Original Communication

Middle Finger Length - a Tool for Stature Estimation

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Abstract
The estimation of stature from skeletal remains is one of the basic requirements and is extensively studied specifically from long bones. However, stature estimation from fragments of skeletal or body remains is a tedious process and needs to be researched. The present study attempts to determine the stature from middle finger length. Length of middle finger was measured from 200 individuals (100 males & 100 females) belonging to Mysore district, Karnataka, India aged between 21 and 30 years. Measurements of middle finger length (MFL) were recorded using a vernier caliper and the individual height (stature) was recorded using an anthropometric rod and the data was subjected for statistical analysis using SPSS software. Mean stature was significantly higher in males than females. Mean MFL on right and left sides respectively was 9.79 cm and 9.74 cm in males and 9.22 cm and 9.21 cm in females. MFL was larger in males than females in both hands. Statistically significant correlation was observed between stature and middle finger length of both hands. Pearson correlation (r) for stature and finger lengths was higher among females than males. Independent linear regression equations to calculate the height was formulated in males & females separately.
Key words: Anthropometer; middle finger length; stature; identification

Introduction

Stature is considered as one of the primary data for identification. The stature prediction occupies relatively a central position in the identification necessitated by the medico-legal experts or medical jurisprudence and also in the anthropological research.

When a complete dead body is found, stature determination is rather an easy task; but in cases where only parts of the body are available, the determination of stature of the individual becomes difficult.[1]Estimation of stature of an individual from the skeletal remains or from mutilated or amputated limbs or from parts of limbs has obvious

significance in the personal identification in the event of alleged homicide, accidents or natural disasters, mainly concerned with the forensic identification analysis.

The retrieval of mutilated remains is not uncommon, because many a times the bodies are mutilated with the intention of either concealing the identity of the deceased after committing a crime or to facilitate the disposal of dead. In some circumstances fragmentary remains may also be recovered from forests or lonely places mutilated by wild animals.[2] The need to develop methods to construct stature from various bones has been stressed by many workers due to its application in forensic medicine, in medico-legal enquiries and in identifying war or mass disaster casualties.

Till date, most of the workers on stature estimation have used the length of long bones such as femur, tibia, humerus, radius, etc.[3] Very little data is available on previous

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work done for calculation of height from middle finger length. [4]

Material and Methods

The study was conducted in the department of Forensic Medicine and Toxicology attached to a Medical School located in Mysore, India. In this study length of middle finger & height were measured from 200 individuals (100 males & 100 females) belonging to Mysore district, Karnataka, India aged between 21 and 30 years. Non-resident Indians and individuals from other than Mysore district were excluded from the study. Subjects with Skeletal abnormalities and connective tissue diseases, which may be congenital or acquired, were also excluded. Informed written consent was obtained prior to recording the measurements.

Anthropometric measurements and Techniques:

Measurements of middle finger length of males and females were taken by using a vernier caliper and the height was recorded using Anthropometer rod. Stature was measured as vertical distance from the vertex to the floor. Measurement was recorded 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. Anthropometer was placed in straight vertical position in front of the subject with head oriented in eye-ear-eye plane (Frankfurt Plane). The movable rod of the Anthropometer is brought in contact with vertex in the mid sagittal plane[5]. To measure Finger Length the subject is asked to place the hands on a flat table, and the distance between the phallangions and dactylions of the respective fingers was recoded using a vernier caliper. [5]

Statistical analysis:

The data was analysed using SPSS (Statistical Package for social science) version 18.0 to calculate descriptive statistics of stature and finger length for male & female subjects. For assessing the correlation between the stature and middle finger length, Pearson's correlation co-efficient was calculated and its significance was tested at a p-value of less than 0.05. The correlation coefficient was calculated separately for both male and female subjects. Linear regression models and multiplication factor were also derived for stature estimation from middle finger length in males & females keeping the stature as dependant variable and middle finger length as an independent variable. A multiplication factor was derived by dividing stature by middle finger length in each individual. Mean of multiplication factor thus derived was taken as the multiplication factor for the estimation of stature from middle finger length in right and left hand

Results

The stature of the individuals included in the study ranged from 159 cm to 182 cm in males and 145cm to 182cm in females. Mean stature was significantly more in males than females. Mean MFL of right and left sides respectively was 9.79 cm and 9.74 cm in males and 9.22 cm and 9.21 cm in females. MFL was more in males than females in both the hands. Descriptive statistics of stature, middle finger length of both hands are depicted in table No.1 and table No.2. Statistically significant correlation was observed between stature and middle finger length of both hands. Pearson correlation (r) for stature and finger lengths was higher among females than males as shown in table No.3. The relationship between middle finger length and stature among males and females is shown in figures 1(a & b) and 2 (a & b) respectively. The multiplication factors derived for the estimation of stature from MFL in both hands of males and females are shown in table No.4. Linear regression equations for estimation of stature in males and females are shown in table No.5. The MFL showed a significant correlation with the stature in males and females. The right MFL in both sexes appears to be the better predictors of stature.
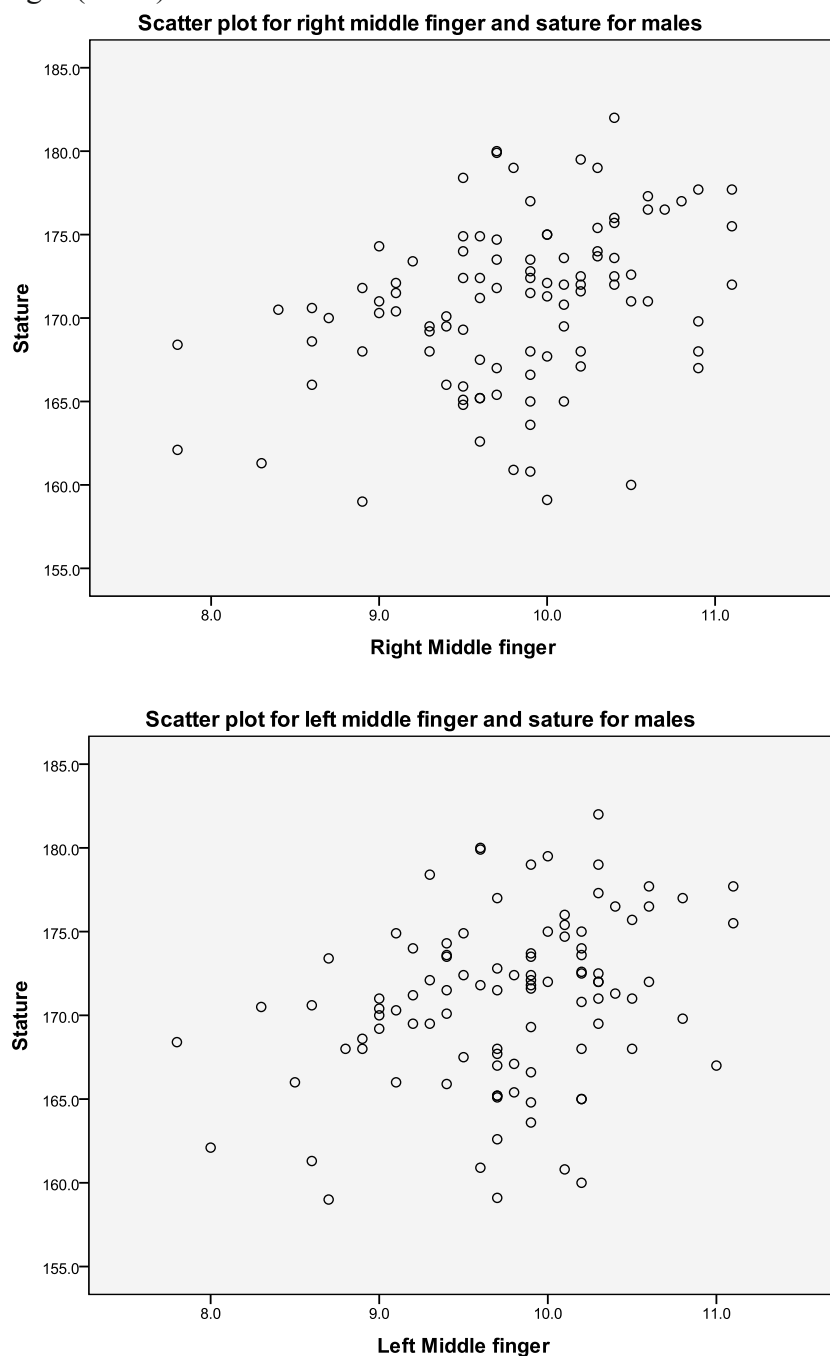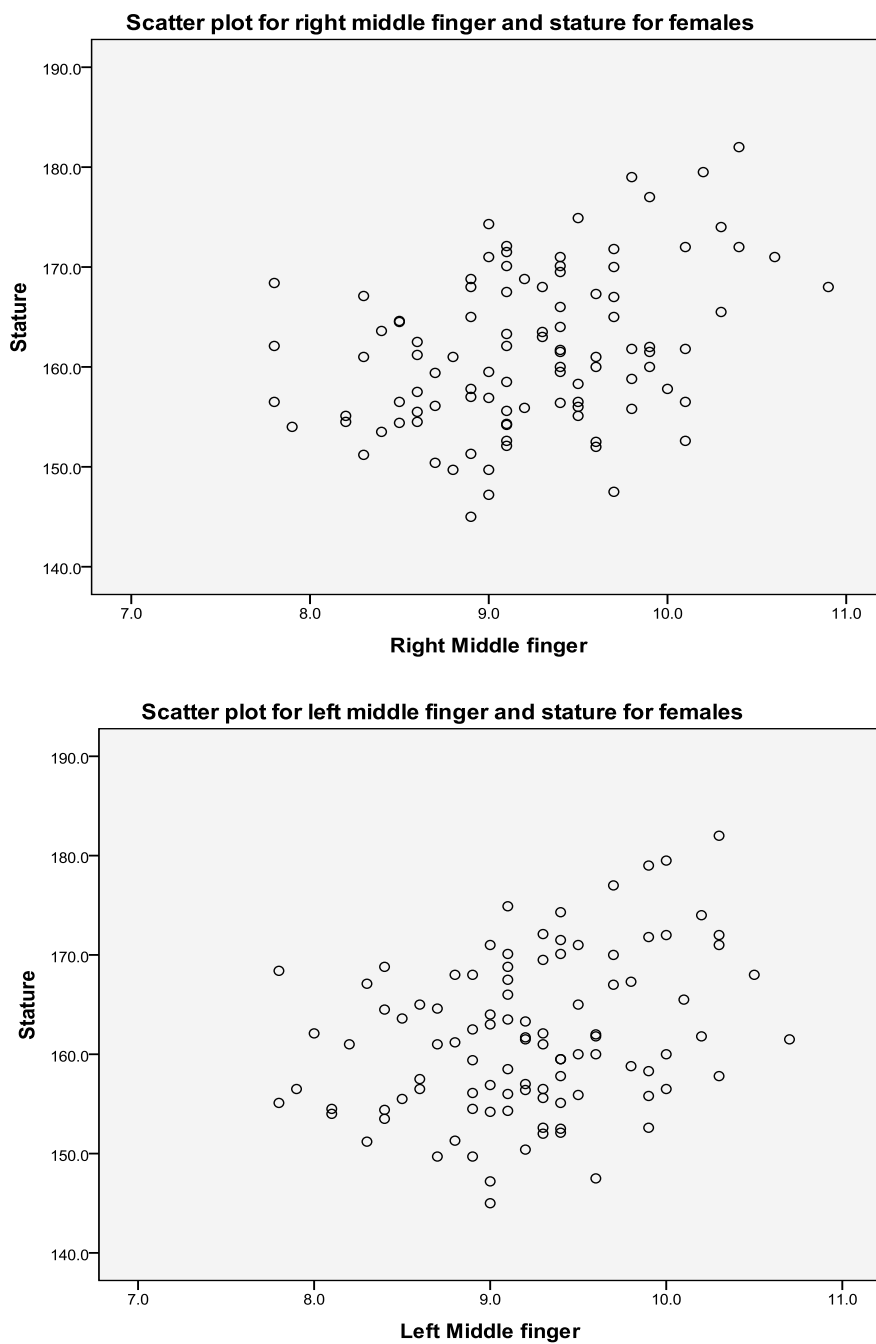
Fig 1 (a & b)

Scatter plot for right middle finger and sature for males

Scatter plot for left middle finger and sature for males

Table 1. Descriptive statistics of stature for the study group

Stature (cm)	Male (n=100)	Female (n=100)
Minimum	159.0	145
Maximum	182	182
Range	23.0	37.0
Mean	170.0	161.626
S.D	4.97	7.78

Table 2. Descriptive statistics of middle finger length for the study group

Middle finger length(cm)	Male (n=100)		Female (n=100)	
	Left	Right	Left	Right
Minimum	7.8	7.8	7.8	7.8
Maximum	11.1	11.1	10.7	10.7
Range	3.3	3.3	2.9	3.1
Mean	9.74	9.79	9.214	9.22
S.D	0.64	0.68	0.62	0.63

Fig 2 (a & b)

Scatter plot for right middle finger and stature for females

Scatter plot for left middle finger and stature for females

Table 3. Pearson correlation between middle finger length and stature (CM)

Stature	Males (n=100) (p value)	Females (n=100) (p value)
Right middle finger length, (RMFL)	0.346	0.360
Left middle finger length (LMFL)	0.310	0.316

P- value <0.001

Discussion

Prediction of stature plays an important role in the identification as required by the investigating team & also in the anthropological research. Skeletal remains can help to estimate the age, sex, race and stature. Stature is one such parameter that can be established even in mutilated and dismembered bodies.

Over many decades, a close relationship between stature & dimensions of various body segments are reported & the data are frequently employed in medico-legal investigation. In this study an attempt was made to establish the stature of a person by using middle finger length. Males and females aged between 21 and 30 years, those who were natives of Mysore district of Karnataka state were included in the study.

In the present study the mean stature among males was 170.84 cm with a standard deviation of 4.9718. The minimum & maximum heights were being 159 cm and 182 cm respectively. Among females mean stature was 161.62 cm with a standard deviation of 7.79. The minimum and maximum heights were being 145 cm and 182 cm, respectively. The Pearson correlation coefficients showed a high degree of correlation and all the values were statistically significant (p value < 0.05).

Macdonnel studied 3000 English criminals. He compared the stature with the length of middle finger.[6] Trotter and Glesser found that there is a loss of height for every two decades of age over the age of 30 years.[3] Therefore in the present study the age of the subjects was taken as more than 21 and less than 30 years.

As this study was conducted on living individuals, a correction factor of 2.5 to 4 cm should be added to the height determined when bones are available for stature estimation.[7] From this study it is found that, for more accurate prediction of stature, independent linear regression equation should be used. This study involved a small sample size and only native people of Mysore district of Karnataka state, so there is scope for further work to determine similar regression equations with larger sample for people from other parts of the Country and World.

Conclusion

Present study shows that there is significant correlation between stature and middle finger length. Hence this can be of helpful can be used in identity of unidentified and dismembered bodies. This study is conducted in localized geographical area with limited sample size hence similar studies are proposed in different population of larger sample size.

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