Determination of Stature From Index and Ring Finger Lengths in South Indian Population

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Abstract

Introduction: Personal identification is an important role of forensic experts during mass disasters like earth quakes, tsunamis, and plane crash etc. Stature determination is an important factor in establishing identity in forensic practice. Forensic anthropometrists use various anthropometric techniques to determine stature from such dismembered body parts. These techniques aim to derive equations from various body measurements that could estimate stature in males and females.

Aim: The aim of present study is to correlate index and ring finger lengths and stature in both sexes and to derive linear regression equations to estimate stature.

Materials and Method: The study was conducted in the Department of Forensic Medicine & Toxicology, M.S. Ramaiah Medical College Bangalore in the year 2019. The material consisted of 150 young and healthy students (66 males and 84 females) in the age group of 20-21 years after taking informed consent to participate in the study. Subjects of south Indian origin were selected based on their mother tongue. The data obtained were computed and analysed using Statistical Package for Social Sciences (SPSS, version 25.0) computer software.

Results: In the present study, mean stature, index finger length and ring finger length were significantly higher in males than females. Statistically significant correlation was observed between stature, index finger length and ring finger length in right and left hands. Correlation coefficient was higher among males than females. Among males left ring finger length and in females right index finger length showed more correlation with the stature.

Conclusion: Sex specific linear regression formulae were derived for estimating stature from index finger length and ring finger length. Study concludes that stature can be estimated from the index finger length and ring finger lengthwith a reasonable accuracy among South Indians.

Key Words*: Forensic Science, Stature, Index finger length and Ring finger length, Identification, Anthropometry*

Introduction

Establishment of the identity of the deceased is of the greatestsignificance to the forensic expert in situations wherebodies are badly mutilated. Identification of victims from dismembered human remains has always been a challengein medico-legal investigation. Such a scenario is commonly encountered in mass disasters or in homicides where deceased bodies have beendismembered to suppress the identity of the murdered.[(1)]Stature estimation from skeletal remains and body parts is based on the principle that height of an individual has a definite and linear relationship with various body parts and long bones of an individual.[(2)]

Estimation of stature is more accurate and reliable using long bones than any other part of the body. Studies on the estimation of stature from finger length and phalanges are limited in literature when compared to studies for estimation of stature from upper and lower

extremities.

Dimensional relationship between body segments and the whole body has been the focus of scientist, anatomistand anthropologist for many years. [3] For this purpose, many sets of regression equation have been developed,and the better known are Karl Pearson, Trotter and Glesser from western countries and Pan (1924), Singh andSohal (1952), and Mehat and Thomas were from India. [4]Multiple methods need to be applied in different scenarios for a positive identification.

The present study was carried out tocorrelate index and ring finger lengths with stature in both sexes specifically for population of South India.

Material and Method

The study was conducted in the Department of Forensic Medicine & Toxicology, M.S. Ramaiah Medical CollegeBangalore in the year 2019. The material consisted of 150 young and healthy students (66 males and 84 females) in the age group of 20-21 years after taking informed consent to participate in the study. Subjects of south Indian origin were selected based on their mother tongue.

Sliding calipers was used to measure both index and ring finger lengths. Measurements were taken from the midpoint of the proximal crease at the base of the fingers to their tips.

Stature is the vertical distance from vertex to the floor with the head of the subject held in the Frankfurt Horizontal plane. It was measured with the help of an anthropometer rod.

Inclusion criteria

1. Medical students above 20 years of age and less than 21 years of age studying in M.S. Ramaiah Medical College, Bangalore

2. Subjects of south Indian origin using mother tongue (Tamil, Telugu, Malayalam, and Kannada etc.) as a criteria for origin.

Exclusion criteria

1. Subjects having any skeletal deformity and other disorders which could have affected the general or bony growth.

Statistical Analysis

The data obtained were computed and analysed using Statistical Package for Social Sciences (SPSS, version 23.0) computer software. Correlation coefficient was calculated and the correlation between the stature and index and ring finger length was drawn. Regression formulae were derived for stature estimation from index finger length (IFL) and ring finger length (RFL) in males and females keeping stature as the dependent variable and index finger length and ring finger length as an independent variable. P-value of less than 0.05 was considered as significant.

Results

The stature ranged from 153.3- 186.0 cm in males and from136.5- 177.8 cm in females. Mean stature was significantlylarger in males (Table No. 1). Mean IFL on right and left sidesrespectively was 7.41 cm and 7.38 cm in males and 6.79 cm and6.72 cm in females. RFL was greater than IFL in males and in females RFL was greater only on the left side. The mean RFL on right and left sides respectively was 7.52 cmand 7.61 cm in males and 6.77 cm and 6.83 cmin females. Finger lengthmeasurements (IFL, RFL) were significantly larger in males thanfemales in both hands.

Table No. 1: Statistical comparison of stature

Cases	Stature		
	Range (cm)	**Mean (cm)**	**SD**
Males	153.3- 186.0	172.67	6.47
Females	136.5- 177.8	158.39	7.00

Table No. 2: Statistical comparison of right and left sided finger lengths

Cases	Parameters	Right			Left		
		Range (cm)	Mean (cm)	SD	Range (cm)	Mean (cm)	SD
Males	Index finger length	6.30- 8.65	7.41	0.40	6.25- 8.70	7.38	0.41
	Ring finger length	6.11- 8.50	7.52	0.44	6.30- 8.70	7.61	0.43
Females	Index finger length	6.08- 7.84	6.79	0.41	5.82- 7.76	6.72	0.41
	Ring finger length	5.85- 7.62	6.77	0.43	5.90- 7.85	6.83	0.41

Descriptive statistics ofstature, IFL and RFL in both hands are shown in Table No. 1 and 2. Statisticallysignificant correlation was observed between stature and fingerlengths (IFL, RFL) in right and left hands (Table No. 3). Pearson correlation(r) for stature and finger lengths was higher among males(ranging between 0.384 for the right IFL and 0.538 for the left RFL)than females (ranging between 0.432 for the left IFL and 0.506 forthe right IFL). Among males and females, correlation coefficient washigher for the ring finger length than the index finger length except for females on the right hand.In males the correlation was higher between left ring finger and stature (r=0.538) while in females the correlation was higher between right index finger and stature (r=0.506).

Table No. 3: Correlation coefficient between Stature and different finger measurements

Variables	Males (r value)	Females (r value)
Stature vs. Right Index Finger	0.384	0.506
Stature vs. Right Ring Finger	0.511	0.483
Stature vs. Left Index Finger	0.437	0.432
Stature vs. Left Ring Finger	0.538	0.481

Table No. 4: Linear regression equations for finger length and stature

	Male	Coefficient of Std. error	Female	Coefficient of Std. error
Right Index	S= 126.8 + 6.18 (RI)	+/- 1.86	S= 100 + 8.58 (RI)	+/- 1.61
Right Ring	S= 116.3 + 7.49 (RR)	+/- 1.57	S= 105 + 7.86 (RR)	+/- 1.57
Left Index	S= 121.9 + 6.87 (LI)	+/- 1.77	S= 108 + 7.39 (LI)	+/- 1.70
Left Ring	S= 112.1 + 7.95 (LR)	+/- 1.56	S= 101 + 8.29 (LR)	+/- 1.67

Linear regression models derived for reconstruction of stature in males and females are shown in Table No. 4. Coefficient of Standard Error was determined to find the predictive accuracy of linear regression models for stature estimation from IFL and RFL. The Coefficient of Standard Error in stature estimation from IFL and IFL using linear regression models ranged between +/- 1.57 to +/- 1.7 among females and between +/- 1.56 to +/- 1.86 in males. IFL and RFL showed a significant correlation with the stature in males and females. Left RFL in males and right IFL in females appear to be the better predictors of stature.

Discussion

Stature is one of the primary characteristics of identification. Estimation of stature of an individual is an important aspect of medico legal examination. Ratio in size of different parts of the body to one another and to the stature varies considerably in different individuals an also in different races. Studies have shown that no two individuals are exactly alike genetically; even identical twins differ in some aspects, and the variability is strongly influenced by genetic and environmental factors.[5]

Studies where stature can be estimated from finger lengths are few. Hence the present study was conducted to correlate index and ring finger lengths (IFL & RFL) with stature in both sexes specifically for population of South India. Amongst the study sample, mean stature was significantly larger in males (172.67 cm) than in females (158.39 cm). The mean RFL on right and left sides respectively was 7.52 cm and 7.61 cm in males and 6.77 cm and 6.83 cm in females. Finger length measurements (IFL, RFL) were significantly larger in males than females in both hands.

Statistically significant correlation was observed between stature and finger lengths (IFL, RFL) in right and left hands. Pearson correlation (r) for stature and finger lengths was higher among males (ranging between 0.384 for the right IFL and 0.538 for the left RFL) than females (ranging between 0.432 for the left IFL and 0.506 for the right IFL). In males the correlation was higher between left ring finger and stature (r=0.538) while in females the correlation was higher between right index finger and stature (r=0.506).

Tyagi et al studied the subjects from Delhi and found positive correlation between stature and finger lengths and have suggested that index finger was best for the prediction of stature in both males and females. [6]Jasuja et al had studied the hand and four phalange lengths in 60 subjects belonging to Jat Sikhs community. The researchers had observed correlation coefficient that ranged from 0.215 to 0.681 and concluded that stature could be estimated from studied parameters. [7]Rastogi et al estimated stature from middle finger and noted a positive correlation that ranged from 0.504 to 0.696 between middle finger length and stature while studying the north and south Indian population. [8] Varghese et al studied in Mysore, India and found that best finger to predict the height in case of males was left thumb and in females it was right thumb. [9]

In a study by Manirul Islam, hand length showed a positive correlation with stature.[10]Habib and Kamal [11] and Jasuja and Singh[12] in their studies on reconstruction of stature with measurements of hand and phalange lengths have reported a similar observation. The correlation coefficients between stature and all the measurements of hands were found to be positive and statistically significant. [13]

Linear regression equations derived in the present study would help in estimation of stature with less error. The results of a study show that the extent of error of estimate inherent in estimation of stature by regression analysis is less than that of multiplication method. Hence, confirming that the stature estimation is more accurate and reliable with regression analysis method. [14]

Conclusion

The present study shows significant and positive correlation between stature and finger lengths (LIF, LRF, RIF and RRF) in males and females. Left RFL in males and right IFL in females appear to be the better predictors of stature. This study also shows that the stature can be predicted from the index and ring finger lengths with a reasonable accuracy.

Conflict of Interest- The authors declare that there is no conflict regarding this research and the manuscript.

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Ethical approval- Taken

References

1. Jeyaseelan N et al. Estimation of hand index and sex variations among the University students of Malaysia – an Anthropometric study.IOSR J Human Social Sci (IOSR-JHSS) 2016; 21(1).
2. Krishan K, Kanchan T, Asha N. Estimation of stature from index and ring finger length in a North Indian adolescent population. Journal of Forensic and Legal Medicine; 2012, 19: 285-290.
3. Mukherjee JB, editor. Personal identification. In: Forensic Medicine and Toxicology. 2nd ed. New Delhi: Arnold Associates; 1994. p. 128-9.
4. Bass WM. Anthropology. In: Siegel JA, editor. Encyclopedia of Forensic Sciences.Vol. 1. London: Academic Press; 2000. p. 194-284.
5. Numan AI, Idris MO, Zirahei JV, Amaza DS, Dalori MB. Prediction of Stature from Hand Anthropometry: A Comparative Study in the Three Major Ethnic Groups in Nigeria. British Journal of Medicine & Medical Research 2013; 3(4):1062-73.
6. Tyagi AK, Kohli A, Verma SK, Aggarwal BB. Correlation between stature and finger length.Int J Medical Toxicol Legal Med 1999; 1:20-22.
7. Jasuja OP, Singh G.Estimation of stature from hand and phalange length. JIAFM 2004; 26:100-6.
8. Rastogi P, Kanchan T, Menezes RG, Yoganarasimha K. Middle finger length – a predictor of stature in the Indian population. Med Sci Law 2009; 49:123-6.
9. Verghese AJ, Balraj BM, Kumar PN.A study of estimation of stature from length of fingers in Mysore.Indian J Forensic Med Toxicol.2010; 4: 12-13.
10. Manirul Islam, Sarma H. P. "Anthropometric Measurements of the Hand Length and their Correlation with the Stature of Ethnic Tribal Adult Males of Tripura". Journal of Evidence based Medicine and Healthcare; Volume 1, Issue 13, December 01, 2014; Page: 1589-1594.
11. Habib SR, Kamal NN. Stature estimation from hand and phalanges lengths of Egyptians. J Forensic Leg Med 2010;17:156- 60.
12. Jasuja OP, Singh G. Estimation of stature from hand and phalange length. J IndAcad Forensic Med 2004;26:100-6.
13. Pal A, De S, Sengupta P, Maity P, Dhara PC. Estimation of stature from hand dimensions in Bengalee population, West Bengal, India. Egyptian Journal of Forensic Sciences.2016; 6: 90–98.
14. Krishan K, Kanchan T, Sharma A. Multiplication factor versus regression analysis in stature estimation from hand and foot dimensions. Journal of Forensic and Legal Medicine.2012; 19: 211-214.