



Original Research Article

Stature Estimation from the Anthropometric Measurements of Hands in Tribal Population of Udaipur District by 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 anthropology.

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 District.

Material and Methods: The present study was conducted on 200 tribal males in age group (years) of 18-32. 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 was an 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.

Key words: Stature, Hand length, Hand breadth, Regression equation.

INTRODUCTION

Anthropometry, the typical traditional tool of physical anthropology, provides the scientific methods for estimating the various measurements and observations on the living as well as skeleton of man. Estimation of stature has a significant importance in the field of forensic anthropology. 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. 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. The biological profile of an individual is an inherent as age, sex, ethnicity and stature can be determined with the help of anthropometry.

The stature of an individual is an inherent characteristic; its estimate is considered to be an important assessment in the identification of unknown human remains. It is common to find the peripheral parts of the body such as hand and foot in explosions, aircraft and railway accidents. Estimation of stature from hand length can be use an alternative measure to stature when stature cannot be measure directly due to deformities like kyphosis, lordosis, scoliosis, contracture or missing legs.

Despite the relationships between body parameters that have been determined, it has been emphasized that these vary from population to population and ethnic origin to ethnic origin due to differences in nutrition and levels of physical activity. [1] To the best of our knowledge such data are not available for tribal population of Udaipur district of Rajasthan. Therefore this study was carried out to assess and correlate the hand length, hand breadth and the stature. An effort was made to develop regression equations which could be used for determination of stature of an individual from his hand length and hand breadth in Udaipur district.

MATERIALS & METHODS

Inclusion Criteria: 200 tribal males of Udaipur district between age group of 18-32 years were included in the study.

Exclusion Criteria: Males having physical deformity affecting stature and hands were excluded from the study.

Statistical Analysis: All measurements were recorded to the nearest millimeter using standardized anthropometric measuring equipment; stature meter and digital vernier calipers. To assess the statistical difference between observations of right and left sides in males paired sample t- test was

performed. The data was tabulated, analyzed and subjected to statistical calculations using SPSS Version 17.

Stature: It is measured as vertical distance from the vertex to the floor. The subject was made to stand barefoot in an erect posture against a wall with both the feet close together and hands hanging down on the sides.

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.

OBSERVATIONS

The following observations were calculated after statistical analysis:

TABLE 1. Distribution of age among study population

MEASURES OF CENTRAL TENDENCY AND DISPERSION	MALES (N=200)
Mean	24.465
Median	24.000
S.D	4.623
Range	14.000
Minimum	18.000
Maximum	32.000

The age of the study population ranged between eighteen and thirty two years for males. The mean age of males was 24.465 ± 4.623 years.

Table 2 shows descriptive statistics for various parameters studied in males. The average stature of males was 1605.735 ± 82.295 mm and ranged between 1426 to 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 paired sample t- test was performed.

TABLE 2. Descriptive statistics of parameters of males under study

COLUMN	SIZE	MEAN	S.D.	S.E.	RANGE	MAX.	MIN.	MEDIAN
HEIGHT	200	1605.735	82.295	5.819	374	1800	1426	1602
RHL	200	172.242	12.436	0.879	48.5	190	141.5	173.65
LHL	200	172.039	12.545	0.887	48.7	190	141.3	173.72
RHB	200	82.146	6.284	0.444	27.68	98.38	70.7	81.65
LHB	200	81.891	6.336	0.448	28.17	98.2	70.03	81.25

TABLE 3. Significance between Right and Left side of Males (Paired Sample t-test)

SAMPLE		t-value	df	Significance (2-tailed)
Pair 1	Right Hand Length-Left Hand Length	4.424	199	0.000**
Pair 2	Right Hand Breadth-Left Hand Breadth	6.150	199	0.000**

** Highly Significant

Significant difference between the observations of right and left sides in males was observed using paired sample t-test and thus null hypothesis was rejected. All the parameters in males were highly significant as shown in Table 3.

TABLE 4. Correlation between the parameters of males under study

Parameters	Pearson Correlation	Significance (2-tailed)
Male Right Hand Length-Male Left Hand Length	0.996	0.000**
Male Right Hand Breadth-Male Left Hand Breadth	0.985	0.000**

**Highly significant

There is high correlation between the right and left side various hand parameters of males. It is clear from the table that in males all parameters strongly correlated.

TABLE 5. Correlation between height and right and left hand length and hand breadth in Males

PARAMETERS	PEARSON CORRELATION	SIGNIFICANCE (2-tailed)
Right Hand Length	0.085	0.230
Left Hand Length	0.092	0.196
Right Hand Breadth	0.086	0.225
Left Hand Breadth	0.073	0.303

There was a positive but low correlation between height and various hand parameters- hand length and hand breadth. With increase in height, there is increase in

the hand parameters but with less relationship.

TABLE 6. Linear regression equations for various parameters studied in male

$HEIGHT = 1508.619 + 0.564 \times RHL \pm 82.203$
$HEIGHT = 1502.008 + 0.603 \times LHL \pm 82.154$
$HEIGHT = 1513.106 + 1.128 \times RHB \pm 82.197$
$HEIGHT = 1527.806 + 0.952 \times LHB \pm 82.281$
$HEIGHT = 1505.215 + 0.584 \times Hand Length \pm 82.179$
$HEIGHT = 1520.343 + 1.041 \times Hand Breadth \pm 82.240$

Table 6 showing linear regression equations predicting stature using various hand parameters in males. The equations also exhibit standard error of estimate (S.E.E.).The S.E.E. predicts the deviations of estimated stature from the actual stature. It ranged between 82.154 to 82.281.A low value indicates greater reliability in the estimated stature. Left Hand length in males exhibited a lower value and gives better reliability in prediction of stature (as in Table 6).

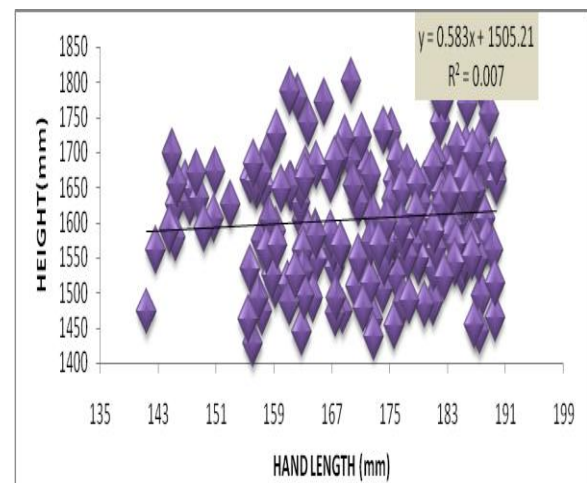


Figure 1- Showing Correlation between Height and Hand Length

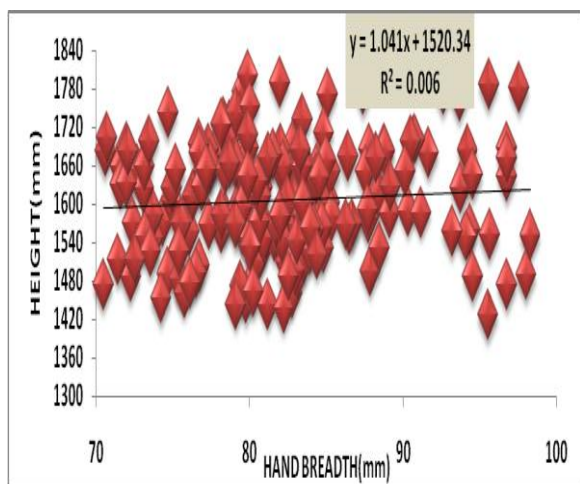


Figure 2-Showing Correlation between Height and Hand Breadth

DISCUSSION

Kewal Krishan ^[2] (2007) derived a regression equation between personal height and hand breadth, their correlation coefficient was +0.514 for males. Prateek Rastogi ^[3] (2008) derived a regression equation between personal height and hand breadth, their correlation coefficient was

+0.504 for males. Sumeet Shende ^[7] (2012) derived a regression equation between personal height and hand breadth, their correlation coefficient was +0.75 for right hand breadth and for left hand breadth correlation coefficient was +0.77 in males. Abdi Ozaslan ^[8] (2012) derived a regression equation between personal height and hand breadth, their correlation coefficient was +0.173 for males. Nihal Ahmad ^[9] (2014) derived a regression equation between personal height and hand breadth, their correlation coefficient was +0.482 for males. Morphometry of hand provides important evidence in crime scene investigation which helps in estimation of stature of a criminal. In the present study the correlation coefficient between height and hand length is + 0.083 and correlation coefficient between height for the hand breadth is + 0.077 in the males.

TABLE 7. Following table showing comparison of various similar studies of Hand Breadth

S.N O.	POPULATION	SEX	AREA	AUTHOR	YEA R	REGRESSION EQUATION	SEE	VALUE OF r
1	Rajputs	Male	Himachal	Kewal Krishan ^[2]	2007	$H=98.23+ 8.51 \times \text{Hand Breadth}$	5.6	0.514
2	North Indians	Male	Mangalore	Prateek Rastogi ^[3]	2008	$H=98.547+ 9.07 \times \text{Hand Breadth}$	5.74	0.504
3	South Indians	Male	Mangalore	Prateek Rastogi ^[3]	2008	$H=84.340+10.808 \times \text{Hand Breadth}$	5.71	0.594
4	Tribals	Male	Udaipur	Charu Taneja	2014	$H = 1520.343 + 1.041 \times \text{Hand Breadth}$	82.24	0.077

TABLE 8. Following table showing comparison of various similar studies of Hand Length

S.NO.	POPULATION	SEX	AREA	AUTHOR	YEAR	REGRESSION EQUATION	SEE	VALUE OF r
1	Jat Sikhs	Male	Punjab	Dr.O.P.Jasuja ^[4]	2004	$H=69.513+5.223 \times \text{Hand Length(R)}$	4.003	0.502(R)
2	Jat Sikhs	Male	Punjab	Dr.O.P.Jasuja ^[4]	2004	$H=84.742+4.491 \times \text{Hand Length(L)}$	4.003	0.452(L)
2	Turks	Male	Adana, Turkey	SultanG Sanli ^[5]	2005	$H=439.52+3.29 \times \text{Hand Length}$	42.66	0.722
3	Rajputs	Male	Himachal	Kewal Krishan ^[2]	2007	$H=88.243+4.39 \times \text{Hand Length}$	5.17	0.304
4	North Indians	Male	Mangalore	Prateek Rastogi ^[3]	2008	$H=81.343+4.78 \times \text{Hand Length}$	5	0.659
5	South Indians	Male	Mangalore	Prateek Rastogi ^[3]	2008	$H=69.006+5.469 \times \text{Hand Length}$	4.85	0.731
6	Medical students	Male	Galle, Srilanka	I. Ilayperuma ^[6]	2009	$H=103.732+3.930 \times \text{Hand Length}$	5.22	0.58
7	Tribals	Male	Udaipur	Charu Taneja	2014	$H = 1505.215 + 0.584 \times \text{Hand Length}$	82.179	.083

There is positive but low correlation between height and hand length in the males. 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 district 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 were included so the results may not be applicable to the persons having any deformity or any congenital abnormality.

CONCLUSION

It is concluded that the dimensions of hands can provide good reliability in estimation of stature. The left hand length gives better prediction of stature than the right hand length. Stature estimation is more accurate in case of male tribals of Udaipur district.

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