



Original Research Article

## Stature Estimation from Hand Dimensions In North Interior Karnataka Staff of B.L.D.E University

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### ABSTRACT

**Background:** Stature is one of the most significant and useful anthropometric parameter that determines the physical identity of an individual. Identification of human remains is a crucial problem and is of immense importance to forensic scientists, anatomists, human biologists and anthropologists.

**Objective:** The purpose of this study is to analyse the anthropometric relationship between dimensions of the hand with stature and to devise regression formulae to estimate height from hand length and hand breadth.

**Method:** Study was conducted on 300 subjects aged between 25 to 50 years belonging to north interior Karnataka. Hand length and hand breadth of both hands were measured and height was recorded.

**Results:** The statistical analysis revealed that there was a positive correlation between stature and various parameters studied and this was found to be statistically highly significant. The right hand length had the highest correlation coefficient (0.7506) and the least correlation coefficient was found with left hand breadth (0.6112). Linear regression equations to calculate the stature were obtained for each of the hand dimensions separately.

**Conclusion:** To conclude, the present study provides us with regression equations for four different parameters that can be used for stature estimation in population of North interior Karnataka.

**Keywords:** Stature, hand length, hand breadth, sliding caliper, correlation.

### INTRODUCTION

Personal identity means determination of the individuality of a person. Stature is one of the most significant and useful anthropometric parameters that determines the physical identity of an individual and occupies a relatively significant position in the anthropometric research.

Growth-the vital process is measured by measuring the height of a person. <sup>[1]</sup> Height is sexually dimorphic and statistically more or less normally distributed. Height, like other phenotypic traits, is determined by genetic and environmental factors. Noticeable growth is said to stop at 18 years in females and 20 years in males. <sup>[2]</sup> Stature prediction occupies a central position in

anthropological research and in the identification necessitated by the medico-legal experts. [3]

Identification of human remains is a crucial problem and is of immense importance to forensic scientists, anatomists, human biologists and anthropologists. Estimation of stature from the incomplete skeletal decomposing human remains has always been a challenge for forensic experts and has obvious significance in the personal identification in the events of murders, air plane crashes, train and road traffic accidents and natural disasters.

India is known to be quite unique for human diversity in anthropometry. [4] There are inter-racial and inter-geographical differences in measurements and their correlation with stature. [5] What is true for one race or one region or a particular ethnicity may not be true for the other due to differences in nutrition, climate, socio economic status and levels of physical activity. Anthropometry constitutes the means of giving quantitative expression to the variations which different individuals or traits exhibit. Although many formulae for stature estimation from long bones have been proposed, there is concern regarding the accuracy of the use of population specific formulae on other human populations. [6] The purpose of this study is to analyze the anthropometric relationship between dimensions of the hand with stature and to devise regression formulae to estimate height from hand length and hand breadth in residents of north interior Karnataka working in BLDE University.

## **MATERIALS AND METHODS**

The study was conducted in 300 staff (teaching & non-teaching) aged between 25 to 50 years belonging to North interior Karnataka, working in B.L.D.E. University's Shri B.M. Patil Medical College, Hospital and Research Centre. 209

were males and 91 were females. All subjects were healthy and free from any apparent symptomatic deformity of hand and spine. Based on meteorological zones, North interior Karnataka comprises of the following districts Belgaum, Bidar, Bijapur, Bagalkot, Haveri, Gadag, Dharwad, Gulbarga, Koppal, Bellary, Yadgiri and Raichur districts.

The purpose and procedure of the study was explained to all the staff and their oral consent was taken. All the measurements were taken in a well lit room, at a fixed time between 10 am to 1 pm to avoid diurnal variation, as the stature varies during different timings of the day by 1.5-2cms, being less in the evening. [7,8]



Figure 1: Measurement of hand length

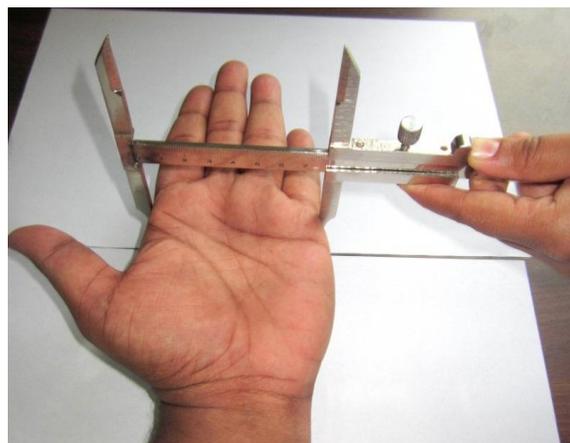


Figure 2: Measurement of hand breadth

Hand dimensions were taken independently on right and left sides of each individual using sliding caliper, when the hand is held straight and stretched in supine position. **Hand length:** The projected distance between the distal creases of wrist to the tip of middle finger (Fig.1). **Hand breadth:** The distance between the most prominent point on the lateral aspect of head of 2<sup>nd</sup> metacarpal to the most prominent point on the medial aspect of head of 5<sup>th</sup> metacarpal (Fig. 2). **Stature:** Measured as the vertical distance between the vertex and the floor. Measuring tape was kept fixed on the wall. Measurement was taken by making the subject stand erect on a horizontal resting plane, bare footed with shoulder blocks and buttocks touching the wall. Palms and hands were turned inwards and fingers kept pointing downwards. Height was recorded with a right angled device. All the measurements were recorded thrice to avoid measuring errors and mean was calculated for accuracy. Data was analysed using SPSS v.17 software. Statistical tests such as

correlation of regression were used to determine the relationship between the various anthropometric measurements.

## RESULTS

The stature, hand length and hand breadth of the individuals were assessed and an attempt was made to correlate hand length and breadth with stature and derive regression equations to calculate the stature from hand length and breadth. For summarizing the data, the range, minimum, maximum, mean and standard deviation were estimated and presented. The prediction function was derived through linear regression for each of the hand dimensions with the stature. The presentation provides the values of correlation coefficient.

**Table 1: Descriptive statistics of age and height of the study group**

	Age	Height (cm)
Mean	36.32	162.979
Median	35.00	-
Standard Deviation	9.051	8.4183
Range	25	47.0
Minimum	25	140.0
Maximum	50	187.0

**Table 2: Descriptive statistics of hand parameters studied**

	Right Hand Length (cm)	Left Hand Length (cm)	Right Hand Breadth (cm)	Left Hand Breadth (cm)
Mean	17.780	17.806	7.719	7.664
Median	17.800	17.800	7.800	7.700
Standard Deviation	0.9855	0.9822	0.5351	0.5323
Range	5.9	5.9	2.8	2.7
Minimum	15.1	15.4	6.3	6.2
Maximum	21.0	21.3	9.1	8.9

**Table 3: Mean ± SD of hand dimensions and height in males and females**

Measurements	Males (n=209)		Females(n=91)	
	Right (Mean±SD)	Left (Mean±SD)	Right (Mean±SD)	Left (Mean±SD)
Hand length	18.146±0.8 (16.0-21.0)	18.170±0.847 (16.2-21.3)	16.935±0.768 (15.1-18.8)	16.968±0.727 (15.4-18.7)
Hand breadth	7.952±0.425 (6.8-9.10)	7.892±0.429 (6.6-8.9)	7.185±0.348 (6.3-7.9)	7.139±0.341 (6.2-8.0)
Height	166.166±7.097 (144-187)		155.775±6.611 (140-175)	

**Table 4: Table showing correlation between mean height & various parameters studied**

Correlation Coefficient Between	Spearman's 'r'	P
Mean Height And Right Hand Length	r = 0.7506	p < 0.0001 HS
Mean Height And Left Hand Length	r = 0.7341	p < 0.0001 HS
Mean Height And Right Hand Breadth	r = 0.6189	p < 0.0001 HS
Mean Height And Left Hand Breadth	r = 0.6112	P < 0.0001 HS

Since the data was not normally distributed, Spearman's correlation for skewed data was applied to find the r value. Table 4 showed that the p value of all the hand dimensions versus stature was highly significant (p <

0.0001) in North interior Karnataka population.

**Table 5: Linear regression equation for the prediction of stature by hand dimensions in North interior Karnataka individuals**

Hand Dimensions	Linear Regression Equation
Right Hand Length	Stature (S) = 46.163+ [6.5712*RHL]
Left Hand Length	Stature (S) = 45.659+ [6.589 *LHL]
Right Hand Breadth	Stature (S) = 85.26+ [10.068*RHB]
Left Hand Breadth	Stature (S) =85.96+ [10.05*LHB]

RHL= Right hand length, LHL= Left hand length, RHB= Right hand breadth, LHB= Left hand breadth. Stature (S) in cm and hand dimensions in cm.

## DISCUSSION

The present study is unique in its sample selection. The sample was drawn from the North interior Karnataka population. Length and breadth of both the hands were measured in the study population. Linear regression equation was derived for each of the hand dimension with stature.

The mean hand length of males and females in our study is lower compared to the study done by Jasuja O P et al in 2004. Right hand length had the highest correlation coefficient in males and females in their study.<sup>[9]</sup> The mean stature, mean hand length of males in our study is higher compared to the study done by Waghmare V K R et al in 2011 in males and they concluded that right hand length of male Maharashtrians had higher correlation coefficient than left hand length which is similar to ours.<sup>[10]</sup> The mean hand length and the mean hand breadth of males and females in our study are lower compared to the study done by Devi K V S et al in 2012.<sup>[4]</sup> their study showed that left hand length had higher correlation coefficient which was in contrast to the present study.

## CONCLUSION

The present study provides us with regression equations for four different parameters that can be used for stature estimation in population of North interior

Karnataka. It is however, important to note that these equations cannot be used for other Indian population groups as the anthropometric measurements of every ethnic group depend on a plethora of factors.

Another key finding of our study is that the right hand length is the most reliable and accurate hand dimension to estimate stature in population of North interior Karnataka. This should be taken into consideration when options of measuring all hand dimensions are in the offering. If the same study is conducted on the same population group after several years, it will help to identify the micro evolutionary changes.

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