 1505.215 + 0.584 \times$ Hand Length	82.179	.083
19.	Rajputs	Female	Himachal	Kewal Krishan ⁴	2007	$H = 110.39 + 6.13 \times$ Hand Breadth	4.5	0.503
20.	North Indians	Female	Mangalore	Prateek Rastogi ⁵	2008	$H = 97.058 + 8.570 \times$ Hand Breadth	5.4	0.46
21.	South Indians	Female	Mangalore	Prateek Rastogi ⁵	2008	$H = 85.503 + 10.767 \times$ Hand Breadth	5.73	0.592
22.	Volunteers	Female	Turkey	Abdi Ozaslan ¹	2012	$H = 1298.32 + 4.25 \times$ HB	62.27	0.257
23.	Jat Sikhs	Female	Punjab	Dr OP Jasuja ³	2004	$H = 133.961 + 1.473 \times$ Hand Length	5.127	0.529(R)
24.	Turks	Female	Adana, Turkey	Sultan G Sanli ⁶	2005	$H = 743.11 + 2.38 \times$ Hand Length	34.96	0.709
25.	Rajputs	Female	Himachal Pradesh	Kewal Krishan ⁴	2007	$H = 81.314 + 4.42 \times$ Hand Length	3.78	0.33
26.	North Indians	Female	Mangalore	Prateek Rastogi ⁵	2008	$H = 80.200 + 4.60 \times$ Hand Length	4.24	0.717
27.	South Indians	Female	Mangalore	Prateek Rastogi ⁵	2008	$H = 83.044 + 4.45 \times$ Hand Length	3.76	0.678
28.	Medical Students	Female	Galle, Srilanka	I. Ilayperuma ²	2009	$H = 93.689 + 3.625 \times$ Hand Length	5.75	0.59
29.	Volunteers	Female	Turkey	Abdi Ozaslan ¹	2012	$H = 1116.56 + 2.80 \times$ Hand Length	60.32	0.309
30.	Tribals	Female	Udaipur	Charu Taneja	2014	$H = 1516.156 + 0.204 \times$ Hand Length	92.146	0.026

Conclusion

It is concluded that the dimensions of hands can provide good reliability in estimation of stature. The right hand breadth gives better prediction of stature than the left hand breadth in case of female tribals of Udaipur. In males the left hand length gives better prediction of stature than the right hand length in case of male tribals of Udaipur.

References

1. Abdi O, Beytullah K, Melek OK. Predictive role of hand and foot dimensions in stature estimation. Rom J Leg Med. 2012;(20):41-6.
2. Isurani I, Ganananda N, Nadeeka P. Prediction of stature based on hand length. Galle Medical Journal. 2009 Sep;14(1):15-8.
3. Jasuja OP. Estimation of stature from hand and phalange length. Journal of Indian Academy of Forensic Medicine. 2004;26(3):100-106.
4. Krishan K, Sharma A. Estimation of stature from dimensions of hands and feet in north Indian population. Journal Clin. Forensic Med. 2007;14(6):327-32.
5. Rastogi P, Nagesh KR. Estimation of stature from hand dimensions of North and South Indians. Leg Med (Tokyo). 2008 Jul;10(4):185-89.
6. Sanli SG, Kizilkanat ED, Boyan N, *et al.* Stature estimation based on hand length and foot length. Clin Anat. 2005;18:589-96.
7. Shende S, Tirpude BC, More S. To study the correlation between hand and foot dimensions and stature among the population in a district of Maharashtra situated in central India. International Journal of Medical Toxicology Legal Medicine. 2012 Dec;15(1):44-8.

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