Estimation of Stature of an Individual with the Help of Length of Middle Finger

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Abstract: *Stature is the natural height and built of a body or person. Stature has been one of the most important factor in the description of the human body characteristics. Various types of parameters are used while estimating stature of human body. Prediction of Stature with the help of length of middle finger appear to be significant to forensic Science experts, anthropologists, archeologists and demographers. The objectives of the study were to establish correlation of length of middle finger with height.*

Material & Methods: *This study was conducted on 240 medical, paramedical students and staff in age group of 20-50 years of UPUMS Saifai, Etawah, UP, India. Length of middle finger of subjects was measured by Vernier caliper in similar anatomical position and at fixed time to avoid diurnal variation. Correlation and Regression analysis were carried out to establish relationship of length of middle finger with the height.*

Results: *Statistical significant positive correlations between length of right middle finger and the height for male (r=0.4725; p-value<0.00001) and for female (r=0.454; p-value<0.00001), and between length of left middle finger and the height for male (r=0.501; p-value<0.00001) and for female (r=0.4438; p-value<0.00001) were observed respectively. Regression equations for stature were also derived.*

Conclusion: *The finding of study suggest that length of both right and left middle finger can be successfully used for stature reconstruction.*

Keywords: *Middle finger length, Stature, Anthropology, Stadiometer.*

I. Introduction

Identity of an individual is the set of physical, functional or psychic and normal or pathological characteristics. Stature or body height is one of the most important parameters to determine the physical identity of an individual. Various types of parameters are used while estimating stature of human body.

Estimation of stature of an individual from the skeletal material or from the mutilated or from amputated limbs or from parts of limbs has obvious significance in the personal identification in the events of the murders, accidents or natural disasters mainly concerned with the forensic identification analysis.[1] Forensic anthropologists have uphill task to keep themselves abreast with the changing pattern of rapid metamorphosis in criminal behavior and acts, so that they can serve the society better with their expertise as and when required. In recent years crime behavior in India is globalizing with very heinous approaches to commit and hide the crime, such as dismembering body in 300 pieces by a celebrity and her fiancée in Mumbai [2], the Nithari Murder case.[3] Other modes of concealing the body beyond identification are also practiced by criminal for example burning.

Kerley [4] states that every body part bears a more or less constant relationship with stature. Simmons et al [5] derived formulae to calculate stature with good results, even when only parts of the bone are available. Anthropometric measurements of different body segments have been used in the derivation of regression equations or multiplication factor for stature assessment in different population groups.[6,7] Studies indicate that only few studies are available in India and the data derived from different ethnic groups around the world may not be applicable to Indian population due to genetic and environmental variations, which emphasis the need to establish standard in different ethnic population.[8,9]

A large number of studies have been done on stature estimation using the length of bones such as femur, tibia, humerus, radius, height from finger length etc. The purpose of this study is to estimate that which parameter is better for stature estimation, from length of right middle finger or length of left middle finger.

II. Material and Methods

This study was conducted in the Department of Anatomy, Uttar Pradesh University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India. Ethical clearance was obtained from the ethical committee of the college prior to the study. This study was a Cross-Sectional study. The study was conducted on 240 medical, paramedical students and staff of age group of 20 to 50 years of age in UPUMS, Saifai, Etawah, UP, India. Any subject having any significant diseases, orthopedic disability and paralysis was excluded from the study. Subjects not giving consent to participate in the study were also excluded from the study.

The researcher obtained the permission from the UPUMS, Saifai. The length of middle finger was measured by Vernier Caliper, and height of individual was measured by Stadiometer. Vernier caliper capable of measuring of the nearest 0.02mm and Stadiometer capable of measuring nearest 0.1 cm. All data was entered into SPSS Software V.23.0. Data was analyzed and correlation coefficient was also calculated.

Figure 1:Vernier Caliper   **Figure 2: Stadiometer**

Length of Middle Finger was measured as straight distance from the midpoint of the proximal finger crease to the tip of the middle finger. Stature was measured as vertical distance from vertex to the floor by making the subject stand erect on a horizontal resisting plane bare footed with shoulder blocks and buttocks touching the wall. Palms of hand had to be turned inwards and fingers horizontally pointing downwards. Anthropometer was placed in straight vertical position in front of the subject with head oriented in eye-ear-eye Plane (Frankfurt Plane). The movable rod of the Anthropometer was brought in contact with vertex in the mid saggital plane.

Figure 3: Measurement of length of Middle Finger

Figure 4: Measurement of Height

III. Observations and Result
Table 1: Gender wise measurements and analysis of Stature

Stature	Minimum (cm.)	Maximum (cm.)	Mean (cm.)	SD (cm.)
Male (n=155)	149.2	188.8	168.92	6.18
Female (n=85)	134.9	173.8	156.35	5.99

(SD=Standard deviation)

Table 2: Gender wise measurements and analysis of Length of Middle Finger

Middle Finger Length	Minimum (cm.)	Maximum (cm.)	Mean (cm.)	SD (cm.)	r	p-value
Right side (Male)	6.22	9.002	8.00	0.47	0.4725	<0.00001
Right side (Female)	6.472	8.812	7.41	0.47	0.454	<0.00001
Left side (Male)	6.962	9.164	8.00	0.47	0.501	<0.00001
Left side (Female)	6.44	8.962	7.41	0.47	0.4438	<0.00001

(r=Pearson's correlation coefficient, p-value=Probability)

Regression Analysis:
Simple Linear Regression Formula: H=a+bP
H=Height (cm.), a=constant (cm.), b=Regression coefficient, P=Parameter (cm.)

Table 3: Gender wise regression analysis

	Right Middle Finger Length (cm.)		Left Middle Finger Length (cm.)	
	Regression Formula	Standard Error	Regression Formula	Standard Error
Male	H=119.15+6.21P	0.937512	H=115.88+6.63P	0.926215
Female	H=113.28+5.82P	1.252701	H=117.74+5.21P	1.15479

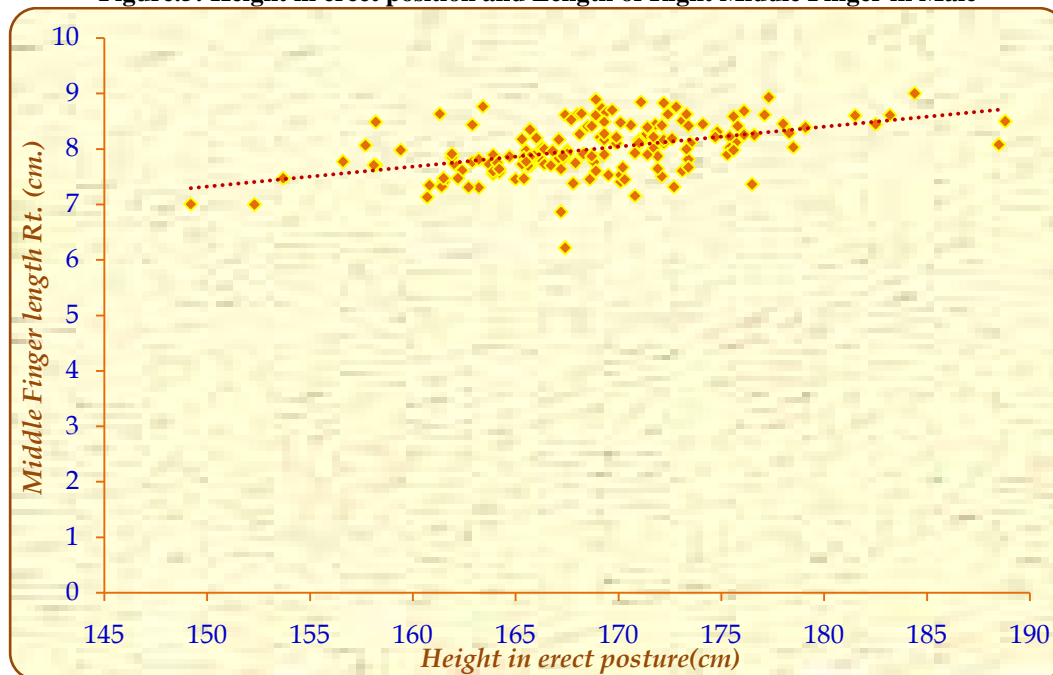**Figure.5: Height in erect position and Length of Right Middle Finger in Male**

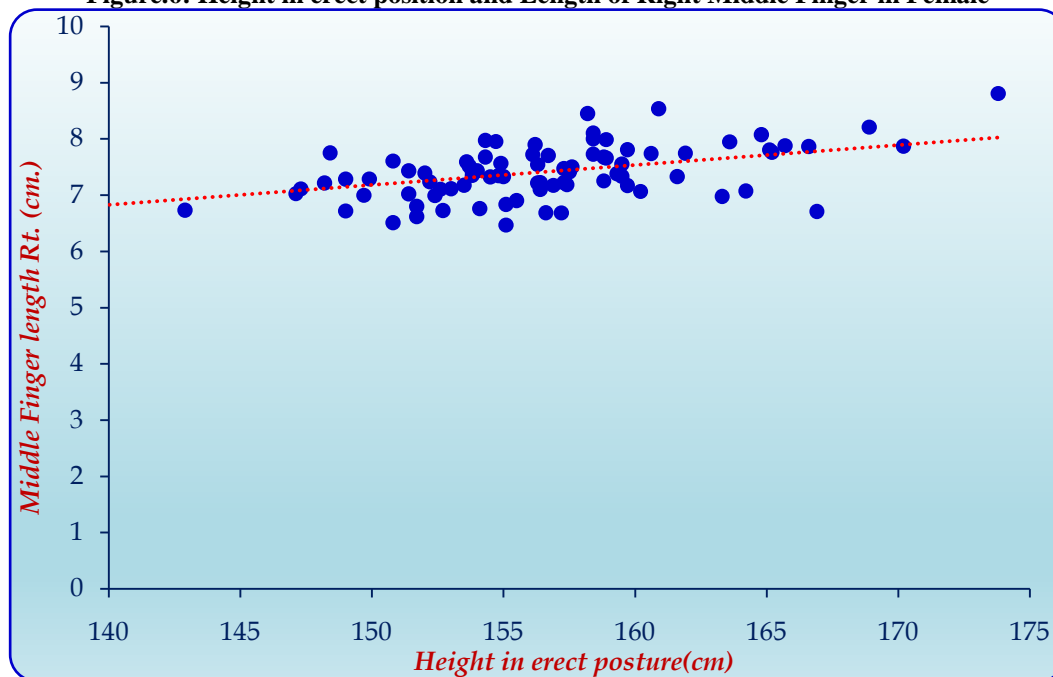**Figure.6: Height in erect position and Length of Right Middle Finger in Female**

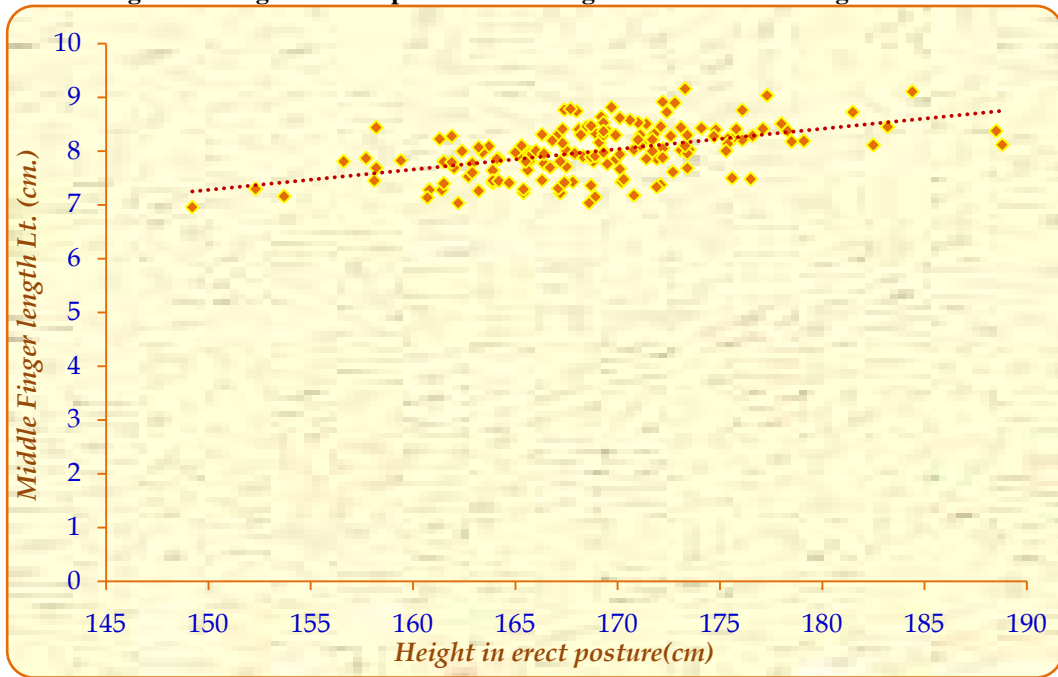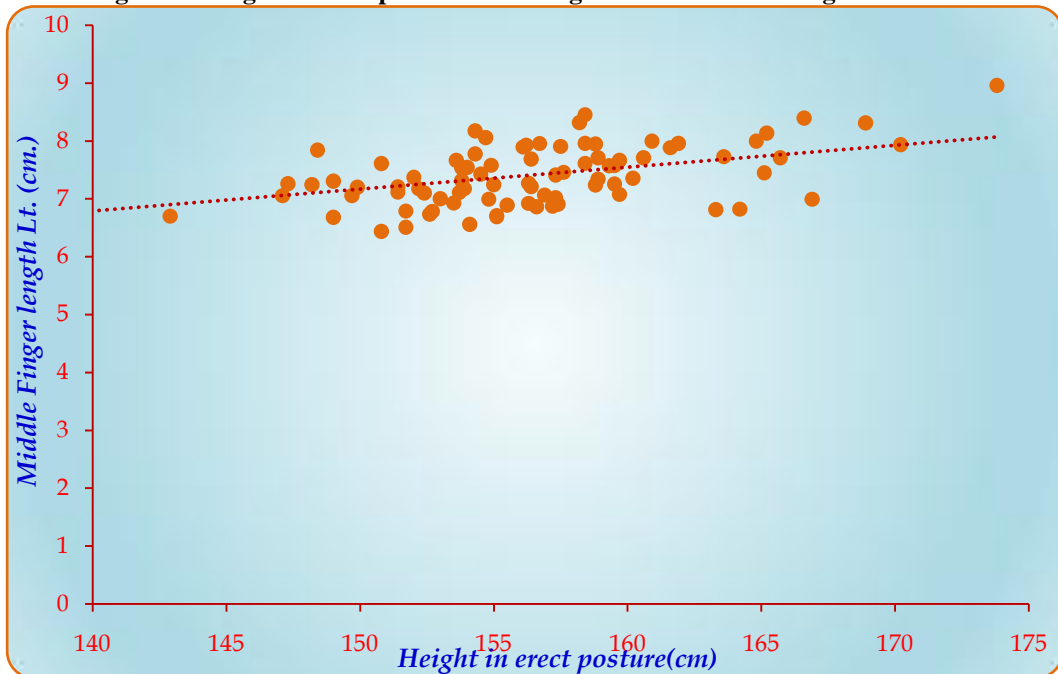**Figure.7: Height in erect position and Length of Left Middle Finger in Male**

Figure.8: Height in erect position and Length of Left Middle Finger in Female

Calculation of Height-

(1) From Length of Right Middle Finger in Male

H=a+bP

a=119.15, b=6.22, P=7.91

H=119.15+6.22x7.91

Calculated Height=168.3 cm.

Measured Height=168.32 cm.

(2) From Length of Right Middle Finger in Female

H=a+bP

a=113.28, b=5.82, P=6.616

H=113.28+5.82x 6.616

Calculated Height=151.75cm.

Measured Height=151.7 cm.

(3) From Length of Left Middle Finger in Male

H=a+bP

a=115.88, b=6.63, P=7.9

Y=115.88+6.63x7.9

Calculated Height=168.27 cm.

Measured Height=168.3 cm

(4) From Length of Left Middle Finger in Female

H=a+bp

a=117.74, b=5.21, P=6.512

H=117.74+5.21x6.512

Calculated Height=151.67 cm.

Measured Height=151.7 cm.

The estimated statures, calculated with the help of regression equations of length of middle finger of both right and left for male and female are found approximate to their measured values.

IV. Discussion

Determination of human stature from the different body parts is an important parameter in medico-legal and anthropological examination. The present study provides valuable new data pertaining to the length of middle finger and its correlation with the stature in adult Indian population. A general linear regression model was found to be most promising and validating in both male and female.

Correlation between length of right middle finger and length of left middle finger with height in male with correlation of 0.4725 and 0.501 respectively interpreting that length of right middle finger and length of left middle finger may be good tool for estimation of height in male. Pearson's correlation was used to predict the significant relationship between the height and length of middle finger of the subjects. This indicates a high significant ($P<0.00001$) relation between length of right middle finger and the height in case of male and relation between length of left middle finger and the height is also high significant ($P<0.00001$) in case of male .

Correlation between length of right middle finger and length of left middle finger with height in female with correlation of 0.454 and 0.4438 respectively interpreting that length of right middle finger and length of left middle finger may be good tool for estimation of height in female. Here are also a high significant ($P<0.00001$) relation between length of right middle finger and the height in case of female and relation between length of left middle finger and the height is also high significant ($P<0.00001$) in case of female .

According to Lal and Lala [10] regression coefficient (b) is a better guide for calculation of height of an individual when the identity of the individual is not known.

Table 4: comparison of regression coefficient of our study with other studies in different populations

Study	Region	Middle Finger of Male		Middle Finger of Female	
		Right	Left	Right	Left
Present study	different parts of India	6.22	6.63	5.82	5.21
Kuppast N et al [11]	Karnataka	7.49	4.17	6.86	5.54
Suseelamma D [12]	different parts of India	7.99	7.64	3.54	3.14
Jasuja OP [13]	northern India	13.652	13.868	2.082	-0.423

V. Conclusion

One hundred fifty five adult male and eighty five female subjects have been studied for their stature, length of right middle finger and length of left middle finger. Statistically high significant correlation is present among the stature and these measurements. This study shows that there is a definitive and good correlation between the height and length of both right and left middle finger in both sexes. The regression equations have been derived from these measurements. The regression equation for reconstruction of stature from length of

both right and left middle finger in both sexes is H=a+bP   where, H=Height, a=Constant, b=Regression Coefficient and P=Length of Parameter.

Regression lines provided in the present study are simple, comprehensive, less cumbersome and rapid tool for estimating height of unknown Indian individuals anywhere in the world. This study is done in individuals distributed in different part of India. India is a country of different races so there is a lot of variation in the estimates. Hence there is a need to conduct more studies among people of different regions & ethnicity, so that stature estimation becomes more reliable & identity of an individual is easily established.

Conflicts of Interests: None
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