

Stature Estimation by Index and Ring Finger Length

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Abstract

Background: A series of systemized techniques of measuring quantitatively the dimensions of human body and skeleton is called as Anthropometry and it is often viewed as traditionally the basic tool for biological anthropology and it has a long traditional use in forensic sciences and its findings has increased its use in medical sciences specifically in speciality of Forensic Medicine.

Aim and objective: To find out correlation between Index and Ring finger length with stature of the individual and to devise a linear regression equation to determine stature from Index and Ring finger length.

Type of Study: Descriptive cross sectional study with analytical and comparative components.

Place of Study: Department of forensic medicine and Toxicology Narayana Medical College, Nellore District of Andhra Pradesh State.

Material and Method: Stature: using the stadiometer, the subject was made to stand barefoot in the standard standing position on its baseboard. The length of the Index and ring fingers was measured from proximal crease to the tip.

Observation and Discussion: The Mean \pm SD age of study samples was 21.41 \pm 2.1 years. There was no significant difference between the mean age of the two genders ($P > 0.001$). Accordingly the Mean \pm SD height was 164.62 \pm 8.56 cm in total cases, 168.12 \pm 7.6 cm in males, and 161.1 \pm 8.01 cm in females, which differed significantly ($P < 0.0001$). The Mean \pm SD lengths of index and ring fingers were 6.55 \pm 0.48 cm and 6.6 \pm 0.51 cm in total samples, 6.72 \pm 0.52 cm and 6.78 \pm 0.55 cm in males, and 6.37 \pm 0.37 cm and 6.42 \pm 0.38 cm in females, respectively.

Conclusion: In our study there exists a significant and positive correlation between stature and Index and ring finger length between both the sexes indicating strong and reliable relationship between the parameters.

Keywords: Index and ring finger length; Regression equation; Stature.

Introduction

A series of systemized techniques of measuring quantitatively the dimensions of human body and

skeleton is called as Anthropometry and it is often viewed as traditionally the basic tool for biological anthropology and it has a long traditional use in forensic sciences and its findings has increased its use in medical sciences specifically in speciality of Forensic Medicine.¹

Determination of Individuality of person is Identification and it includes determination of sex, race, age, stature of a person and in this Stature and sex carries most importance.² It was Rollet in the year 1988³ who conducted a research in this field and in his research used 50 male and female corpses and showed the relationship between various body measurements and the stature. Later it was Pearson⁴

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in 1899 that was a mathematician and used the data to derive regression equations and suggested that equation to be population specific. Henceforth numerous advancement had been made in this field,⁵ and had been used efficiently and applied in process of identification. As these measurements are population specific it becomes imperative to have a data from population and make a comprehensive data base based on geographical locations.

The stature of an individual in a given scenario where it cannot be estimated, for example in bedridden, old or frail patients or in an individual where limb or vertebral column deformity is present in such scenario indirect estimation can be achieved by correlating the stature with other skeletal parameters.⁶

Use of stature estimation by a forensic scientist can narrow down pool of possibilities of victim matches in any ongoing investigation. Stature is considered to be directly proportional to different body parts and it shows a definite biological and genetic relation with each other, in forensic cases stature is usually estimated by using both anatomical and mathematical techniques,⁷ various researchers have established a relationship between stature and various measurements of different body parts which are often represented using linear regression equation derived from them.² The present study was undertaken with an aim and objective to obtain a specific regression equation for stature estimation from Index finger and Ring Finger length among male and female population of Nellore district of state Andhra Pradesh.

Aim and Objective

The present study was undertaken with an aim and objective to obtain a specific regression equation for stature estimation from Index finger and Ring Finger length among male and female population of Nellore district of state Andhra Pradesh, To find out correlation between Index and Ring finger length with stature of the individual and to devise a linear regression equation to determine stature from Index and Ring finger length.

Material and Method

Present study was conducted at Narayana Medical College, Chinthareddy Palem, Nellore State Andhra Pradesh by the Department of forensic medicine and Toxicology on the Consenting volunteers of Nellore District of State Andhra Pradesh. The

research was with the aim of estimation of stature from Index finger and Ring Finger length among male and female measurements collected in 300 adult volunteers with age of 18 to 25 years.

The subjects were confirmed to be descent from Nellore district and were specifically selected with residence of Nellore district only, irrespective of their caste, religion, dietary habits and socio-economic status. The study was a predominantly descriptive cross sectional study with analytical and comparative components. Sufficient permissions and consents are procured before the measurements of the volunteers are taken and clearance from the Institutional Ethical committee is obtained in advance. Measurements taken by single investigator and with the same instrument to avoid any technical or inter observer error and to maintain reproducibility and measurements were taken thrice and their mean value were considered for stature estimation.

Stature: Using the stadiometer, the subject was made to stand barefoot in the standard standing position on its baseboard. Both feet are in close contact with each other and head oriented in Frankfurt's plane. The height was then recorded in centimeter from the standing surface to the vertex in the weight bearing position of foot.

Index and Ring Finger Length: The length of the Index and ring fingers was measured from proximal crease to the tip. The fingers length was measured by a caliper with an accuracy of millimeters. Digital Vernier caliper. Technique: The measurement was taken in standing position with stabilization of hand on table. The caliper was horizontally placed along the ventral surface of the hand. The fixed part of the outer jaw of the caliper was applied to the proximal crease of Index and Ring finger and the mobile part of the caliper was approximated to the tip of the Index and Ring finger and measurement was taken and the measurement was obtained up to one decimal place. Any kind of error from Instrumental, all the instruments were verified at significant level and variation of + 0.01 cm was observed.

Exclusion Criterion: Those with any apparent disease, orthopedic deformity, morphologically showing the congenital malformations, Dwarfism / Achondroplasia, features of nutritional deficiencies and injuries to extremities, using medication thought to alter growth, neuromuscular weakness or abnormal tone or with any other major medical illnesses or growth disturbance were excluded from the study.

Statistical Part: Descriptive statistics like min., max., mean, standard deviation, and confidence interval etc. of stature and length of index and ring finger of male, female and combined group were done. Association between stature on Index and Ring finger length were positively correlated and it is shown by scatter diagram with a check on the significance of correlation between stature and index, ring finger length by using correlation t-test. So, on the basis of that we calculate the simple regression equations of stature on index and ring finger length, by using regression equation we can predict the stature value by using independent variable index and ring finger length. As well checking the significance at 5% level of significance, complete statistics was done in MS-Excel.

Results

As per Table 1 in our study the Mean \pm SD age of study samples was 21.41 ± 2.1 years. There was no significant difference between the mean age of the two genders ($P > 0.001$). Accordingly the Mean \pm SD height was 164.62 ± 8.56 cm in total cases, 168.12 ± 7.6 cm in males, and 161.1 ± 8.01 cm in females, which differed significantly ($P < 0.0001$). The Mean \pm SD lengths of index and ring fingers were 6.55 ± 0.48 cm and 6.6 ± 0.51 cm in total samples, 6.72 ± 0.52 cm and 6.78 ± 0.55 cm in males, and 6.37 ± 0.37 cm and 6.42 ± 0.38 cm in females, respectively.

There was a statistically significant difference between genders in the length of the index and ring fingers ($P < 0.0001$).

As per Table 2, Person's correlation coefficients of Stature and index finger length were 0.7, 0.611 in male, and in female samples 0.624 and 0.617 respectively. Moreover, Person's correlation coefficients of height and index finger length for male and female combined was 0.708 for index finger length and 0.66 for Ring finger length.

The correlation between height, and index and ring fingers length in male, female and total cases was significant ($P < 0.0001$). On the basis of statistically significant correlation between height, and index and ring fingers length, the following formulas were estimated:

Stature of male (cm) = $99.75 + 10.16 \times \text{length of index finger}$

Stature of male (cm) = $110.37 + 8.52 \times \text{length of ring finger}$

Stature of female (cm) = $75.81 + 13.38 \times \text{length of index finger}$

Stature of female (cm) = $78.28 + 12.91 \times \text{length of ring finger}$

Stature of combined (cm) = $82.19 + 12.59 \times \text{length of index finger}$

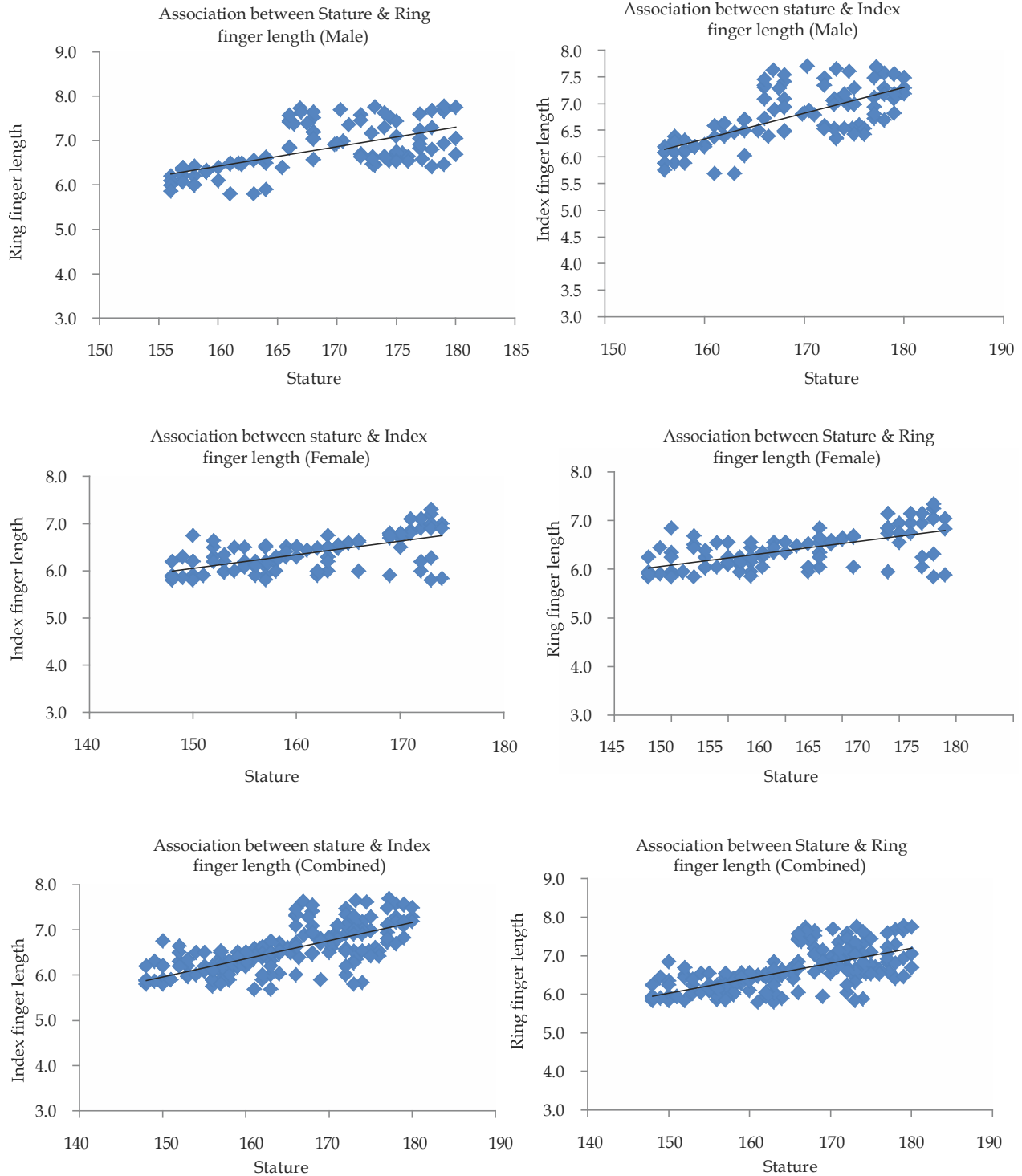
Stature of combined (cm) = $90.86 + 11.18 \times \text{length of ring finger}$

Table 1: Descriptive Statistics of stature and finger length.

Parameter	Minimum	Maximum	Mean + SD	95% Confidence Interval		
				Lower bound	Upper bound	
Age	Male	18	25	21.41 ± 2.1	21.01	21.82
	Female	18	25	21.33 ± 2.02	20.93	21.73
	Combined	18	25	21.37 ± 2.05	21.09	21.66
Stature	Male	156	180	168.12 ± 7.6	166.63	169.62
	Female	148	174	161.1 ± 8.01	159.54	162.68
	Combined	148	180	164.62 ± 8.56	163.43	165.8
Index Finger Length	Male	5.69	7.69	6.72 ± 0.52	6.62	6.82
	Female	5.8	7.3	6.37 ± 0.37	6.3	6.45
	Combined	5.69	7.69	6.55 ± 0.48	6.48	6.61
Ring Finger Length	Male	5.79	7.77	6.78 ± 0.55	6.67	6.89
	Female	5.84	7.34	6.42 ± 0.38	6.34	6.49
	Combined	5.79	7.77	6.6 ± 0.51	6.53	6.67

Table 2: Correlation of stature and finger length.

Gender	Correlated parameters	Correlation (r)	t-test	p - Value	Significance
Male	Index finger length	0.7	9.703446	0.000001	All are highly significance
	Ring finger length	0.611	7.640674	0.000001	
Female	Index finger length	0.624	7.905161	0.000001	
	Ring finger length	0.617	7.761467	0.000001	
Combined	Index finger length	0.708	14.10686	0.000001	
	Ring finger length	0.66	12.36184	0.000001	



Multiple regression analysis:

Stature of male (cm) = 99.43 + 9.78*Index finger length + 0.43*Ring finger length

Stature of female (cm) = 75.86 + 11.53*Index finger length + 1.83*Ring finger length

Stature of combined (cm) = 81.49 + 10.88*Index finger length + 1.8*Ring finger length

Discussion

Stature estimation is an important parameter in forensic investigation and anthropological research, anthropological measurements of fingers can be used to estimate stature hence the present study was carried out to investigate the relationship between index and ring finger length and Stature.

The average stature of adult males within a given population is significantly higher than that of adult females⁸⁻¹⁰ and our observation in the present study correlate with the same findings.

In our study the correlation between stature, and index and ring fingers length in population of Nellore region of state Andhra Pradesh. The average height was 164.62 ± 8.56 cm in the total subjects, 168.12 ± 7.6 cm in males and 161.1 ± 8.01 cm in females, which was statistically significant ($P < 0.05$). It was Akhlaghi et al. who reported the average height amongst Iranian student population between 21 to 26 years age group as 176 cm in males and 162 cm in females.¹¹ It is concluded that observation in our study related with average stature and the significant difference between male and female samples are in line with the earlier studies made by other researchers. Mean length of index finger in our study 6.72 ± 0.52 cm in males and 6.37 ± 0.37 cm in females, which was statistically significant ($P < 0.0001$). The mean length of the index finger in males was similar to the results of Bardale et al.¹² and also same kind of observation was obtained for mean length of index finger in females. But the mean length of the index finger in male and female samples was lower in the studies by Akhlaghi et al.¹¹

In our observation the mean length of the ring finger was 6.78 ± 0.55 cm in males and 6.42 ± 0.38 cm in females, which was statistically significant ($P < 0.001$), similarly The mean length of the ring finger in males same in observation made by Krishan et al. but comparatively lower than those of Bardale et al. and Akhlaghi et al.^{12,11} The obtained results on the mean length of index finger in females were in line with the studies by Krishan et al.¹³ but lower than those of Akhlaghi et al.¹² Based on the results obtained from our assay and previous studies, the mean length of index and ring fingers were significantly higher in males ($P < 0.0001$).

It was Krishan et al.¹³ who suggested a significant correlation between height and index finger length, which was higher among males than females. In Previous studies, they demonstrated similar results regarding the significant correlation between average ring finger length and height. Pearson's correlation coefficient between index and ring fingers length and height was higher in males than females ($P < 0.001$), which was similar to the results of Krishan et al.¹³ Inconsistent with our results, Bardale et al. reported a higher correlation between height, and index and ring fingers length in females.¹² Our obtained data indicated 0.708 and 0.66 correlation coefficients between index

finger length and stature, and between ring finger length and Stature, respectively. Results obtained by Oladipo et al. was in line with ours.¹⁴ On the other hand, Krishan et al.¹³ reported that index finger length had a higher correlation coefficient to estimate height, in comparison to the ring finger length.^{15,16}

Conclusion

In our study there exists a significant and positive correlation between stature and Index and ring finger length between both the sexes indicating strong and reliable relationship between the parameters. We conclude that the regression equations presented here can be used to estimate ante-mortem stature, with reasonable accuracy of unknown mutilated or dismembered human fingers remains from Index and Ring finger length in medico-legal cases, particularly from Nellore district of State Andhra Pradesh. However the formulae derived cannot be generalized to all population groups, hence it is necessary to derive regression equations which are region wise and population specific. Thus the data of this study are recommended in anthropological studies for stature estimation amongst the ethnic group under study.

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