

## Utility of middle finger length in stature estimation among Maharashtrian students at S. R. T. R. Government Medical College, Ambajogai, Dist. Beed, in Maharashtra, India

Shashank S. Waghmare<sup>1</sup>, Vishwajeet G. Pawar<sup>2\*</sup>, Rajesh V. Kachare<sup>3</sup>

<sup>1</sup>Junior resident, <sup>2</sup>Associate Professor, <sup>3</sup>Professor and Head, <sup>1-3</sup>Dept. of Forensic Medicine, SRTR Govt. Medical College, Ambajogai, Dist. Beed, Maharashtra, India.

**Corresponding Author: Vishwajeet G. Pawar**

Email: drwaghmare444@gmail.com

### Abstract

**Introduction:** Establishing the identity of person is very essential for the Forensic investigation. Moreover, the work gains importance while dealing with mass disaster or examining mutilated and commingled body parts or dismembered body parts. For the medico legal experts to identify a body, stature is an important component. So in the present study an effort has been made to study correlation between stature and middle finger length using appropriate statistical methods.

**Aims and Objectives:** To establish correlation between stature and middle finger length and also to derive regression formulae to indicate relationship between stature and middle finger length.

**Material & Methods:** The present cross sectional study consists of 240 medical students between the age group of 18-25 year at SRTR Government Medical College, Ambajogai, Dist. Beed, Maharashtra, India. We measured stature and middle finger length of study subjects with the help of stadiometer and digital vernier calliper.

**Results:** Proportion of variance ( $r^2$ ) and p value for stature and middle finger length in males, of right and left side were 0.2642, 0.0001 and 0.2686, 0.0001 respectively (Table 5). While the similarly estimated values in females were 0.1827, 0.0001 and 0.1824, 0.0001 for right and left middle finger respectively. Regression equations of estimation of stature in male was  $6.443 \times \text{RMFL} + 118.7$  for right middle finger and  $6.473 \times \text{LMFL} + 118.56$  for left middle finger length. While in female regression equation was  $5.589 \times \text{RMFL} + 114.18$  and  $5.621 \times \text{LMFL} + 114.10$  for right and left middle finger.

**Conclusion:** Stature and middle finger length of both the hands shows positive strong correlation so that forensic experts can estimate the stature with the help of middle finger length.

**Keywords:** Forensic Investigation, Identity, Regression formula, Stature.

### Introduction

Establishing the identity of person is very essential for the Forensic investigation. Moreover, the work gains importance while dealing with mass disaster or examining mutilated and commingled body parts or dismembered body parts. Identification determines the individuality of a person based on certain physical characteristics in living or dead person, mutilated bodies, decomposed bodies and skeletonized bodies and is one of the most important factors in completing the crime investigation.<sup>1-6</sup> Stature, age, sex, and ancestry will help to narrow down the pool of victim matches in forensic investigations.<sup>7</sup>

For the medico legal experts to identify a body, stature is an important component. Various parameters such as age, sex, ethnicity, stature etc. are used for personal identification. Among these, stature estimation is an essential parameter of medico-legal investigations, once a body is disfigured or dismembered. The stature prediction occupies relatively a central position in the identification necessitated by the medico-legal experts or medical juries and also in the anthropological research. Stature is the natural height of a person in an upright position. It is maximum between the age group of 20-25 years.<sup>8-11</sup>

The loss of stature in the older individuals has been recognized by forensic experts, anthropologists and other researchers who were interested in the study of aging process. There are many studies showing intra-individual diurnal and positional variation of stature.<sup>12</sup>

Determination of stature is quite easy when complete body is recovered, but it will become difficult task for forensic experts when there are only few body parts or fragments. At times Forensic experts may come across cases like skeletal remains, body parts remains in accidents, murders, natural disasters like conditions, for medico-legal examination and identification analysis and from these evidence they skillfully determine stature and important information of recovered body parts. There is scanty data regarding estimation of stature from middle finger length in Maharashtrian population. Dimensional relationships between the body segments and whole body has been an area of interest to anatomists, anthropologists and medico legal experts for long time. Prediction of stature when only hand or fingers are found can be ascertained with the help of regression formula for certain geographical area as stature is influenced by many factors like nutrition, region, race, etc.<sup>13</sup>

So in the present study a sincere effort has been made to study correlation between stature and middle finger length using appropriate statistical methods and software among medical Students of S R T R Government Medical college of Maharashtra, India.

### Aims and Objectives

1. To establish correlation between stature and middle finger length.
2. To derive regression formulae to indicate relationship between stature and middle finger length.

## Materials and Methods

### Source of Data

The present cross sectional study consists of 240 Maharashtrian medical students between the age group of 18-25 years of SRTR Government Medical College, Ambajogai, Dist. Beed, Maharashtra, India.

### Method of Collection of Data

The study was conducted in SRTR Government Medical College, Ambajogai, Dist. Beed, Maharashtra, India. The period of study was from July 2018 to December 2018. The objectives and the methods of the study was explained to the sample population, and informed written consent was obtained, by taking their signatures. All the measurements were taken in a reasonably well lit room, at a fixed time between 9.00 a.m. to 5.00.p.m. to eliminate diurnal variation. It was measured and recorded only by me, to avoid inter observer error in methodology. Students having deformities in the hand like amputation of finger, congenitally malformed limbs, metabolic disorders and also developmental defects were excluded from the study along with non-consenting students.

### Anthropometric Measurements

1. Stature
2. Middle Finger Length of the left and right sides were measured.

### Land Marks and Technique involved in Taking Anthropometric Measurements

#### Stature

It was measured as vertical distance from the vertex to the floor. Measurement was taken by making the subject to stand erect on a horizontal resisting plane, bare footed with shoulder blocks and buttocks touching the wall. Palms of hand were turned inwards and fingers horizontally pointing downwards. Stadiometer was placed in straight vertical position in front of the subject with head oriented in Frankfurt Plane (eye-ear-eye plane). The movable rod of the Stadiometer is brought in contact with vertex in the mid sagittal plane. (Fig. 1)



**Fig. 1:** Estimation of stature by stadiometer.

#### Middle Finger Length

The subject is asked to place the hands on a flat table, and the distance between the phalanges and dactylions of the middle finger was taken using a sliding digital vernier caliper. (Fig. 2)



**Fig. 2:** Estimation of middle finger length by digital vernier calliper

### Statistical Methodology Adopted

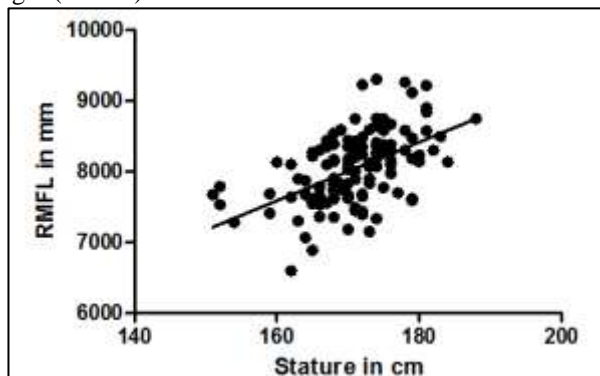
Initially for summarizing the data, the Range, Minimum, Maximum, Mean and Standard deviations are estimated and presented. To study the relation between Middle Finger lengths of each side and Stature, the Pearson correlation coefficient for finger length with stature was estimated and the significance was tested through Z-test. The results are presented separately for Males and Females.

The prediction factor was derived through linear regression for each of the finger measurement with stature for both Males and Females separately. The presentation provides the values of Constant, Regression coefficient with its significance, Percentage variation ( $r^2$ ).

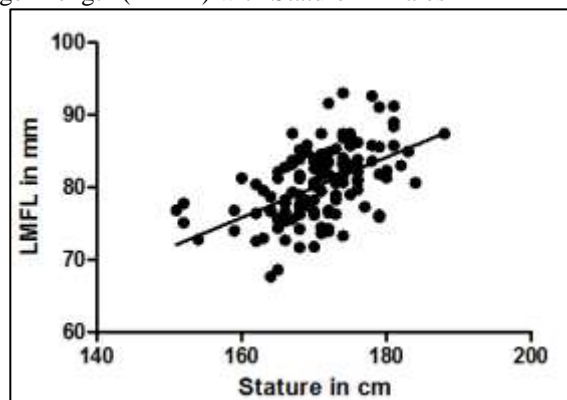
**Results**

In the presents study we observed 240 medical students between theage group of 18-25 years of S R T R Government Medical College, Ambajogai, Dist. Beed, of Maharashtra, India for establishing co-relation between stature and middle finger length.

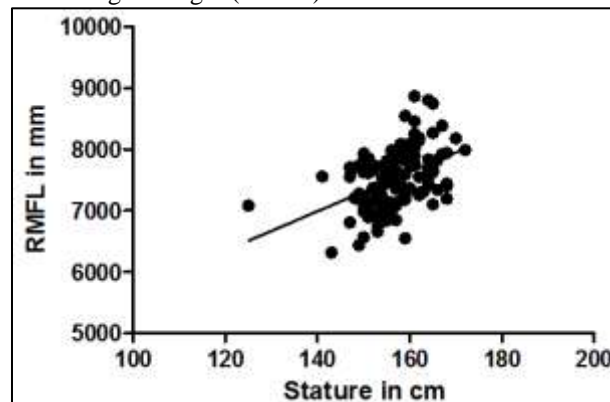
**Graph 1:** Variation ( $r^2$ ) and p value of right middle finger length (RMFL) with stature in males



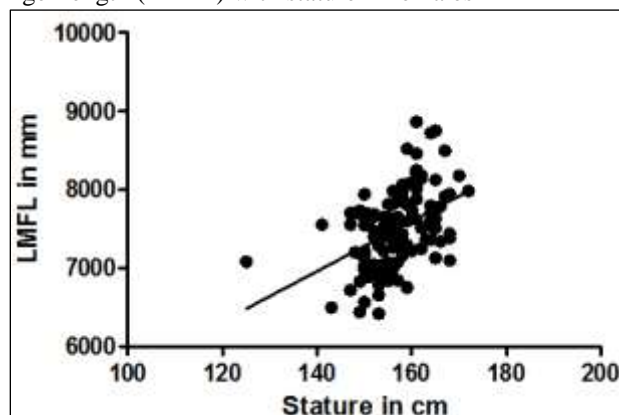
**Graph 2:** Showing linear regression analysis of Left Middle Finger Length (LMFL) with Stature in Males



**Graph 3:** Showing linear regression analysis of Right Middle Finger Length (RMFL) with Stature in Females



**Graph 4:** Showing linear regression analysis of left middle finger length (LMFL) with stature in females



**Table 1:** Distribution of study population according to sex

Study Population	Number	Percentage (%)
Male	126	52.5
Female	114	47.5
Total	240	100

**Table 2:** Distribution of study population according to age groups

Study Population Age groups in year	Male	Female	Total
>18 – 19	14	06	20
>19-20	25	31	56
>20-21	25	32	57
>21-22	35	23	58
>22-23	21	13	34
>23-24	3	7	10
>24-25	3	2	05
Total	126	114	240

**Table 3:** Minimum- Maximum Mean, Standard deviations, p value and standard error of mean of stature measurements.

Stature (cm)	Number	Minimum (In cm)	Maximum (In cm)	Mean (In cm)	Std. Deviation	SEM
Male	126	151	188	170.5	6.097	0.4423
Female	114	125	172	156.1	6.253	0.4315

P value is 0.0001 showing highly statistical significance.

**Table 4:** Minimum - Maximum Mean, Standard deviations and standard error of mean of middle finger measurements

MFL (cm)	Side	No.	Minimum (In cm)	Maximum (In cm)	Mean (In cm)	SD	SEM
Male	Right	126	6.599	9.305	8.021	0.4911	0.035
	Left	126	6.770	9.301	8.019	0.4896	0.035
Female	Right	114	6.314	8.864	7.503	0.4687	0.032
	Left	114	6.418	8.865	7.474	0.4674	0.032

**Table 5:** Variation ( $r^2$ ) and p value of middle finger measurements with stature in males

Middle Finger	r2	p value
Right Side	0.2642	0.0001
Left Side	0.2686	0.0001

**Table 6:** Variation ( $r^2$ ) and p value of Middle Finger Measurements with Stature in Females

Middle Finger	R	p value
Right Side	0.1827	0.0001
Left Side	0.1824	0.0001

**Table 7:** Regression equations for estimation of stature in males

Right Hand Middle Finger	Left Hand Middle Finger
Stature = 6.443×RMFL+118.7	Stature = 6.473×LMFL+118.56

**Table 8:** Regression equations for estimation of stature in females

Right Hand Middle Finger	Left Hand Middle Finger
Stature = 5.589×RMFL+114.18	Stature = 5.621×LMFL+114.10

## Discussion

In the present study we observed 240 medical students between 18 to 25 years of age for correlation of stature and middle finger length. Out of study population 126 were male and 114 were female (Table 1). We divide study population according to age groups and we found that maximum 58 students were from 21 to 22 years of age group (Table 2).

For estimation of correlation of stature and middle finger we measured stature of study population. The stature ranges from 151 cm to 188 cm in male students and 125 cm to 172 cm in female student. The mean was 170.5 cm for male and 156.1 cm for female, p value was 0.0001 stating that high statistical significance in stature of male and female (Table 3).

In male students the mean of right and left middle finger length was 8.021 cm and 8.019 while in female it was 7.503 cm and 7.474 cm for right and left middle finger respectively (Table 4).

Proportion of variance ( $r^2$ ) and p value for stature and middle finger length in males, of right and left side were 0.2642, 0.0001 and 0.2686, 0.0001 respectively (Table 5). While the similarly estimated values in females were 0.1827, 0.0001 and 0.1824, 0.0001 for right and left middle finger respectively (Table 6). These results proved positive

correlation between stature and middle finger length with high statistical significance.

After detail analysis we found regression equations of estimation of stature in male 6.443×RMFL+118.7 for right middle finger and 6.473×LMFL+118.56 for left middle finger length (Table 7). While in female regression equation is 5.589×RMFL+114.18 and 5.621×LMFL+114.10 for right and left middle finger (Table 8).

Similar findings of significant correlation between stature and middle finger length were observed by Katwal B et al<sup>14</sup>, Vishal Koulapur et al<sup>15</sup>, Kan F et al<sup>16</sup>, Shivakumar AH et al<sup>17</sup>, Pooja Ahuja et al<sup>18</sup>, Gayathri Matheswaran et al<sup>19</sup>.

## Conclusion

Stature and middle finger length of both the hands shows positive strong correlation so that forensic experts can estimate the stature with the help of middle finger length. This research is not going to serve only as a useful tool in forensic investigation and clinical practice, but also has relevance in ergo-design applications of hand tools and devices.

**Conflict of Interest:** None.

## References

1. Bardale RV, Dahodwala TM, Sonar VD. Estimation of stature from index and ring finger length. *J Indian Acad Forensic Med* 2013;35(4):353-57.
2. Kroeber AL. Kroeber Anthropology-chapter 1. 3rd Indian Reprint. New Delhi: Oxford & IBH Publishing Co; 1976:1-13.
3. Reddy KSN. The Essentials of Forensic Medicine and Toxicology. 27th ed Hyderabad: K Sugunadevi; 2007: 74-5.
4. Parikh CK. Parikh's Textbook of Medical Jurisprudence and Toxicology. 6<sup>th</sup> Ed. New Delhi: CBS Publishers and Distributors; 2002:2.2,2.31-2.32.
5. Krogman WM. The human skeleton in Forensic Medicine. 2<sup>nd</sup> ed. Springfield: Charles C Thomas; 1986:302-51.
6. Nandy A. Principles of forensic medicine. 2<sup>nd</sup> ed. Calcutta: New Central Book Agency; 2001:86-89.
7. Manoj B., Vina Ravi Vaswani. Estimation of Stature from the Length of the Right Index Finger in a Population in an Area in Dakshina Kannada and Sexual Dimorphism Exhibited. *J Forensic Sci Criminal Invest* 2017;5(2):1-8.
8. Dayal MR, Steyn M, Kuykendall KL. Stature estimation from bones of South African Whites. *S Afr J Sci* 2008;104:124-28.
9. Galloway A. Estimating Actual Height in the Older Individual. *J Forensic Sci* 1988;33(1):126-36.
10. Krishan K, Vij K. Diurnal Variation of Stature in Three Adults and One Child. *Anthropologist* 2007;9(2):113-17.
11. Laila SZH, Ferdousi R, Nurunnobi ABM, Islam S, Holy SZH, Yasmin F. Anthropometric Measurements of the hand length and their correlation with the stature of Bengali adult Muslim females. *Bangladesh J Anat* 2009;7(1):10-13.
12. Sinnatamby CS. Last's Anatomy. Regional and applied. 10<sup>th</sup> ed. Edinburgh: Churchill Livingstone; 1999. p103-69.
13. Sushil K, Kumar S. Estimation of stature by anthropometric examination of forearm and hand. *J Indian Acad Forensic Med*. 32(1):971-4.
14. Katwal B, Panta P P, Pandit R, Shrestha N. Estimation of stature from length of middle finger among nepalese medical student of Nepal Medical College and Teaching Hospital. *MedPulse Int J Forensic Med* 2017;3(2):1-4.
15. Koulapur V. Estimation of stature from middle finger length. *Int J Forensic Med Toxicol Sci* 2017;2(1):8-12.
16. Khan F, Vaswani VR, Pramod KL, Badiadka KK. Estimation of stature from middle finger length among. *Int J Recent Trends Sci Technol* 2016;18(3):384-87. ISSN 2277-2812 E-ISSN 2249-8109.
17. Shivakumar AH, Raju GM, Vijayanath V. Prediction of Stature by Right Middle Finger Length in Males among South Indian. *Indian Internet J Forensic Med Toxicol* 2013;11(4):90-3.
18. Ahuja P, Christal G, Manve P and Dahiya. Estimation of Stature from Finger Length. *J Forensic Sci Criminal Invest* 2018;7(2):555709. MS
19. Matheswaran G, Vallabhajosyula R. Digit length displays a significant fraction in stature estimation: a study from coastal region of south india. *Int J Anat Res* 2014;2(2):336-39.

**How to cite this article:** Waghmare SS, Pawar VG, Kachare RV. Utility of middle finger length in stature estimation among Maharashtrian students at S. R. T. R. Government Medical College, Ambajogai, Dist. Beed, in Maharashtra, India. *Int J Forensic Med Toxicol Sci* 2019;4(2):34-8.