

ORIGINAL ARTICLE

Stature Prediction from Anthropometric Measurements of Palm and Finger in South Indian Population

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ABSTRACT

INTRODUCTION

AIM: To establish correlation between stature and palm lengths and individual finger length of both the hands in both males and females separately in South Indian population.

SETTINGS AND DESIGN: The present study was set up in the department of anatomy of Al Ameen Medical College, Bijapur. Among the volunteers, 300 healthy adults of age group 18-30 years were selected for the study.

MATERIALS AND METHODS: Stature was measured using Standard Stadiometer and palm and finger length were measured using Vernier caliper.

STATISTICAL ANALYSIS USED: Pearson's correlation coefficient and Regression equation formulas for stature estimation were calculated for all the parameters using trial version of SPSS software. Result: all the parameters displayed positive and significant correlation with stature in given population. Regression equations were calculated to estimate stature from given palm length or finger lengths.

CONCLUSION: There exists a definite correlation between stature with palm and finger length in both males and females included in the study.

KEYWORDS | Stature; Correlation; Regression equation

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INTRODUCTION

As the world is developing, modern technology is at its pinnacle, with it came wars, mass disasters, natural disasters, terrorist attacks, etc creating a need to handle such situations with great efficacy. The onus lies on the law agencies and medico legal experts to solve the problems of identification which arises under these scenarios where multiple victims are involved.

Determining the stature of an individual from the dismembered body parts is one of the vital duties of a medico legal expert to aid in identification of an individual.

In forensic investigations, stature can be calculated by using either anatomical method or mathematical method. The anatomical method involves measuring and adding together the lengths or heights of a series of contiguous

skeletal elements from the skull through the foot to reconstruct of stature. This method has proved to be more precise to estimate the stature of victims of mass disasters, where the corpses are occasionally unidentifiable.¹

Estimating statures through human remains is based on the principle that there is a linear relationship between statures and various parts of the human body and bones.² Based on the correlation, attempts have been made to establish the stature from the dimensions of almost all the body parts/ bones.³

The present study is undertaken to study the correlation between stature with individual finger length and palm lengths at the level of second to fifth finger separately in both males and females of South Indian population.

MATERIALS AND METHODS

The present study was set up in the department of anatomy of Al Ameen Medical College, Bijapur. 300 healthy adult 150 females and 150 males, of age varying from 18 to 30 years were selected after taking informed consent from all the participants.

Those individuals who are left handed subjects or subjects with skeletal abnormalities and connective tissue disorders, which may be congenital or acquired were exclude from the study.

METHOD OF COLLECTION OF DATA

Stature: Stature was measured as the distance from the utmost point of the crown of the head in the mid sagittal plane to the feet on flat surface using a standard Stadiometre. Subject was made to stand on the resting base of stadiometer, with palm turned inwards, fingers pointing vertically downward and the head positioned in Frankfurt Plane. The movable rod of the Stadiometer was brought in contact with vertex in the mid saggital plane.⁴

Palm Length and Finger Lengths were Measured as using Vernier Callipers

Palm length: It is the distance from the distal wrist crease to the proximal phalangeal ridge

of the corresponding fingers.⁵ (PL2 – palm length at index finger, PL3–palm length at middle finger, PL4–palm length at ring finger, PL5–palm length at little finger)

Finger Length: The subject is asked to place the hand on a flat table and the distance between the proximal phalangeal ridge to the most forward projecting point on the tip of fingers was noted.⁶ (TL–thumb length, IFL–index finger length, MFL- middle finger length, RFL–ring finger length, LFL–little finger length)

Statistical Method Adopted: Initially for summarising the data, the Mean, Standard deviation (SD), Correlation coefficient (p) and value of Significance (r) are estimated and presented. Regression equations were derived to estimate stature from palm lengths and finger lengths using trial version of SPSS software 16.0.

RESULTS

The mean age of males was 20.11 years and that of females was 18.47years. The average height of males was 1680+/-63.2mm and that of females was 1564.1+/-59.2mm. (as in table 1)

Table 1: Table showing distribution of age (years) and height (mm) among study population.

		Mean	Standard deviation	Minimum	Maximum
Age	Males	20.11	1.34	18	22
	Females	18.47	5.92	18	22
Height	Males	1683	63.2	1570	1870
	Females	1564	59.2	1440	1700

Palm lengths at second and fifth digit showed negligent correlation coefficient value with stature, whereas there was significant correlation between palm length at third and fourth digit with stature in both males and females. Right hand palm length at third digit showed higher correlation coefficient with stature both in males(r=0.32, p=0.001) and in females(r=0.57, p=0.001). (as in table 2)

Table 2: Mean, Standard Deviation (SD), Regression Coefficient (r) and Significance value (p) for Palm length (in mm) among males and females included in study population.

		PL2	PL3	PL4	PL5
Males: Right Hand	Mean	93.87	101.1	95.85	84.97
	SD	4.63	4.35	4.25	9.23
	r	0.09	0.32	0.24	0.07
	p	0.1	0.001	0.001	0.02
Males : Left Hand	mean	92.22	98.44	93.63	84.6
	SD	5.48	4	4.29	4.67
	r	0.02	0.2	0.21	0.03
	p	0.1	0.002	0.001	0.1
Females: Right Hand	mean	89.3	92.3	88.26	78.36
	SD	5.33	5.57	6.04	7.65
	r	0.03	0.51	0.53	0.05
	p	0.1	0.001	0.001	0.1
Females : Left Hand	mean	87.98	90.73	87.53	77.52
	SD	5.66	5.56	5.87	5.67
	r	0.02	0.21	0.17	0.06
	p	0.2	0.001	0.002	0.12

(PL2 – palm length at index finger, PL3 – palm length at middle finger, PL4 – palm length at ring finger, PL5 – palm length at little finger)

Among males, right third digit length ($r=0.47$, $p=0.001$) and left second digit length ($r=0.47$, $p=0.001$) were better correlated with stature than other digit lengths. Among females, right third digit length ($r=0.58$, $p=0.001$) showed highest correlation with stature than other digit lengths. (as in table 3)

Table 3. Mean, Standard Deviation, Regression Coefficient and Significance value for finger length (in mm) among males study population.

		TL	IFL	MFL	RFL	LFL
Males: Right hand	Mean	56.98	74.78	83.65	79.47	60.53
	SD	6.22	7.54	8.32	8.48	4.95
	R	0.08	0.39	0.47	0.42	0.32
	P	0.1	0.003	0.001	0.001	0.002
	Mean	57.18	73.26	82.83	78.54	60.51
Males: Left hand	Mean	56.98	74.78	83.65	79.47	60.53
	SD	6.22	7.54	8.32	8.48	4.95
	R	0.08	0.39	0.47	0.42	0.32
	P	0.1	0.003	0.001	0.001	0.002
	Mean	57.18	73.26	82.83	78.54	60.51
Female: Right hand	Mean	58.22	65.26	72.72	67.7	54.52
	SD	5.07	5.33	5.44	5.38	5.91
	R	0.1	0.5	0.58	0.53	0.5
	P	0.1	0.001	0.001	0.001	0.001
	Mean	57.14	65.03	72.27	66.7	53.74
Females: Left hand	SD	5.25	6.37	5.44	5.41	5.46
	r	0.16	0.24	0.29	0.23	0.23
	P	0.04	0.001	0.001	0.004	0.003

(TL – thumb length, IFL – index finger length, MFL- middle finger length, RFL – ring finger length, LFL – little finger length).

Table 4: Regression Equations for calculating Stature from Palm lengths of Males and Females included in the study.

		Right hand	Left hand
Males	Height=	1564+0.12 (PL2)	1709+0.02 (PL2)
	Height=	1210.8+0.46 (PL3)	1365+0.32 (PL3)
	Height=	1340.5+0.35 (PL4)	1528+0.16 (PL4)
	Height=	1726+0.05 (PL5)	1518+0.19(PL5)
Females	Height=	1564+0.12 (PL2)	1709+0.02 (PL2)
	Height=	1210.8+0.46(PL3)	1365+0.32 (PL3)
	Height=	1340.5+0.35(PL4)	1528+0.16 (PL4)
	Height=	1726+0.05(PL5)	1518+0.19 (PL5)

Table 5: Regression Equations for calculating Stature from finger lengths of Males and Females included in the study.

		Right hand	Left hand
Males	Height =	1734+0.08 (TL)	1737+0.09 (TL)
	Height =	1436+0.33 (IFL)	1365+0.43 (IFL)
	Height =	1379+0.36 (MFL)	1360+0.38 (MFL)
	Height =	1433.8+0.31 (RFL)	1422+0.33 (RFL)
	Height =	1429+0.41 (LFL)	1453+0.37 (LFL)
Females	Height=	940.5+1.07 (TL)	1456+0.18 (TL)
	Height=	910.02+1 (IFL)	1418+0.22 (IFL)
	Height=	817++1.02 (MFL)	1408+0.21 (MFL)
	Height=	904+0.97 (RFL)	1389+0.26 (RFL)
	Height=	1067+0.9 (LFL)	142.9+0.24 (LFL)

DISCUSSION

Anthropometric studies on correlation of stature with different parts of the body have attracted many researchers across the globe.

In the past, scientists have used each and every bone of the human skeleton right from femur to metacarpals in estimation of stature. They all have reached a common conclusion that stature can be estimated with great accuracy even from the smallest bone.³

In the past, many researchers have correlated stature and various body fragments, but there are handful of studies on correlation and estimation of stature from palm length.

Salama (2013) conducted a similar study on stature estimation by using both actual hand

measurements and hand print measurement in Egyptian population. Using student t. test, it was concluded that there was significant sex difference for all hand parameters. There is no statistically significant difference between left and right hand measurements in both sexes. All hand measurements (including palm length) in both males and females are significantly correlated to stature (P=0.5).⁷

Pal et al. (2016) conducted a study on 1662 adult Bengalese women aged from 20 to 40 years. Palm length at the level of 3rd digit was measured. He concluded that, palm length was significantly correlated with the stature and there was no significant bilateral variation in palm length measurements.⁸

Ekezie et al. (2014) conducted a similar study in ethnic group of Nigeria. He concluded that palm length provides the highest reliability and accuracy in estimating stature.⁹

In the present study all the parameters of palm length showed significant correlation with the stature. Palm length at 3rd and 4th digit showed higher correlation with the stature in both male and female study population.

In a study, conducted by Kumar et al. (2014) on 200 medical students and staff of Mysore district of Karnataka, it was found that there exists Statistically significant correlation was observed between stature and middle finger length of both hands.¹⁰

Suseelamma et al. (2014) conducted a similar study correlating stature and finger length. It was concluded that a significant correlation was present between all the finger lengths and stature in both males and female study subjects. Pearson correlation between finger length and stature was higher among males than females height and length of the fingers of the hand were significantly more in males compared to females.¹¹

In the present study, all the finger lengths have shown positive correlation with stature in both male and female study subjects (p< 0.1). The mean finger length in males was higher than in females included in the study (Males mean finger length: 56.98mm-83.65mm in right hand and 57.18mm-82.83mm in left hand) (females, mean finger length : 54.52mm-

72.72mm in right hand and 53.74mm-72.27mm in left hand).

CONCLUSION

The anthropometric measurements fluctuate in different sex and ethnic groups which can be determined by genetic and environmental elements suggesting the need for different normograms for different populations.

These varieties of researches are of anthropological importance because it facilitates to understand the distinction among populace. If the study is repeated on

the identical population group after numerous years, it will assist to perceive the micro evolutionary changes. In addition it facilitates forensic evaluation in organizing identification of individual in question, where in stature is one of the primary traits of identification.

Conflict of Interest:

The author has made no acknowledgment in this article.

Ethical Clearance

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