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Original Research Article

Estimation of stature from little finger length and formulation of regression equation in both sexes

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ABSTRACT

Estimation of stature or height of a person is subject to variations during life due to muscular relaxation and elasticity of intervertebral discs, but could be still valuable in identification. Stature of an individual may reduce as age advances after 30 years due to natural senile degeneration. The stature will be reduced by 0.6mm per year after thirty. The identification of the dead body and corpus delicti is important before sentence is passed in murder trials. The present study was carried in the department of Forensic Medicine and Toxicology, ESIC Medical College, Kalburagi. Total 140 students (70 males and 70 females) from ESIC Medical College, Kalburagi were randomly selected for the study. The present study "Estimation of stature from little finger length and formulation of regression equation in both sexes" is taken with the aim, to determine correlation between stature and little finger length of a person and develop regression formulae to estimate stature from little finger length for both male and female sexes separately. The results of this study showed that there is a statistically significant relationship between the little finger length and the stature. In this study females shows strong correlation between little finger length and stature compared to males. The regression equation developed in the study can be used to estimate stature of a person efficiently with SE of 6.6289 and 6.5957 in males for right little finger and left little finger respectively and SE of 6.3239 and 5.3946 in females for right little finger length and left little finger length respectively.

1. Introduction

Estimation of stature or height of a person is subject to variations during life due to muscular relaxation and elasticity of intervertebral discs but could be still valuable in identification.[1] Stature of an individual may reduce as age advances after 30 years due to natural senile degeneration. The stature will be reduced by 0.6mm per year after thirty. In lying posture, the length will be more by approximately 2 cm. body length lengthens after death by about 2cm. Due to relaxation of muscles and joints, but when the rigor mortis is set in, there will be not much difference in length.[2] Stature estimation from dismembered body parts can be done on the basis of the ratio of the body part concerned, in relation to the entire body.[1] To trace the victim's movement and to know the background, dead victim should be identified by the police. To solve the crime, victim's identity is very important, otherwise it is difficult to solve the crime. The identification of the dead body and corpus delicti is important before sentence is passed in murder trials.[3] Among various identification data's stature along with age and sex are considered as primary characteristics

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of identification.[3] This process of identification is usually encountered in cases of mass disaster, assault cases where the body is mutilated to dismembered and establishment of identity of the victim poses a big challenge for investigating authorities.[4] Excessive complications are faced in the burnt dead bodies where only remnants are recovered.[5–7] First study of this type is conducted by Rollet in the year 1888, where he studied 50 male's and 50 female's corpses to show the relationship between various body measurements and the stature.[8] Many studies have established the relationship between stature and hand anthropometry.[9–13] Several authors have offered regression equations based on the length of long bones; however it is well known that formulae that apply to one population do not always give accurate results for other populations. In the previous studies conducted by scientists & researchers, it was observed that a proportions of body segment vary between the population of one place from other place which may be a cause of metamorphosis in environment, occupation etc.[14] Because of different body parts response differently and ripen change in environmental conditions as well as genetics. Pearson stated that a regression formula derived for one population should be applied to other groups with caution.[15] Many previous studies insisted that regression equation for stature estimation from various body measurements should be population specific. So, the present study "Formulation of regression equation to estimate stature from little finger length" is taken with the aim,

1. To determine correlation between stature and little finger length of a person.
2. To develop regression formulae to estimate stature from little finger length for both male and female sexes separately.

2. Materials and Methods

The present study was carried in the department of Forensic Medicine and Toxicology, ESIC Medical College, Kalaburagi. Total 140 students (70 males and 70 females) from ESIC Medical College, Kalaburagi were randomly selected for the study. Preliminary data like age, sex and address were noted. Height, length of both right and left little finger length of each student was measured during the time period of 2.00pm to 4.00pm to eliminate diurnal variation of height and by the same observer, using the same instrument to avoid personal error in methodology. Sufficient permissions and consents were procured before the measurements of the volunteers are taken and clearance from the Institutional Ethical committee is obtained in advance.

2.1. Inclusion criteria

All volunteers, both Male and Female were selected, irrespective of their socio-economic standards. The ages of these volunteers are falling between 18 years and 25 years with no history of any sort of deformity of the hand, metabolic disorders and any developmental process. This age group was chosen because the growth of an individual ceases by this age and there is no age-related loss in body height at this age.

2.2. Exclusion criteria

Subjects possessing injuries or deformities in the little finger of the hand, history of skeletal injuries, who are on any form of hormonal medications and morphologically showing the congenital malformations, Dwarfism /Achondroplasia, features of nutritional deficiencies were excluded from the studies.

2.3. Method used for taking finger length

The length of the little finger (RFL) of the left and right hand of each subject were measured with the aid of manual Vernier caliper, from the tip of the digit to the ventral proximal crease, where there was a band of crease at the base of the digit, the most proximal crease was used.

2.4. Method used for taking stature (height)

Stature is measured using the Stadio-meter, the subject was made to stand barefoot in the standard standing position on its baseboard. Both feet are in close contact with each other and head oriented in Frankfurt's plane. The height was then recorded in centimeter from the standing surface to the vertex in the weight bearing position of foot.

3. Results

The statistical data which are extracted from calculation are tabulated in Tables 1, 2, 3 and 4.

1 shows average, standard deviation and median for height, right little finger and left little finger length

2 shows correlation co-efficient of height with right little finger length and left little finger length separately for male and female. For males, correlation co-efficient of height with right little finger length and left little finger length are 0.2211 and 0.2416 respectively which show low degree positive correlation. Similarly, for females correlation co-efficient of height with right little finger length and left little finger length are 0.5064 and 0.6774 respectively which shows high degree positive correlation.

Table 3: Regression formulae developed for stature estimation

	Regression Equation
Males	Height = 152.04 + 4.12X Right Little finger Length
	Height = 149 + 4.473X Left Little finger Length
Females	Height = 110 + 9.19X Right Little finger Length
	Height = 89.75 + 12.99X Left Little finger Length

Table 1:

All in centimeters	Average		Standard Deviation		Median	
	Male	Female	Male	Female	Male	Female
Height	176.66	160.21	6.748	7.281	176.5	162
Rt. Little finger Length	5.97	5.46	0.361	0.401	6	5.5
Lt. Little finger Length	5.97	5.42	0.364	0.379	6	5.5

Table 2:

	Male	Female
Correlation of height with right little finger length	0.2211	0.5064
Correlation of height with left little finger length	0.2416	0.6774

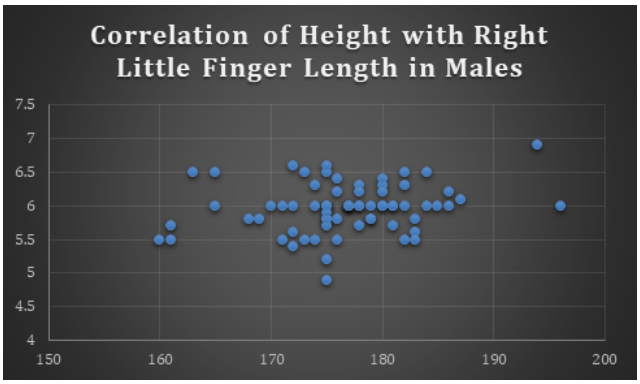

Fig. 1: Scatter diagram showing correlation of height with right little finger length in males

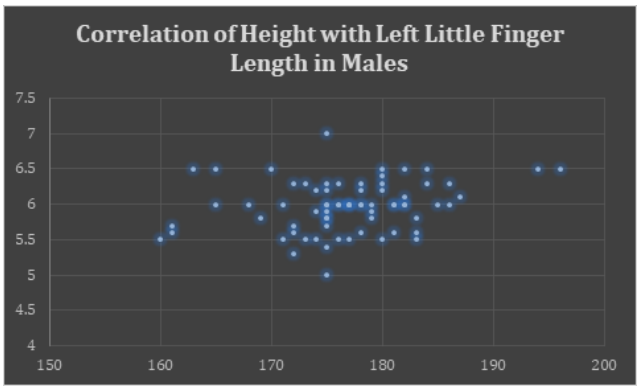

Fig. 2: Scatter diagram showing correlation of height with left little finger length in males

Table 4:

Standard Error	Male	Female
Right Little finger length	6.6289	6.3239
Left Little finger length	6.5957	5.3946

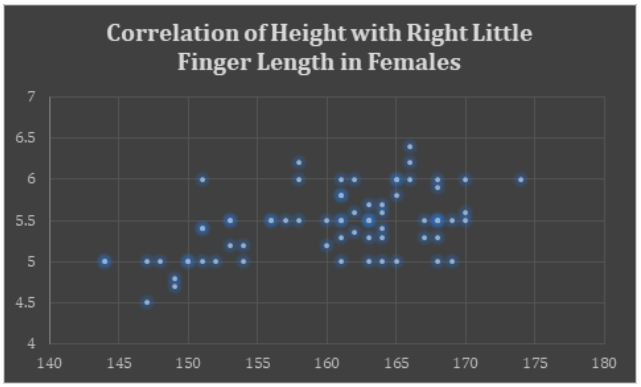

Fig. 3: Scatter diagram showing correlation of height with left little finger length in females

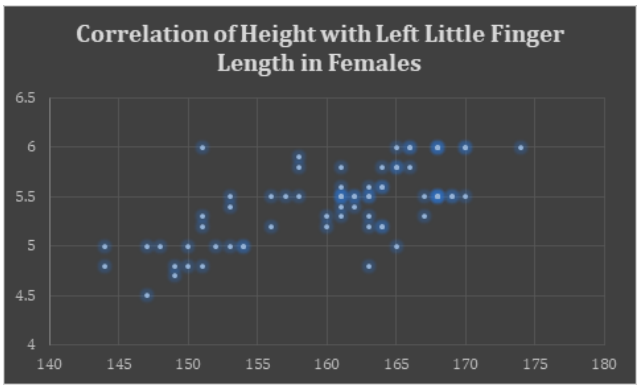

Fig. 4: Scatter diagram showing correlation of height with left little finger length in females

4. Discussion

In the present study stature shows good positive correlation coefficient with little finger lengths. For males, correlation co-efficient of height with right little finger length and left little finger length are 0.2211 and 0.2416 respectively which show low degree positive correlation. Similarly, for females correlation co-efficient of height with right little finger length and left little finger length are 0.5064 and 0.6774 respectively which shows high degree positive

correlation.[16] Where as in a study done by Rhiu I. and Kim W., shows correlation coefficient between height and Little Finger length +0 .485**in males and + .293 in females. In male it shows moderate degree of correlation where as in female it shows less degree of correlation.[17] In a study done by Manisha, Amit Chauhan* and S K Shukla shows correlation coefficient between height and right Little Finger length +0 .173 in males and + .289 in females and left Little Finger length +0 .159 in males and + .297 in females. In male and female it shows less degree of correlation.[18] In a study conducted by B. Vasant Nayak, Ch. Laxmanrao, Nishat Ahmed Sheikh shows high degree correlation coefficient between stature and little finger lengths. In males correlation of stature with right little finger length is 0.894 and with left little finger length is 0.896. in females correlation coefficient of height with right little finger length is 0.874 and with left little finger length if 0.861.[19] In a study conducted by Suseelamma et al. also showed positive correlation in case of RFL with the stature in both the genders.[20] 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.[21] According to study conducted by Bardale RV et al., amongst males, correlation was higher between the ring finger length and stature (right hand r = 0.546 and left hand r = 0.572). In females, correlation was higher between index finger and stature (right hand r = 0.618 and left hand r = 0.612).[22]

5. Conclusions

The results of this study showed that there is a statistically significant relationship between the little finger length and the stature. In this study females shows strong correlation between little finger length and stature compared to males. The regression equation developed in the study can be used to estimate stature of a person efficiently with SE of 6.6289 and 6.5957 in males for right little finger and left little finger respectively and SE of 6.3239 and 5.3946 in females for right little finger length and left little finger length respectively. Most authors have underlined the need for population-specific stature estimation formulae. The main reason for this is, the ratio of various body parts differs from one population to another.

In addition to ethnic differences, secular trend and even environmental factors such as socioeconomic and nutritional status can influence body proportion. So in this study we derived a separate regression equation for male and female to estimate stature from little finger length for this region.

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