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TO STUDY DETERMINATION OF HEIGHT BY FOOT LENGTH IN FEMALES

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ABSTRACT

The present study was carried out in Mahadevappa Rampure Medical College, Gulbarga. Total of 100 female students from 1st semester to 5th semester are included in the study. Individual student's foot length and stature are taken separately. The length of foot is measured from outer most margin of heel to the tip of extension of longest toe in both the feet with the help of a verniers caliper and it is recorded in centimeters. In the present study a significant correlation of stature with right and left foot length has been observed ($P < 0.01$). The results show that there is no statistically significant difference in right and left foot length in female students ($P > 0.05$). Either right or left foot length may be used to predict the stature by regression formula. Regression equations are derived separately for individual foot length. Estimation of stature from foot length is easy, economical and convenient. No specialized equipment or training is required.

Keywords: Foot length, P value, stature, verniers caliper

INTRODUCTION

Though there are several parameters which help in identifying a person, stature of an individual is one of the important parameter, as it is an inherent characteristic. There is an established relationship between stature and dimensions of various parts of the body allowing the Forensic expert to estimate the stature from available data. Many studies have been carried out to estimate the stature from different body parts like arm length, fore arm length, hand and finger length, length of long bones, foot and shoe lengths etc. Linear regression models are widely used to predict height of an individual on the basis of their body parts¹.

Examination of footprint provides important evidence in a crime scene investigation as it helps in the estimation of stature of a criminal.

Significant and positive correlation coefficient has been shown to exist between stature and measurements of foot prints. Ossification of bones of foot occurs earlier than that of long bones of lower extremities. Even during adolescent age, the height can be predicted more accurately from foot measurements than long bones of lower limb. Taken together, evidences suggest that relationship between foot length and stature is of practical use in medico legal cases, anthropology and archeological studies; when such evidence is provided to the investigator, it helps to establish the individual's physical description. Footprints are also used for identifying newborn babies in hospitals.

Analysis of bare footprints is often carried out in the developing countries where the footprints are

frequently recovered at the crime scene. In most of the countries, a footprint record is maintained for all the air-force flying personnel since feet often resist destruction (often shoe clad) by aircraft accidents, fires etc². Foot prints and shoe prints are different forms of physical evidence which have tremendous values in tropical country like India. Footprints have been accepted as evidence of identification in courts of many countries.

AIMS AND OBJECTIVES OF THE STUDY

1. To study the relation between human foot length and stature in females.
2. To compare between the stature estimation by right foot length and stature estimation from the left foot length females.

METHODOLOGY

The present study was carried out in Mahadevappa Rampure Medical College, Gulbarga. Total of 100 female students from 1st semester to 5th semester are included in the study. The aim and objective of the intended study were properly explained to all the students and consent is taken on the proforma. Individual student's foot length and stature are taken separately.

The length of foot is measured from outer most margin of heel to the tip of extension of longest toe in both the feet with the help of a verniers caliper and it is recorded in centimeters.

Each student is asked to stand bare feet in anatomical position on the floor with her heel and occiput touching to the wall where markings for measuring the height are already made. Student is instructed not to move the head while measuring the height. A thin cardboard is kept horizontally at the vertex of the head. The height is measured from heel to the horizontal cardboard in centimeters.

With this foot length, height of the individual is calculated with the help of regression formula. The calculated height is compared with the actual height of the individual and the results are encouraging.

Any student with abnormality of foot/lower limb or any spinal deformities are not included in the study.

OBSERVATIONS AND RESULTS

RFL – Right foot length, Min Ht – Minimum height, Max Ht – Maximum height, Avg Ht – Average height, SD – Standard Deviation

The average height of 100 female students with corresponding various levels of right foot length is presented in table-1.

A linear correlation and regression analysis was done on data obtained from 100 girls for assessing the relationship between right foot length with stature and estimation of height for different levels of right foot lengths. In our study the maximum number of female students had right foot length of 22-23cms in which there were 34 individuals and average height in these girls was 163.6cms with Standard Deviation of 6.14 as shown in this table.

In 100 girls we studied, right foot length varied from 20-25cms. The average height in girls with right foot length of 20-21cms was 152.87cms, which increased to 170.77cms with maximum right foot length of 24-25cms showing a positive correlation between the right foot length and stature.

Table-2 shows left footprint length and actual height of 100 female students. Linear correlation and regression analysis were done for assessing the relationship between left foot length with height in 100 female students and for estimation of stature for different levels of left foot length. In this study the maximum number of 33 girls had left foot length of 22-23cms, and their mean height is 163.54cms. with Standard Deviation of 6.77cms. Average height of female students with corresponding various levels of left foot length is represented.

Left foot length among these girls ranged from 20-25cms. It can be seen that height of the girls increases as the left foot length increases, showing positive correlation between the two parameters.

Average height was 153.55cms for left foot length of 20-21cms which increased to 172.57cms with maximum left foot length 24-25cms.

Table-3 shows correlation between right foot length, left foot length, and height in 100 female students.

From the analysis it was revealed that there was a significant positive correlation between right foot length and left foot length ($r = +0.88$ for both RFL and LFL) with stature. The difference in correlation coefficient is statistically significant ($P < 0.01$). With this significant correlation an attempt was made to estimate stature based on any given right foot length and left foot length in girls. Stature could be predicted from right foot length in girls by using regression equation.

$$Ht = 70.6 + 4.10(RFL)$$

And from left foot length by using regression equation.

$$Ht = 92.8 + 3.12(LFL)$$

It can be observed from this table that there is no statistically significant difference in right foot length and left foot length when both are compared ($P > 0.05$).

Correlation and regression analysis were applied to know the relationship between right foot length with stature and left foot length with stature. An attempt is made to predict the stature from a known right or left foot length.

Following points can be observed from the present study:

- There is no statistically significant difference in right and left foot length.
- Stature can be determined by right or left foot length separately in females.
- There is no statistically significant difference in stature estimated by right foot length and left foot length.

The present study is statistically significant ($P < 0.01$) and shows that height can be predicted by regression equation by known foot lengths in females.

DISCUSSION

Theodoros B Grivas³ (2008) stated that right foot length and left foot length are independent predictor of stature. These findings are supported by the present study.

Abraham Philip⁴ estimated stature from known foot size by regression method. In the present study regression equations are derived to predict stature separately for right foot length and left foot length for both sexes.

In a study by Devesh V (2006)⁵ correlation coefficient (r) of 0.698 for males, 0.738 in females and 0.848 in combined group was obtained between stature and left foot length. In present study, correlation coefficient obtained separately for right foot and left foot in females. Correlation coefficient is + 0.8 for right foot for left foot in females.

Deopa Deep⁶ (2010) also observed a significant and positive correlation between foot length and height in individuals of Uttarakhand region.

The results of the present study are quite encouraging and would ultimately help the investigating officer and Forensic experts to estimate stature of a person by foot length. In fact the aim of taking present study was to help the concerned authorities to restrict their field of investigation by including or excluding few subjects from the list of suspects. Investigating officer sometimes depend on the eye witnesses to get rough idea about the height of the person which is not reliable. If footprint length is available at the scene of crime stature could be predicted. This study has proved that stature could be predicted by a known footprint length.

SUMMARY AND CONCLUSION

In the present study right foot length, left foot length and heights of 100 female students studying in M.R. Medical College are taken.

Though there are several parameters which help in identifying a person, stature of an individual is one of the important parameter, as it is an inherent characteristic. There is an established relationship

between stature and dimensions of various parts of the body allowing the Forensic expert to estimate the stature from available data. Many studies have been carried out to estimate the stature from different body parts like arm length, fore arm length, hand and finger length, length of long bones, foot and shoe lengths etc. Linear regression models are widely used to predict height of an individual on the basis of their body parts. Examination of foot provides important evidence in a crime scene investigation as it helps in the estimation of stature of a criminal. Significant and positive correlation coefficient has been shown to exist between stature and measurements of foot.

In the present study a significant correlation of stature with right and left foot length has been observed ($P < 0.01$). The results show that there is no statistically significant difference in right and left foot length in female students ($P > 0.05$). Either right or left foot length may be used to predict the stature by regression formula. Regression equations are derived separately for individual foot length.

Estimation of stature from foot length is easy, economical and convenient. No specialized equipment or training is required. Anthropologists, forensic experts and investigating officers may use this method to their added advantage. Thus this study is able to add another method to estimate the stature from foot length in male individuals.

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Table-1: Right Foot Length and Actual Height in Female Students

Sl. No.	RFL	No of individuals	Min Ht	Max Ht	Avg Ht	S.D
1	20 – 21	08	148	157	152.87	4.12
2	21.1 – 22	20	149	165	158.8	5.32
3	22.1 – 23	34	160	167	163.6	6.14
4	23.1 – 24	29	162	172	166.6	5.81
5	24.1 – 25	09	165	176	170.77	4.32

RFL – Right foot length, Min Ht – Minimum height, Max Ht – Maximum height, Avg Ht – Average height, SD – Standard Deviation

Table-2: Left Foot Length and Actual Height in Female Students

Sl. No.	LFL	No of individuals	Min Ht	Max Ht	Avg Ht	S.D
1	20 – 21	09	148	159	153.55	4.04
2	21.1 – 22	19	149	166	158.89	5.81
3	22.1 – 23	33	160	167	163.54	6.77
4	23.1 – 24	32	162	172	166.4	6.31
5	24.1 – 25	07	169	176	172.57	4.16

LFL – Light foot length, Min Ht – Minimum height , Max Ht – Maximum height, Avg Ht – Average height, SD – Standard Deviation

Table-3: Correlation between Right Foot Length, Left Foot Length and Stature in Female Students

Variable	n	Mean ± SD	Range	Cor. Coeff. r-value	Reg. Coeff. b-value	Reg. Equation
RFL	100	22.61±1.51	20-25	+0.88	4.10	Ht = 70.60+4.10 (RFL)
Actual Ht	100	163.29±5.45	148-176			
LFL	100	22.59±1.62	20-25	+0.88	3.12	Ht = 92.8+3.12 (LFL)
Actual Ht	100	163.29±5.45	148-176			

RFL = Right Foot Length LFL = Left Foot Length, Ht = Height
 Comparing Right Foot Length and Left Foot Length Z = 0.92 and P > 0.05