

Finger Length as a Predictor Variable in Estimation of Stature.

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Abstract:

Identification of person is one of the most common objectives of forensic investigation. Recent studies use various body parts, especially finger lengths to estimate the stature of individuals. The present study tries to observe statistically significant correlation between stature and finger length from primary data of 200 undergraduate students (100 male and 100 female). Study also tries to predict the accuracy of regression models derived from such parameters. The findings of the study indicate that figure length can be used as predictor variable to predict the height of individuals.

Key words: identification, forensic, stature, finger length.

Introduction:

Identification of an individual is a very essential especially in forensic cases like mass disasters, mutilated, commingled, dismembered body parts found in murders, accidents and natural disasters. Identification can be done by various methods and techniques, one of which is by estimating stature. When a complete body is found the estimation of stature is very easy, but in cases where only few parts are available the estimation of stature is difficult. Estimating the stature is based on the principle that every body part has a constant relationship with the height of a person. In various studies the estimation of stature of an individual have done by correlating the foot length, palm length and even ring and index finger length with the height of a person. Current study aims to estimate the stature from the finger length and to find the most reliable finger for the estimation of stature on the basis of correlation and regression. The current study aims to identify the stature from finger length and to find the most reliable finger for the estimation of stature. One such study conducted by Suseelamma D et al. [1] was the Correlation between stature and length of fingers in which the objective of the study was to estimate stature from finger lengths and to predict the accuracy of regression models derived from such parameters [1]. A second study was conducted by GM Raju et al. [2] on Estimation of stature from index and ring finger length in Davangere district. The study was conducted by taking the measurement of index and ring finger length of right hand and height of 250 medical students of age group 18 to 25 years. Statistical analysis was done to establish the relationship between a person's index and ring finger length of right hand and stature. Regression equation and 'P' values were obtained. Rajesh Vajjnathrao Bardale et al. [3] conducted a study on Estimation of stature from index and ring finger length. 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 [4]. Ahuja, P. et al. in their study concluded that the left index and left middle finger are more reliable for the estimation of stature.[5]

Aims and Objectives:

- To study the correlation between stature and lengths of the fingers for both hands of an individual.
- To find out which finger is best to estimate the stature of an individual.

Methods and Methodology:

The present study was carried over the under graduate students of colleges of sivasagar, Assam which is located in the North-Eastern region of India. The study was carried out on a cross sectional sample of 200 under graduate students out of which 100 were males and 100 were females of 18-21 age groups. The students were selected randomly. Data on age, sex, height, and length of the fingers are collected from the students. The lengths of the fingers were measured by Vernier Calipers and height using Stadiometer.



Fig. 1: Measurement of Stature and figure length using Stadiometer and vernier calipers.

Pearsonian correlation coefficients between stature and lengths of each finger are obtained separately in an individual. Here we carried out the t-test to test the significance of correlation.

$$t = \frac{r}{\sqrt{1-r^2}} \times \sqrt{n-2} \quad \text{with } (n-2) \text{ degrees of freedom.}$$

To obtain the significance of the relationship between stature and finger length the linear regression equation is

$$y = \beta_0 + \beta_1 x$$

Where y = height, β_0 = constant (in cm), β_1 = regression coefficient (in cm),

x = figure length

Results and Discussion:

The data collected from 100 males and 100 females were statistically analysed using the SPSS software. The correlation between the stature and the finger lengths was done along with the regression equation. The correlation was done using the SPSS software and here positive correlation coefficient was found which are shown in the following tables. Along with these, regression equations and estimated value of height are shown in the tables 1 to 8.

TABLE 1: Pearson correlation coefficient of Right hand finger measurements with stature in males

Right Hand(Male)				
	Correlation Coefficient	p-value	t-test	p-value
Thumb Finger	0.452691	<0.001	5.006	<0.005
Index Finger	0.553571	<0.001	6.482	<0.005
Middle Finger	0.490452	<0.001	5.576	<0.005
Ring Finger	0.564014	<0.001	6.671	<0.005
Little Finger	0.442651	<0.001	5.378	<0.005

TABLE 2: Pearson correlation coefficient of Left hand finger measurements with stature in males

Left Hand(Male)				
	Correlation Coefficient	p-value	t-test	p-value
Thumb Finger	0.366848	<0.001	4.025	<0.005
Index Finger	0.580028	<0.001	7.089	<0.005
Middle Finger	0.515148	<0.001	6.056	<0.005
Ring Finger	0.387466	<0.001	4.197	<0.005
Little Finger	0.458944	<0.001	5.117	<0.005

TABLE 3: Pearson correlation coefficient of Right hand finger measurements with stature in females

Right Hand(Female)				
	Correlation Coefficient	p-value	t-test	p-value
Thumb Finger	0.406268	<0.001	4.1	<0.005
Index Finger	0.46072	<0.001	5.117	<0.005
Middle Finger	0.457825	<0.001	5.117	<0.005
Ring Finger	0.425732	<0.001	4.73	<0.005
Little Finger	0.335115	<0.001	3.581	<0.005

TABLE 4: Pearson correlation coefficient of Left hand finger measurements with stature in females

Left Hand(Female)				
	Correlation Coefficient	p-value	t-test	p-value
Thumb Finger	0.414602	<0.001	4.460	<0.005
Index Finger	0.441156	<0.001	4.460	<0.005
Middle Finger	0.398913	<0.001	3.231	<0.005
Ring Finger	0.3456	<0.001	3.686	<0.005
Little Finger	0.308869	<0.001	3.231	<0.005

TABLE 5: Regression equation for estimation of stature in males.

	Male Right Hand (in cm)	Male Left Hand(in cm)
Thumb Finger	Height=133.08+5.73(RT)	Height=139.12+4.86(LT)
Index Finger	Height=115.57+7.6(RI)	Height=110.57+8.29(LI)
Middle Finger	Height=114.20+7.07(RM)	Height=114.40+6.98(LM)
Ring Finger	Height=109.94+8.13(RR)	Height=129.97+5.436(LR)
Little Finger	Height=129.41+6.85(RL)	Height=129.33+6.89(LL)

TABLE 6: Regression equation for estimation of stature in females.

	Female Right Hand (in cm)	Female Left Hand(in cm)
Thumb Finger	Height=120.54+6.19(RT)	Height=120.986+6.215(LT)
Index Finger	Height=109.65+7.06(RI)	Height=117.63+5.905(LI)
Middle Finger	Height=111.05+6.216(RM)	Height=116.68+5.46(LM)
Ring Finger	Height=118.09+5.69(RR)	Height=125.32+4.628(LR)
Little Finger	Height=132.08+4.59(RL)	Height=137.54+3.58(LL)

TABLE 7: Regression coefficient for estimation of stature in males

Fingers	Constant(β_0)(in cm)	Regression coefficient(β_1) (in cm)
Thumb(RT)	133.08	5.73
Index(RI)	115.57	7.6
Middle(RM)	114.2	7.07
Ring(RR)	109.94	8.13
Little(RL)	129.41	6.85
Thumb(LT)	139.12	4.86
Index(LI)	110.57	8.29
Middle(LM)	114.4	6.98
Ring(LR)	129.97	5.436
Little(LL)	129.33	6.89

TABLE 8: Regression coefficient for estimation of stature in females.

Fingers	Constant(β_0)(in cm)	Regression coefficient(β_1) (in cm)
Thumb(RT)	120.54	6.19
Index(RI)	109.65	7.06
Middle(RM)	111.05	6.216
Ring(RR)	118.09	5.69
Little(RL)	132.08	4.59
Thumb(LT)	120.986	6.215
Index(LI)	117.63	5.905
Middle(LM)	116.68	5.46
Ring(LR)	125.32	4.628
Little(LL)	137.54	3.58

From the above calculations and results we came to the following conclusions. For female students of under graduate class the correlation values between stature and finger lengths of all the fingers significant. We observed that the regression coefficient is highest in Index finger (both right and left hand). For index finger (for right and left hand) we also got the best estimate of the height. In this case there is no difference between observed height and estimated height. For other fingers viz; right middle finger, right little finger, left thumb finger we got the estimated value same as observed value. But correlation between stature and middle finger (0.457), stature and little finger (0.425) (both for right and left hand) are high, there is slight difference from the respective highest correlation. There is also a slight difference of the correlation between stature and thumb finger length for left hand. For these above mentioned correlation the estimate height is equal to the observed height.

From the above discussion we may come to the conclusion that for female of age between 18 years to 21 years the length of index finger is the best to calculate the height of the individual.

The correlation between stature and the finger length of all the fingers of both hands are significant for males. The correlation was maximum for the index finger in the left hand and ring finger in the right hand. The difference of estimated stature for right thumb, right index, right middle, left thumb, right ring are slight differ from the measured height. The difference between estimated height and measured height are maximum for right ring and left index finger for which we got the maximum correlation. It is observed that the estimated height of male student is best for the ring finger of left hand.

Conclusion:

The height and length of the fingers of the hand were significantly more in males compared to females, a direct relationship was observed in both sexes. Pearsonian correlation coefficient between stature and figure length are higher for males than females. For female index figure is the best estimator to the height of the individuals. For male ring figure of left hand is the best estimator to estimate the height of individuals.

The study can be further continued by large population and for a high range of age group. It can also be done with respect to specific region or specific community.

References:

- [1] Suseelamma D, Gayathri P, Deepthi S, Chandra Mohan M, Uday Kumar et al. (2014) Study of Correlation between Stature and Length of Fingers. Sch J App Med Sci 2(2D): 773-784.
- [2] Raju GM, Shahina, Sarvesh Dubey, Vijayanath V (2014) Estimation of stature from index and ring finger length in Davangere district. International Journal of Clinical Trials 1(1): 18-21.
- [3] Rajesh VajjnathraoBardale, Taikhoom Mohammed Dahodwala, Vaibhav Digambar Sonar (2013) Estimation of Stature from Index and Ring Finger Length. J Indian Acad Forensic Med 35(4): 353-357.
- [4] Tyagi AK, Kohli A, Verma SK, Aggarwal BB; Correlation between stature and finger Length. International Journal of Medical Toxicology and Legal Medicine, 1999; 1: 20-22.
- [5] Ahuja P, Manve P, christal G, Dahiya MS(2018); Estimation of Stature from Finger Length; Journal of Forensic Sciences and Criminal Investigation.
- [6] Krishan K, Kanchan T, Asha N (2012) Estimation of stature from index finger length in north Indian adolescents population. J Forensic Med 19(5): 285-290.