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Estimation of Stature from Hand Length & Hand Width in Students of Tertiary Care Hospital

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ABSTRACT

Introduction: 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 medicolegal 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. 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 skilfully determine stature and important information of recovered body parts.

Objectives:

1. To find out the relationship between stature and hand length.
2. Comparison between male and female hand width & hand length.

Methods: Cross sectional study was conducted during October 2021-November 2021 in Department of Forensic Medicine in Medical College and Hospital Maharashtra. Study Population included 100 undergraduate medical students. **Result**: Simple linear regression was calculated to predict height (calculated height) based on hand length measurements. The test revealed that there was no significant difference between observed and calculated height of both male and female students, $p>0.05$. **Conclusion**: Hand length is a reliable parameter in reconstructing the stature of an individual.

Key Words: *Stature, Identification, Forensic expert.*

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INTRODUCTION:

Identification is determination of individuality of a person, living or dead. It can be complete or partial. Establishing the identity of person is very essential in Forensic investigation. It is important 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[1-6] Stature, age, sex and ancestry will help to narrow down the pool of victim matches in forensic investigations[7].

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[8-11].

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[12].

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 orfragments. 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 hand width in Maharashtrian population.Prediction of stature when only hand is 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[13]. With this background present study was planned with following objectives.

Objectives:

1. To find out the relationship between stature and hand length.
2. Comparison between male and female hand width & hand length.
3. Comparison between right and left hand of an individual.

Material & Methods:

Cross sectional analytical study was conducted in Department of Forensic Medicine in Medical College and Hospital. After obtaining clearance from institutional ethical committee, data was collected from 100 students aged between 20-25 years. Study was done during October 2021 to November 2021. Student's with physical debilities, skeletal defects and past historyof diseases affecting bones and joints and subjects who are on any form of hormonal medications were excluded from the study. All the subjects were briefed about the purpose of study and informed and written consent was obtained.

Parameter measured:

Hand length measurement was taken as a direct distance from the level of tip of the most distal point on the styloid process of the radius to the tip of the middle finger by using the spreading caliper. The student was asked to place the palmar aspect of hand flat on the table with the thumb abducted and fingers adducted. Stature/ height of the student were determined by stadiometer. It is measured as a distance from vertex to heel while standing in Anatomical position with bare foot on flat platform of stadiometer. All the measurements were taken to the nearest 0.1 cm. All the measurements were taken by principle author in order to minimize bias and error of identification of the landmarks involved in measurement. The measurements were taken twice, and an average of the two readings was calculated.

The data was entered in Epi-Info and analyzed with Statistical Package for Social Sciences (SPSS) version 16.0. Kolmogorov-Smirnov test (Normality of distribution) showed normal distribution both anthropometric variables (stature and hand length). Means and standard deviations (SD) were calculated. The relationship between body height and hand length was determined using simple correlation coefficients.

Then a linear regression analysis was performed to formulate an equation which predicts body height from hand length. Estimated height of students was calculated implementing the derived regression equations and the former was compared with the observed height using paired t test. Statistical significance was set at $p<0.05$.

Result:

Of the total 100 undergraduate students, 56 (56%) were males and 44(44%) were females. Mean and standard deviation of observed height for males and females were168.95±5.86 cm and 158.11±6.01cm respectively. The length of right hand in males varied from 14 cm to 21.3 cm with mean andstandard deviation of 17.714±1.43cm; whereas, that of left hand ranged from 14.2 cm to 21.3cm with mean and standard deviation of 17.741±1.37cm. On the other hand, the length of right hand in females fluctuated between 14.5 cm and 20 cm with mean and standard deviation of 17.761±1.46 cm; whereas, that of left hand ranged from 14.5 cm to 20 cm with mean and standard deviation of 17.78±1.41cm. Mean values of length of both right and left hands and height being higherin males than in females but observed difference was not statistically significant.

Table No.1 Stature and hand width in males & females

Measurements		Male (56)		Female (44)		P value
		Range	Mean± SD	Range	Mean± SD	
Observed height		152-183	168.95±5.86	148-171	158.11±6.01	0.001
Hand length	Right	14-21.3	17.714±1.43	14.5-20	17.761±1.46	0.87
	Left	14.2-21.3	17.741±1.37	14.5-20	17.78±1.41	0.88

Table 2: Regressing equations for the estimation of stature from hand length in males and females.

Gender	Side	Correlation coefficient (r)	r2 (coefficient of determination)	Regression equation	P value
Male	Right	0.425	0.18	1.695* PL) + 138.36	0.001

	Left	0.395	0.16	(1.673* PL) + 138.69	0.003
Female	Right	0.335	0.11	(1.5544* PL) + 131.23	0.026
	Left	0.36	0.13	(1.7192* PL) + 128.36	0.016

Simple linear regression was calculated to predict height (calculated height) based on handlength measurements. The significant regression equations were formulated with R2 (coefficient of determination) of 0.18 for males on right side & 0.16 on left side and 0.11 and 0.13 for females on right and left hand respectively.

Table 3: Calculated height using regression equations in males and females.

Gender	Measurement	Minimum	Maximum	Mean±SD	t	p
Male	Right hand length	162.11	174.32	168.87±2.44	0.311	0.75
	Left hand length	162.42	174.46	169.01±2.33		
Female	Right hand length	153.77	162.32	158.12±2.01	-0.022	0.98
	Left hand length	153.29	162.74	158.11±2.16		

Height of each student was calculated by adopting these regression equations, as shown in Table 3. The mean and standard deviation of height (calculated height) computed using the regression equations derived from length of right and left hands in males were 168.87±2.44 cm and 169.01±2.33 respectively, whereas, that in females were 158.12±2.01cm and 158.11±2.16 cm respectively. A paired t test revealed that there is no significant difference in the calculated height derived from regression equations using length of right and left hands in both sexes, p>0.05.

Table 4: Comparison between the observed and calculated height of males and females

Gender	Measurements	Calculated	Observed	t value	P value
		Mean±SD	Mean±SD		
Male	Right hand length	168.87±2.44	168.95±5.82	0.093	0.92
	Left hand length	169.01±2.33		-0.072	0.94
Female	Right hand length	158.12±2.01	158.11±6.01	-0.01	0.99
	Left hand length	158.11±2.16		0	1

The calculated height was compared with the observed height of the students using t test. The test revealed that there was no significant difference between observed and calculated height of both male and female students, p>0.05.

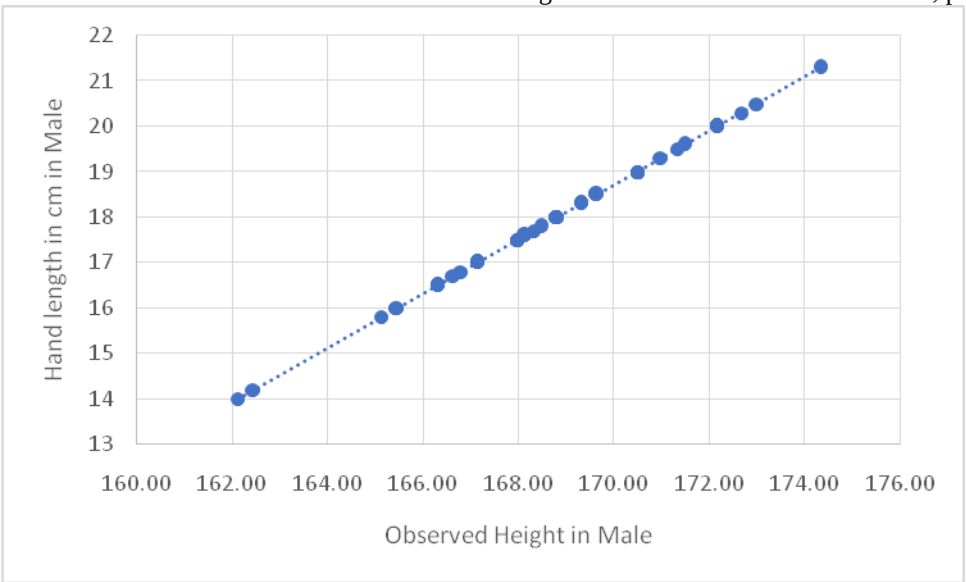

Figure No.1 Shows Right hand length in cm on Y-axis and Stature in cm on X-axis in Male

Limitation:

The present study was undertaken in students of MBBS first and second years with relatively small sample size (comprising of 100 students). Other traits such as age, race and ethnicity were not considered. Hence, result of the study may not be generalized.

CONCLUSION:

Hand length is a reliable parameter in reconstructing the stature of an individual. These regression equations may be immensely useful to the forensic pathologist when stature is to be determined from fragmentary remains of body parts to identify a living or deceased.

Ethical clearance: A prior approval was obtained from the Institutional Ethics Committee
Conflict of interest: None to declare
Source of funding: None to declare

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