Reliability of Foot Length in Prediction of Stature

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Abstract

Identification of person is an important task for Forensic Expert as asked by Investigating Officer to solve the crime, since Identification is first step to investigate the crime. Identification is easy when the whole body is available. But it becomes very difficult when only part of the body is found due to many reasons. The present study is carried out in E S I C Medical College, Kalaburagi, Karnataka. Total 257 students (120 males and 137 females) between age group of 18-25 years are selected. The height of each student, length of both right and left Foot of each student is measured by the same observer with the same instrument and at the same time. After collection of data, it is subjected to statistical analysis. The results of the present study indicate that foot lengths can be efficiently used for estimation of stature. In present study male foot length can give better prediction of stature compared to female.

Keywords: Stature; Foot Length; Correlation Co-efficient; Regression Equation.

Introduction

Identification of person is an important task for Forensic Expert as asked by Investigating Officer to solve the case, since Identification is first step to investigate the crime. Identification is easy when the whole body is available. But it becomes very difficult when only part of the body is found due to many reasons. Among Identification datas stature is a primary characteristic along with sex and age [1]. So assessment of stature is very important in Identification. Among the various parameters of identification, individual's stature is an inherent characteristic, the estimate of which is considered to be important in those cases where only fragmentary or mutilated remains of an unknown person are recovered [2]. Body measurements have direct relationship with shape, sex and form of an individual and these factors are intimately linked with each other and manifestation of internal structure and tissue components which in turn are influenced by environmental and genetic factors [3]. 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 [4].

It was Rutishauser (1968) who for the first time shown that reliability of prediction of stature from foot length is as high as other long bones [5].

It is shown in earlier studies that various measurements of the body tend to differ in various ethnic groups [6]. Consequently, the formulae designed to estimate stature from various anatomical dimensions in one population do not apply to another [7,8]. 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 [9].

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 [7].

Every study have mentioned about the need for

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developing separate regression equation for specific region. So there is a need to develop a separate regression formula for stature estimation from various parameters for a particular population. Hence the present study Estimation of Stature from Foot length is taken.

Materials and Methods

The present study is carried out in E S I C Medical College, Kalaburagi, Karnataka. Total 257 students (120 males and 137 females) between age group of 18-25 yearsborn in Karnatakaare selected. Students with hypochondriasis, achondriasis, and congenital anomalies of bone and with fractures of lower limb and upper limb are excluded from the study. The height of each student, length of both right and left Foot of each student is measured by the same observer with the same instrument and at the same time.

Foot length was defined as the direct distance from the most prominent point of the back of the heel to the tip of the big toe or to the tip of the second toe when the second toe is longer than the big toe. Foot lengths were taken independently on left and right side of each individual using a sliding calliper capable of measuring to the nearest 0.01 mm.

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. Average of three readings of stature, right foot length and left foot length are taken.

After collection of data, it is subjected to statistical analysis. Mean, Standard Deviation and Range for Height, Right Foot Length and Left Foot Length, is calculated separately for males and females. Correlation of Height with Right and Left Hand length is calculated separately for males and females.

Results

The statistical data which are extracted from calculation are tabulated in Table1, Table 2 & Table 3.

Table 1 Shows Mean, Standard Deviation and Range for Height, Right Foot Length and Left Foot Length.

Table 2 Shows Correlation co-efficient of Height with Right Foot Length and Left Foot Length separately for male and female. For males, Correlation Co-efficient of Height with Right Foot Length and Left Foot Length are .616 and .608 respectively which show moderate positive correlation. Similarly for females Correlation Co-efficient of Height with Right Foot Length and Left Foot Length are .424 and .422 respectively which also shows moderate positive correlation.

Regression Formulae developed for stature estimation is shown in Table 3

Table 1:

All in centimeters	Mean		Standard Deviation		Range	
	Male	Female	Male	Female	Male	Female
Height	171.83	158.30	6.55	6.01	160-183	144-171
Rt. Foot Length	25.56	23.14	1.24	1.17	23-28	20-25.8
Lt. Foot Length	25.59	23.14	1.25	1.17	23-28	20-25.9

Fig. 1:

Correlation of Height with Right Foot Length in Males

Table 2:

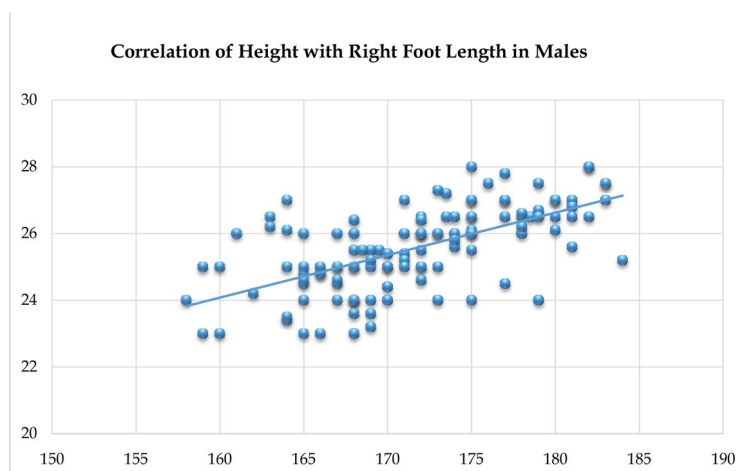|	Male	Female
Correlation of Height with Right Foot length	.616	.424
Correlation of Height with Left Foot length	.608	.422

Table 3:

	Regression Equation
Males	Height = 89.9 + 3.23 Right Foot Length
	Height = 90.7 + 3.17 Left Foot Length
Females	Height = 130.97 + 1.20 Rt Foot Length
	Height = 131.29 + 1.18 Lt Foot Length

Fig. 2:

Correlation of Height with Left Foot Length in Males

Fig. 3:

Correlation of Height with Right Foot Length in Females

Fig. 4:

Correlation of Height with Left Foot Length in Females

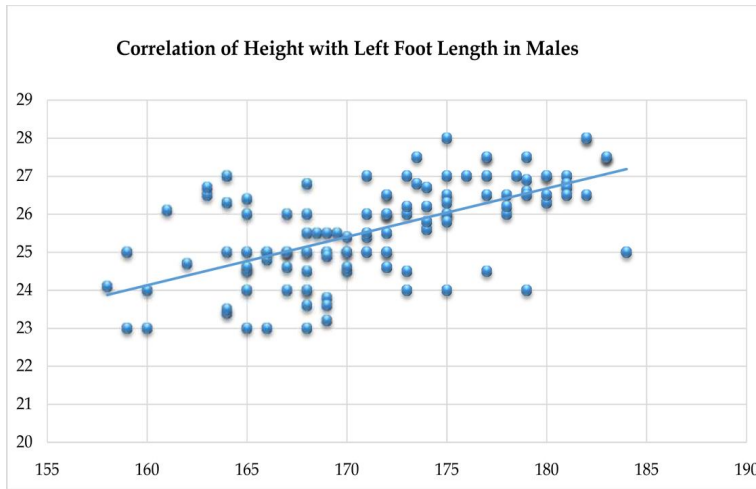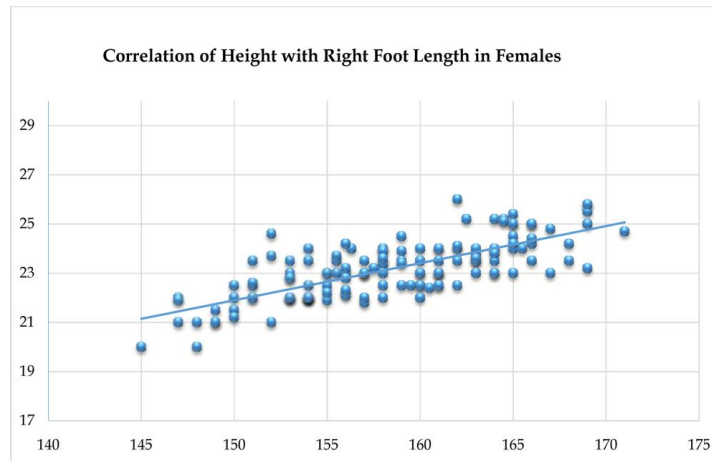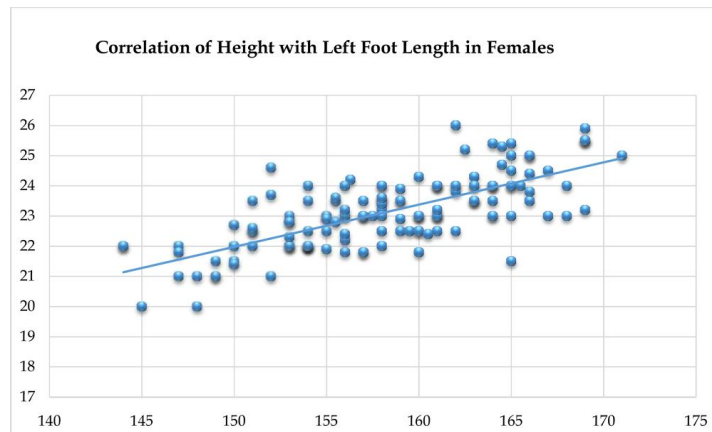## Discussion

Results of present study shows that foot length of males can give better prediction of height when compared with foot length in females. Correlation of height with right and left foot length for male is .616 and .608 respectively, which shows moderate correlation.Whereas, correlation of height with right and left foot length in females is .424 and .422 which shows little less correlation compared to males. Study done by Ilayperuma I, Nanayakkara BG, Palahepitiya KN, shows a correlation coefficient of height with foot length is +0.724 for males and +0.719 for females [10]. According to Krishan and Sharma [11]correlation coefficient of height for male and female is 0.609 and 0.677. A correlation coefficient between height and foot length in Gujarat population was shown to be + 0.69 for males and + 0.70 for females [12]. According toJitender Kumar Jakhar [13] 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 foot Length for males and females to estimate accurate stature of individual.

Conclusion

The results of the present study indicate that footlength 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 [14] and even environmental factors such as socioeconomic and nutritional status can influence body proportion [15]. So in this study we derived a separate regression equation to estimate stature from footlength for Karnataka region.

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