

Estimation Of The Stature From The Anthropometric Measurement Of Hand Length.

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Citation

V Waghmare, R Gaikwad, N Herekar. *Estimation Of The Stature From The Anthropometric Measurement Of Hand Length..* The Internet Journal of Biological Anthropology. 2010 Volume 4 Number 2.

Abstract

Stature or body height is one most important and useful anthropometric parameter that determine the physical identity of an individual. The stature prediction occupies relatively a central position in the anthropometric research. Estimation of stature of and individual from the amputated limbs has obvious significance in the personal identification in the events of murders, accidents or natural disasters. The present study was under taken to measure the stature as well as the hand length to determine whether there is any correlation between the stature and the hand length. The objectives of the study were to measure the hand lengths, to estimate the stature from the hand lengths, and to correlate between the stature and the hand lengths to find out the any multiplication factor for it. The study was carried on two hundred male adult individuals. Measurement of stature and length of right and left side was taken with a standard anthropometer and a sliding caliper respectively. The mean stature and mean length of the right and left were 159.01 (S.D. 6.78) cm, 16.92 (S.D. 0.91) cm and 16.46 (S.D. 0.93) cm. respectively. The present study showed significant ($p < 0.001$) positive correlation between the stature and hand lengths. From the present study, we found some multiplication factors which were helpful for estimation of stature from respective hand lengths. That may be helpful for those who work in this area especially in the various medical disciplines, anthropologists, and security experts.

INTRODUCTION

The use of anthropometry in the field of forensic science & medicine dates back to 1882 when (Alphonse Bertillon) a French police expert invented a system of criminal identification based on anthropometric measurements. His system was based on three fundamental ideas- the fixed condition of the bone system from the age of twenty till death; the extreme diversity of dimensions present in the skeleton of one individual compared to those in other, the ease & relative precision with which certain dimension of the bone structure of a living person can measured using simply constructed calipers.

Estimation of stature is an important parameter in identification of commingled, mutilated and skeletal remains in forensic examinations¹. The identification of isolated extremities is an issue of great significance in the investigation of the identity of victims of mass disasters and fatal assaults. In forensic investigations, the dimensions of the hand and foot have been used for determination of sex, age and stature of an individual². Stature reconstruction is important as it provides a forensic anthropological estimate of the height of a person in the living state; playing a vital

role in the identification of individuals³. Intact long limb bones have been used in the derivation of regression equations for stature assessment in different population groups⁴. Anthropologists observe and compare the relation between body and segments to highlight variations between within origins¹. Determination of stature is a major concern in forensic medicine & forensic anthropology. Establishing personal identity of the victims is often required². Estimation of stature from extremities & their parts plays an important role in identifying the dead in forensic examinations. When the health risk is defined in terms of body size, western Caucasian standards have, by default, become the international standard. All through by far the most long term data available on health risks are from Caucasian subjects, there is mounting evidence that these Western standers may not be applicable to all³.

Krishan et al studied the limb a symmetry and its effect on estimation of the stature¹. In 2009, Ryan and Bidmos studied the evaluation of the accuracy of the direct and indirect methods in stature reconstruction². In 2009, Menezes et al studied the estimation of the stature from the length of the sternum in south Indian males³. Kanchan et al established the

relationship between hands and feet and its value in personal identification in mass disasters⁴. In 2008, Krishan successfully estimated stature from cephalo-facial anthropometry and foot segments in a north Indian population^{5,6}. In 2007, Krishan and Sharma studied the estimation of the stature from dimensions of hand and feet in north Indian population⁷. Anthropologists observe and compare the relationship between body segments to highlight variations between ethnic origins

Stature is natural heights of a person in an upright position. The anthropologists and forensic experts have given more importance to the various methods of stature estimation. Stature can be estimated from hand length. The hand lengths can be used as a basis for estimating age related loss in stature and as an alternative measure to stature^{8,9}. Even group specific works can be done when stature cannot be measured directly due to deformity like kyphosis, lordosis and scoliosis, contractures or missing legs. In these cases, the original stature of those people can be estimated by multiplying the dimension of hand lengths of those sexes or ethnic groups with respective multiplication factor. The multiplication factor can be obtained by making ratio of the stature to the hand lengths^{10,11}.

MATERIALS AND METHODS

The study was a predominantly descriptive cross sectional with some analytical component. It was done on two hundred male adult individuals from Maharashtra, age more than 25 years. Measurement of the stature was taken with a standard anthropometer. The stature was measured as the vertical distance from the vertex to the floor. Measurement was taken by making the subject stand erect on a horizontal resting plane bare footed having the palms of the hands turned inwards and the fingers pointing downwards¹². Then, the movable piece of the anthropometer was brought in contact with the vertex in the mid sagittal plane. The length of each hand was measured using a sliding caliper. The subject was asked to place his hand on a table with the fingers together and thumb abducted. The measurement was taken from the level of tip of the most distal point on the styloid process of the radius to the tip of the middle finger¹³ as shown in Fig.1. The measurements were recorded in centimeters to the nearest 0.1 cm

Formula for measurement of any length by sliding caliper.

Length = Reading of the main scale + Vernier coincidence x Vernier constant + Mechanical error.

1. Calculation of the multiplication factor:

Each multiplication factor is the ratio of the stature to the respective physical measurements. A mean multiplication factor was then calculated for each measurement. These mean multiplication factor were used for estimating the stature from those variables.

According to the Lal and Lata¹⁴ Multiplication Factor is -

Multiplication Factor = stature divided by hand length.

2. Statistical analysis of data:

Results were prepared on the basis of collected data and their distributions, central tendencies and standard deviations (S.D.) were calculated.

RESULTS AND DISCUSSION

Stature estimation has been considered as one of the parameters of forensic anthropology and will assist in establishing the biological profile of a person¹⁵.

In the present study, the mean stature and mean length of the right and left were 159.01 (S.D. 6.78) cm, 16.92 (S.D. 0.91) cm and 16.46 (S.D. 0.93) cm. respectively. The length of the right hand of the individuals varied from 14.90-18.80 centimeters as shown in Table 1. The length of the left hand of the individuals varied from 14.20-18.32 centimeters as shown in Table 1. The present study showed positive correlation (p value <0.001) between the stature and hand lengths. The stature and other measurements are shown in Table 1 along with the multiplication factors used to estimate the stature from these relationships between specific measurements and stature.

In the present study, the mean stature is 159.01 (S.D. 6.78) cm and the mean of the right and left hand was 16.92 (S.D. 0.91) cm and 16.46 (S.D. 0.93) cm respectively. The multiplication factor of right side was 9.96 and left side was 9.34 found in our study. Multiplying these multiplication factors with the hand length we found some estimated statures which were correlates with the measured stature. Similar values reported in the stature of the Mangalore adult individuals¹⁶. The highest mean stature was found in the Negroid adult individuals and white Nigerian individuals¹⁷. Higher values are also found in the Other Indians like the Santhals of West Bengali, Punjabi adult individuals¹³. All the measurements in this study were a positive as well as a statistically significant correlation with the stature.

Figure 1

Table 1.

variable	Range (cm)	Mean (cm)	SD	Mean multiplication factor	Correlation of hand length measurements with stature	p- value
stature	148.45- 179.20	159.01	6.78	-	-	-
Right hand length	14.90- 18.80	16.92	0.91	9.96	0.76.	0.001(s)
Left hand length	14.20- 18.32	16.46	0.93	9.34	0.75	0.001(s)

Measurement of the stature and the hand length, the multiplication factors for estimating stature from hand length.

Figure 2

Table 2.

Measurement from which the stature was estimated	Range of Estimated stature (cm)	Mean of Estimated stature (cm)	SD	P value
Right hand length	142.26-176.10	157.60	8.30	0.786 (NS)
Left hand length	140.25- 172.93	153.40	8.01	0.798 (NS)

N= 200. S: significant r: coefficient p: probability ($p < 0.05$ was considered as significant).

Comparison of the measured stature with the stature estimated from hand length of the right and left side.

The measured stature ranged from 148.45-179.20 cm with a mean (SD) of 159.01 (S.D. 6.78). N= 200 NS= Non-significant.

Figure 3

Fig.1 shows the Measurement of the hand length.



CONCLUSION

The resent study will provide baseline information for the Maharashtrian population. It could lead to the development of a standard for such data on various groups of the population. Some amount of the comparison made with the other population could contribute to understanding of the relative status of our population in the context of the anthropometric variants around the world.

From the present study we found some multiplication factors which were helpful for estimation of stature from respective hand lengths. Some amount of the comparisons made with other population could contribute to understanding of the relative status of our population in the context of the anthropometric variations around the world. Significant correlations, as detected in the study between some of the measurements and their implications factors to be useful in estimating one measurement from another. That may be helpful for those who work in this area especially in the various medical disciplines, anthropologists, and security experts.

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