Original Article

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Formulation of Regression Equation to Estimate Stature from Hand Length

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Abstract

Many a times Forensic Experts are asked to identify the person from dismembered part of the body and skeletal remains by the Investigating Officer. If the whole skeleton is available it becomes easy for identification, but the problem arises when only dismembered part of the body, few bones or single bone is available. In identification stature is primary characteristic along with age and sex. The present study is carried out in J.J.M. Medical College, Davangere, Karnataka. Total 100 students (50 males and 50 females) are randomly selected. The height of the students and length of both right and left hand of each student is measured by the same observer and with the same instrument. In this study we formulated the Regression Equation for estimation of stature from right and left hand length for males and females separately. Co-efficient correlation of height with hand length is also calculated. The results of the present study indicate that the hand length can be efficiently used for estimation of stature.

Keywords: Stature Estimation; Hand Length; Regression Equation.

Introduction

Assessment of body height from different parts of body by anthropometric study of skeleton is an area of interest to Anatomists, Forensic Experts and Anthropologists.

In ancient time physician and surgeon like Charaka and Sushruta were well acquainted with the relation of different parts of body and height. According to Charaka, the height of an average man should be 84 anguls, thigh - 21 anguls, leg - 19 anguls, forearm - 15 anguls and arm- 16 anguls [1].

Estimation of stature from incomplete skeletal and decomposing human remains is particularly important in personal identification. The relationship between specific body dimensions/ proportions can be used to solve crimes in the absence of complete evidence. For example, it has been proved that stature can be estimated from imprints of the hand, foot or footprints or from a shoe left at the scene of a crime [2]. Similarly, the stature of a victim can be estimated when a part of body, such as a long bone, or hand, is all that remains [3].

It is shown in earlier studies that various hand measurements tend to differ in various ethnic groups [4]. Consequently, the formulae designed to estimate stature from various anatomical dimensions in one population do not apply to another [5,6].

Furthermore, the need for the alternative formulae for the genders is also proved as rate of skeletal maturity in males and females vary during the course of development [5].

And most studies have stressed that regression formula for stature estimation should be population specific. So there is a need to develop a separate regression formula for stature estimation from various parameters for a particular population.

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So the present study "Estimation of Stature from Hand Length" is taken up.

Materials and Methods

The present study is carried out in J. J.M. Medical College, Davangere, Karnataka. Total 100 students (50 males and 50 females) are randomly selected. The height of the students and length of both right and left Hand of each student is measured by the same observer with the same instrument and at the same time.

Hand length was defined as the direct linear distance between the distal wrist crease and the distal end of the most anterior projecting point, i.e., tip of the middle finger. The subjects were asked to place their hands supine on a flat hard horizontal surface with fingers extended and adducted, following which the hand length was measured. Care was taken to see that there was no abduction or adduction at the wrist joint, i.e., the forearm was directly in line with the middle finger.

Stature is measured as the vertical distance between the point vertex and the heel touching the floor (ground surface). Technique: The subject was made to stand in erect posture against the wall with the feet axis parallel or slightly divergent and the head balanced on neck and measurement was taken without any wear on head and foot using the Anthropometric rod. After collection of data, it is subjected to statistical analysis. Mean, Standard Deviation and Range for Height, Right Hand length and Left Hand length is calculated separately for males and females. Correlation of Height with Right Hand length and Correlation of Height with Left Hand length is calculated separately for males and females.

Table 1:

All in centimeters	Mean		Standard Deviation		Range	
	Male	Female	Male	Female	Male	Female
Height	167.94	155.33	7.57	5.321	139-179	146-171
Rt. Hand Length	18.598	17.05	0.641	0.891	17.2-19.7	15-18.7
Lt. Hand Length	18.682	17.23	0.768	0.770	17-20	15.5-18.7

Table 2:

	Male	Female
Correlation of Height with Right Hand length	0.514	0.770
Correlation of Height with Left Hand length	0.529	0.762

Results

The statistical data which are extracted from calculation are tabulated in Table 1 and Table 2 & Table 3.

Table 2 shows correlation co-efficient of Height with Right Hand length and Left Hand Length separately for male and female. For males, Correlation Co-efficient of Height with Right Hand Length and Left Hand Length are 0.514 and 0.529 respectively which shows moderate positive correlation.

Similarly for females Correlation Co-efficient of Height with Right Hand Length and Left Hand Length are 0.0.77 and 0.762 respectively which shows strong positive correlation.

Regression formulae for estimation of height;

In males

$$Y1 = 55.24 + 6.06X1$$

$$Y2 = 70.55 + 5.21X2$$

In Females

$$Y3 = 77.24 + 4.58X3$$

$$Y4 = 65.49 + 5.21X4$$

X1 & X3 - Right Hand Length

X2 & X4 - Left Hand Length

Y1 & Y3 - Height from Right Hand Length

Y2 & Y4 - Height from Left Hand Length

Discussion

Results of present study are in agreement with study done by Isurani Ilayperuma [7] et al (in his study correlation co-efficient (R) of Height with Hand length for male and Hand Length for female

Comparision Table

Sl. No.	Sex	Regression equations	S.E.E.	Value of r	Author
1	Female	S=68.89+4.96HL	5.40	0.679	Nath and Krishan
2	Female	S=85.22+4.05HL	5.43	0.594	Nath et al
3	Male	S=89.13+4.13HL	4.57	0.599	Kaur
	Female	S=88.13+4.04HL	3.99	0.639	
4	Male	S=123.22+2.37HL	11.57	0.345	Anand and Nath
	Female	S=96.27+3.56HL	9.31	0.597	
5	Male	S=88.243+4.39HL	5.17	0.609	Krishan and Sharma [9]
	Female	S=81.314+4.425HL	3.82	0.677	
6	Male	S=132.488+2.114HL	5.324	0.527	Jitender Kumar Jakhar
	Female	S=79.432+4.591HL	3.750	0.681	

are 0.58 and 0.59 respectively). According to Jitender Kumar Jakhar [8] et. al. correlation coefficients between stature and all the measurements of hands were found to be positive and statistically significant and the left hand length in both the sexes together exhibits the overall highest value of correlation (r = 0.768) with stature .

In this study we have derived a separate regression equations for both Right and Left Hand Length for males and females to estimate accurate stature of individual.

Conclusion

The results of the present study indicate that the hand length can be efficiently used for estimation of stature. Most authors have underlined the need for population-specific stature estimation formulae. The main reason for this is, the ratio of various body parts differ from one population to another. In addition to ethnic differences, secular trend [10] and even environmental factors such as socioeconomic and nutritional status can influence body proportion [11]. So in this study we derived a separate regression equation to estimate stature from hand length for Davangere region.

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