

ESTIMATION OF STATURE FROM FOOT LENGTH

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ABSTRACT

Stature is important indicator of identification which helps in medico legal cases in rapid identification of suspects. There are numerous means to establish stature and their significance lies in the simplicity of measurement, applicability and accuracy in prediction, that is useful for Anatomists to calculate stature in Secunderabad population based on foot length. Aim is to analyze the correlation between foot length and height in population in this geographical area. The present study is conducted on 104 healthy individuals (54 males & 50 females). It is found that there exists linear relationship between the height and foot length.

KEY WORDS

Age, Body height, Foot length, Regression equation.

INTRODUCTION

Stature is the height of the person in upright posture. It is an important physical identity. "Stature" is one of the most important elements in the identification of an individual. It is anatomically complex that includes the dimensions of legs, pelvis, vertebral column and skull and contribution of each of these to the total varies in different individuals and also in different population. Ossification and maturation in the foot occurs earlier than the long bones and therefore, height could be more accurately predicted from foot measurements as compared to that from long bones. There are lot of variations in estimating stature from limb measurements among people of different region & race. Hence there is a need to conduct more studies among people of different regions so that stature estimation becomes more reliable. The Aim of the present study was to find out the correlation between foot length and height of an individual and to derive regression formulae to estimate the height from foot length of an individual.

MATERIAL AND METHODS

The present study is conducted on 104 healthy individuals (54 males & 50 females) from population residing in Secunderabad. The subjects were within the age limit of 21-35 years as stature attains its maximum limit around 21 years. The subjects are apparently free from any skeletal deformity, and informed consent was taken from the subjects. Anthropometric measurements of foot length were taken independently on the left and right side of each individual. Height of the individual was measured in standing erect anatomical position with standing height measuring instrument in centimeters through stadiometer. Foot length was measured as a direct distance from the most prominent point of the back of the heel to the tip of hallux or to tip of second toe when the second toe was longer than hallux in centimeters through measuring scale.

Figure: 1 showing measurement of length of foot and height of subjects.



RESULTS

The data was collected, analyzed and subjected to Statistical Packages for Social Sciences (SPSS) to know the correlation of stature with the lengths of feet and

simple linear regression formulae were derived for various combinations.

Table -1: Height in both males and females

	MALE	FEMALE	BOTH GENDER
TOTAL NUMBER	54	50	104
HEIGHT RANGE(in cms)	154-182	140-174.5	140-182
MEAN HEIGHT	170.98	157.65	164.56
STANDARD DEVIATION OF HEIGHT	6.65	6.6	9.39

Table -2: Left foot indices in both males and females

	MALE	FEMALE	BOTH GENDER
LT FOOT LENGTH RANGE	23.4-27.5	20.8-27.4	20.8-27.5
MEAN LT FOOT LENGTH	25.3	23.23	24.3
STANDARD DEVIATION OF LT FOOT LENGTH	1.287	1.097	1.601
CORRELATION COEFF (R) LT	0.585	0.653	0.602
REGRESSION COEFF (B) LT	3.547	3.349	4.691
VALUE OF CONSTANT(A) LT	80.955	79.83	50.35

Table: 3 Right foot indices in both males and females

	MALE	FEMALE	BOTH GENDER
RT FOOT LENGTH RANGE	22.7-27.2	20.9-26.8	20.9-27.2
MEAN RT FOOT LENGTH	23.4	23.27	24.3
STANDARD DEVIATION OF RT FOOT LENGTH	1.2	1.11	1.56
CORRELATION COEFF (R) RT	0.583	0.66	0.8
REGRESSION COEFF (B) RT	3.468	3.615	4.782

Regression Equation:

Stature Y= Value of Constant (A) + Regression Coefficient (B)* Foot Length

Table: 2 showing regression of foot length

	MALE	FEMALE	BOTH GENDER
LEFT	Y=80.955+3.547*LT length	Foot Y=79.83+3.349*LT length	Foot Y=50.350+4.691*LT length
RIGHT	Y=82.830+3.468*RT length	Foot Y=73.523+3.615*RT length	Foot Y=47.971+4.782*RT length

Figure: 2-Scatter plot – Relation between Height and Left Foot Length

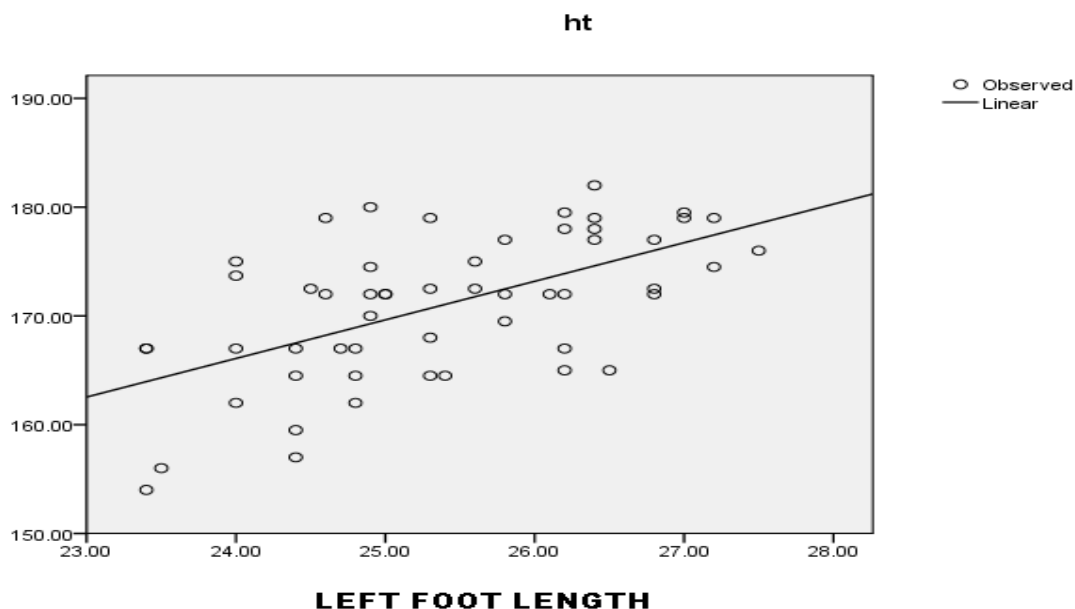
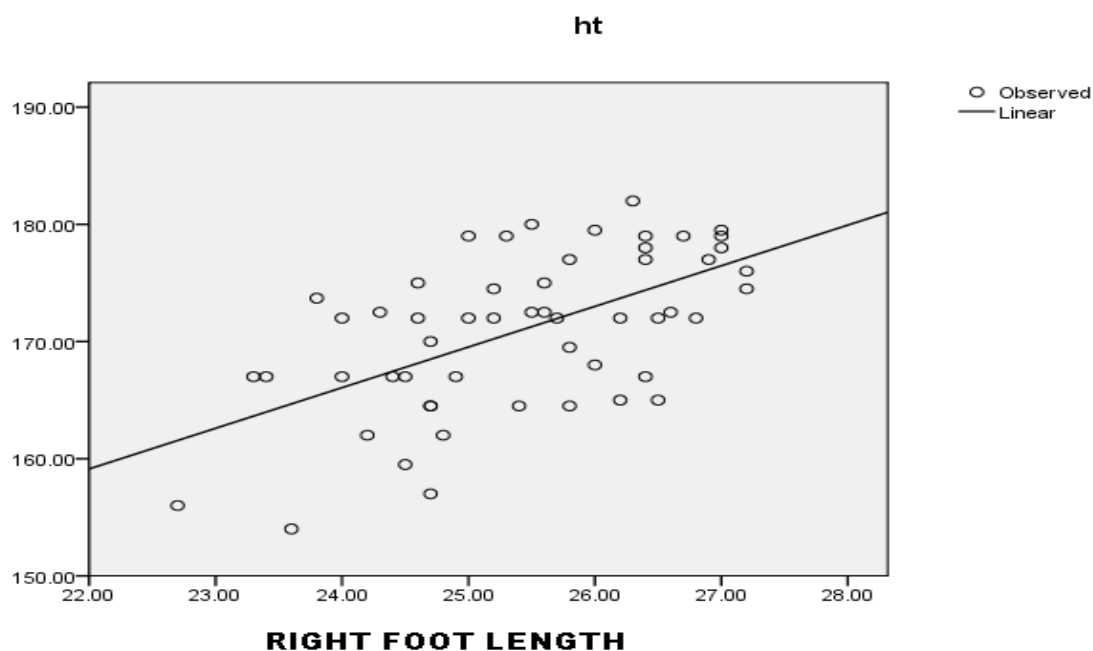


Figure:3 Scatter plot – Relation between Height and Right Foot Length



DISCUSSION

Many studies have been conducted on the estimation of stature many methods are established in estimating stature from the bones but the one of the easiest and the reliable method is by regression analysis. In the present study we have observed the correlation of

Height (in anatomical position) with foot length in population studied **Table-I** show that the height ranges from 154 to 182 cm in male and 140 to 174 cm in female with a significant correlation between them. **Table -2** show Left foot length from 23- 27cm in male and 21 to 27 and right foot length from 22- 27cm in male and 21 to 27cm in female from **Table-3**.

It also shows the correlation coefficients between parameters as height and foot length It is positive, suggesting that it is significant. The correlation coefficients between height and foot length, indicate the foot length provides highest reliability and accuracy in Estimating stature of an unknown individual.

Mohanty & Agrawal¹ studied on population of Odisha has developed a regression equation that could calculate the height of an individual from his foot length. 300 students (M=206, F=94) aged 18-25 years

were included in their study. As height increases foot length of both male and female also increases.

Sonali khanapurkar et.al² conducted study on 1000 Maharashtra medical students in age groups of 19-22 and concluded that multiple linear regression analysis is better over simple linear regression analysis for estimating accurate stature.

The study done by Kewal Krishnan et.al³ by estimation of stature from foot print and foot outline dimensions in Gujjars of North india suggests that the correlation of stature with foot length is extremely high suggesting a close relationship with them. Mansur et.al (4) observed correlation of height with foot length amongst Kathmandu university school of sciences students.

Natarajamoorthy Tharmas⁵ conducted pilot study deals with developing a regression equation for stature estimation from foot length obtained from foot impressions as well as foot outline of 107 randomly selected Malay subjects using a simple linear regression statistical method.

Jithendra patel⁶ conducted the study on 500 asymptomatic healthy medical students of gujarat region in the age group of 14 to 25 years and

concluded that fairly good estimation of height can be made using regression equations in either sex.

Jitendra kumar Jakhar ⁷ carried out study in department of forensic medicine and toxicology at Haryana state. A total number of 103 medical students were included which showed good correlation of height was observed with footlength and it was statistically highly significant

Qamra s,et.al⁸ made a study on height and foot length and derived a correlation coefficient for foot breadth(Male 0.42 and Female 0.70 and footlength(Male 0.69 and Female 0.70) . Jaydip sen et.al⁹ estimated of stature from footlength and foot breadth among population of North Bengal. The higher correlation coefficient between stature and footlength over that of stature and foot breadth points to the fact that footlength rather than foot breadth , is more accurate in estimating stature. No such type of study was carried out in secunderabad.

In present study the correlation coefficient between height and foot length is + 0.582 in male and + 0.656 in female which is highly significant. From the above facts, it is clear that if either of the measurement (foot length or total height) is known the other can be calculated and this fact may be of practical use in Medico-legal investigations and in anthropometry.

CONCLUSION

- The present study has established definite correlation between stature and foot length and also regression equations have been established in the sample studied.
- While calculating regression equation, it is found that there exists linear relationship between the height and foot length which is collaborating with previous workers. It will help in medico legal cases in establishing identity of an individual when only some

remains of the body are found as in mass disasters, bomb explosions, accidents etc.

- It will also help in establishing identity in certain civil cases.

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