



Original Research Article

STUDY OF STATURE BY FOOT LENGTH MEASUREMENT IN MADHYA PRADESH

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Abstract: Anthropometric measurements have been important parameter for personal identification since 1879s of Bertillons period. In this article we have used foot print measurements of R D Gardi Medical College students, where Residents of Madhya Pradesh as well as Non- Madhya Pradesh regions have been covered. As there was no study conducted on footprint length for stature estimation in Madhya Pradesh, this study can be helpful to estimate stature in this population. We have tried to compare the observation of stature observed and calculated between Madhya Pradesh and Non-Madhya Pradesh representing Indian population as a whole along with Gender and Side to which it belongs. The results so obtained are encouraging to utilize Foot length and foot prints length as parameter to estimate stature in India.

Key Words: Forensic Anthropology, Stature, Foot Length, Identification.

INTRODUCTION

Anthropometric measurements have been important parameter for personal identification since 1879s of Bertillons period¹. Anthropometry is being widely used in Forensic investigations for identification of an individual which is an important step in crime investigation. Various parameters used for identification are determination of age, sex, race etc. (Jaboni *et al.*)². Time is a critical factor when a crime has been committed and the investigation begins. The crime scene investigator needs to make rapid and accurate assessments in the field such as identifying possible suspects, especially when the crime is a violent one such as homicide. When processing a crime scene, many variables are usually not known about the suspect.

There may be few (if any) witnesses and the perpetrator seldom leaves behind specific identifying information (e.g., driver's license). Information about the perpetrator's identity is therefore deduced from the evidence left at the scene. Footprints are left behind at scene of crime which can be both of criminals or victim. With the help of length of this footprint we can calculate suspected individuals' height. A person's stature is one identifying characteristic that is often used. Stature is the height of the person in the upright posture. Its estimation from the footprints has obvious significance in the forensic identification analysis. Accurate measurement of the height under field survey, by staff can be possible with minimum training of technique. This study is such attempt to estimate stature in Madhya Pradesh Population.

MATERIALS AND METHODS

In the present study, stature & Foot length and footprint measurements of 147 college students (68 male and 79 female) of ages 18- 25 years were done. Amongst them 102 belonged to Madhya Pradesh and

45 from rest of the India. As there were no subjects available from North East region, we could not include them in study. With proper consent, Participants' bio-data were noted. Left Foot length was measured by sliding caliper as per recommendation of the international agreement for paired measurement at Geneva³.

The footprints were collected using endorsing ink Pad. The subjects were made to stand upright without any support with stained foot on blank white paper, making sure the foot & toes were fully extended. Uniformity was maintained by same ink, same type of paper, same scale and same measurer & in same time slot. Footprint length calculated as the distance between the centre of the back of the heel & the tip of the longest toe & reading the distance against a centimeter scale³. Heights were noted separately by making individuals stand in anatomical position, using standing height measuring instrument. The obtained values were statistically analyzed using SPSS Version 17.0.

RESULTS

Table 1: Mean height and Footprint Lengths in total Subjects

Parameter	Mean	Std. Deviation	Total Subjects
Height	164.9388	9.37040	147
FPL_left	19.7837	3.86450	147
FPL_Right	19.7694	3.55579	147
Foot Length	24.6748	1.38835	147

Table 2: Mean height and Footprint Lengths in total Female

Parameter	Mean	Std. Deviation	Total Male
Height	172.7279	6.42432	68
FL_right	20.6721	3.36930	68
FPL_Left	20.6735	3.77939	68

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Table 3: Mean height and Footprint Lengths in total Male

Parameter	Mean	Std. Deviation	Total Female
Height	158.2342	5.52084	79
FL_right	18.9924	3.54870	79
FPL_left	19.0177	3.7946	79

Table 4: Mean height and Footprint Lengths in total MP

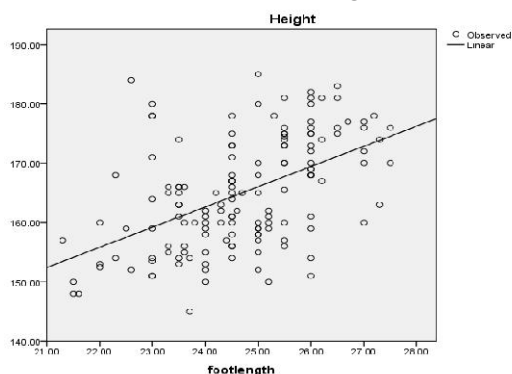
Parameter	Mean	Std. Deviation	Madhya Pradesh
Height	164.2990	9.51998	102
Foot length	24.5627	1.38942	102

Table 5: Mean height and Footprint Lengths in Rest of India

Parameter	Mean	Std. Deviation	Rest of India
Height	166.3889	8.95626	45
Foot length	24.9289	1.36725	45

It was observed that length of footprint is 2-3 cm more than that of actual Foot length. Hence Foot length linear graph is mentioned to simplify equations.

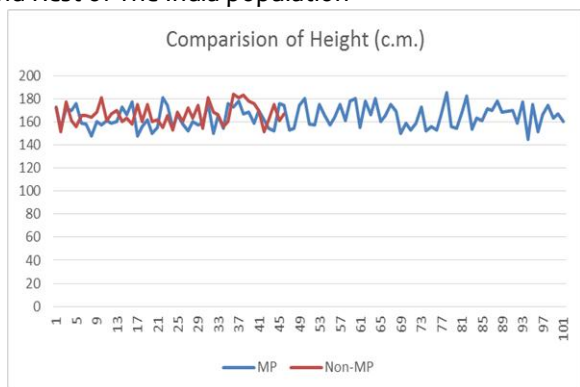
Graph 1: Linear Graph Showing Body height of total subjects with respect to Foot length observed



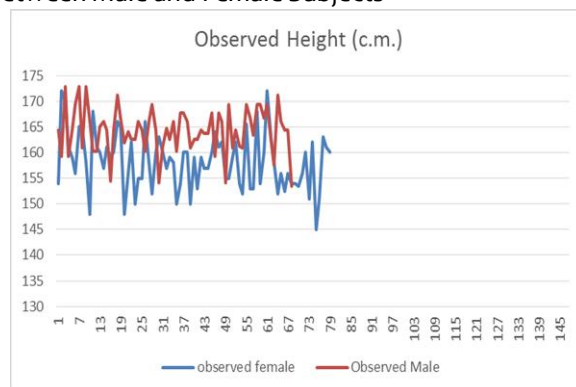
Regression equation obtained:

For Male: $Y = 1.35 \times (\text{Foot length}) + 140.59$
 For Female: $Y = 1.604 \times (\text{Foot length}) + 121.505$
 For Both: $Y = 3.404 \times (\text{Foot length}) + 82.934$

Graph 2: Showing comparison of Statue between MP and Rest of The India population



Graph 3: Showing comparison of Observed heights between Male and Female Subjects



It is observed in above graph that there is not much difference between Madhya Pradesh and Non MP subjects. Hence we can apply single formula for stature estimation for Overall Indian Population.

In another graph it is seen that stature cannot be differentiated from male to that of female. Although if the gender is identified then one of the regression equation mentioned before can be utilized separately.

DISCUSSION

The stature obtained by different researchers such as, Deopa et al.,⁴, Barnadas et al.,⁵, Tharmar et al.,⁶ & Ozaslan A et al.,⁷ varies due to Geographical variations & variation in the morphology of different population group, however they had noticed that males have greater mean value of stature as compared to females. Similar results are seen in Mansur D I e al⁹, Jitender et al.,¹⁰, Ozaslan et al.,⁸ studied on 356 randomly selected subjects in Turkey & developed a regression equation for stature estimation from the foot length obtained from the foot impression. Bhavna et.al¹⁶ have studied on 503 male Shia Muslims of Delhi, India & reported a body dimensions which correlates highly with the stature. Patel et al.,¹³ in their study on 502 medical students between 17 to 22 years of age belonging to various regions of Gujarat & reported a regression formula between foot length & height of an individual.

In present study, the formula i.e Regression equation derived is:

For Both $Y = 82.934 + 3.404 \times \text{Foot length}$
 For Male $Y = 140.59 + 1.35 \times \text{Foot length}$
 For Female $Y = 121.50 + 1.604 \times \text{Foot length}$

The correlation coefficient between height & foot length is + 0.688 in Male & +0.587 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 & this fact

may be of practical use in Medico-legal investigations. Various other regression formulae obtained in different studies are as follows:

Mansur D I, Nepal, 2012⁹

$$Y = 2.738(x) + 100.2 \text{ (for Left foot male)}$$

$$Y = 2.74(x) + 100.1 \text{ (for Right foot male)}$$

$$Y = 2.66(x) + 96.40 \text{ (for Left foot Female)}$$

$$Y = 3.179(x) + 87.65 \text{ (for Both Male \& Female)}$$

Jitender Pratap, et al., 2013, New Delhi¹⁰

$$Y = 2.967(x) + 88.235$$

Abdi Ozaslan et al., Turkey 2012¹⁶

$$S = 840.88 + 3.52(x) \pm 49.40 \text{ (for Male)}$$

$$S = 941.95 + 2.96(x) \pm 55.95 \text{ (for Female)}$$

Ingrid H.E, et al., 1967, Uganda¹¹

$$\text{Height} = (6.23 \times X) + 4.66$$

Khairulmazidah, et al., 2013, Malaysia¹²

Male	RFL	→	$Y = 84.663 + 3.321(x) \pm 4.93$
	LFL	→	$Y = 92.819 + 2.972(x) \pm 5.182$
Female	RFL	→	$Y = 86.554 + 3.115(x) \pm 4.483$
	LFL	→	$Y = 84.325 + 3.214(x) \pm 4.394$

Patel S.M. et al., 2007, Gujarat¹³

Male	$Y = 75.45 + 3.64(x)$
Female	$Y = 75.41 + 3.43(x)$

ArtiNarde, et al., 2013, Nagpur¹⁴

Male Right	$Y = 9.01 + 5.96(x) \pm 1.738$
Male Left	$Y = 8.57 + 5.96(x) \pm 1.813$
Female Right	$Y = 53.0 + 4.26(x) \pm 0.992$
Female Left	$Y = 53.3 + 4.23(x) \pm 1.057$

Ilayperuma, et al., 2008³

Male	$H = 79.042 + 3.590(x)$
Female	$H = 65.549 + 3.944(x)$
Both	$H = 44.107 + 4.922(x)$

Kewal Krishnan et al., Chandigarh, (2011)¹⁵

$$S = a + b(x) \pm SE$$

Where a = constant, b = regression coefficient,
x = Foot length, SE = Std. error.

CONCLUSION

The present study revealed that footprints dimensions are strongly correlated with stature & can be used for predicting the stature in the Forensic Examination. We have found that, there is not much difference between statures of subjects from Madhya Pradesh & Non- Madhya Pradesh. It has been found similar as far as male & females are concerned. By above study, it can be concluded that, one single formula can be used all over India to estimate the stature from foot length. We further would like apprise

to continue to work on estimating stature by unique formula which can be utilized irrespective of gender and region, at least for India.

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