

ESTIMATION OF STATURE FROM TOTAL UPPER LIMB LENGTH IN UNDERGRADUATE STUDENT POPULATION

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ABSTRACT

Introduction: Stature is a useful anthropometric parameter which is used to identify the bodily uniqueness of the person. Anthropometry is a basic tool in anthropology based on biological aspect. By knowing the length of anthropometric parameters we can estimate the stature of an individual. Stature estimation is useful for developing anthropometric databases. This technique helps in estimating the stature from bone length of unidentified body parts during mass disaster, accidents and also it help in identifying the victim in murder cases. The main task in forensic science is to identify an individual. Stature estimation is useful for identifying individuals in forensic science. The aim of this research study was to evaluate the stature from upper arm length in undergraduate student's residents.

Materials and Methods: This study was conducted among 60 female students. Their total height was measured by using a standard framework of measurement and total upper limb length was measured by using a measuring tape. Using SPSS software, the statistical analysis was done and regression analysis was done to correlate the data.

Results: The mean height and upper arm length were calculated and a regression equation was made. Stature and upper arm length were analyzed for correlation. The linear regression equation for height is $Y=56.69+1.407x$ and the correlation coefficient is 0.824.

Conclusion: The analyzed data showed that there was a strong statistical correlation between the individual's stature and upper arm length. From this it is clear that the height shall be assessed using length of upper arm.

Key words: Stature, upper limb, anthropometric parameter, anthropometry, bone length

INTRODUCTION

Identifying an individual stature is essential which also shows a great part in medicolegal and forensic analysis. Stature is a useful anthropometric parameter that is used to identify an individual. Anthropometry is a basic tool in biological anthropology. Anthropometric techniques help to estimate the stature and bone length of unidentified body parts (1). Forensic anthropology applies anthropological theories for solving problems related to skeleton identification in judicial matters (2). Statures possess racial variation and are affected due to environmental factors, genetic, age, sex and nutrition. Helps in estimating the stature from fragmented remains, amputated limbs and dispersed body parts. This helps in identifying the victim in murder cases, natural disasters or accidents.

There are two methods to estimate the stature. They are mathematical methods and anatomical methods. For the former it requires a single bone and making use of a regression formula to estimate stature based on correlation of single bone measurement to stature seen in population. The latter requires the entire skeleton and adding a correction factor to compensate for the soft tissue (3). The widely used method to estimate stature is devised by Trotter and Gleser (4). There is an association among the physique height and parts of the body (5). If there is no evidence for the crime, it can be solved by using anthropometric parameters (6). Mostly the statures are estimated by using long bones, especially femur (7).

Assessment of stature from skeletons of South African White population was conducted by Manisha R Dayal et al. They concluded that standard error for the lumbar vertebrae shows large value in both male and female and the correlation with total skeletal height is poor (8). Xinghua Zhang et al., did a study to estimate the stature with the help of the dimension of right hand and right foot in Chinese adults of Han population. They concluded that foot and hand dimensions can be used to estimate stature (9). An evaluation study was steered by Lukpata et al., to validate the correlation among forearm and height, hand length and hand breadth of upper limb in Elik people in Cross River state, Nigeria. They concluded that there is a strong correlation of the measured parameter with height (10).

Our scientist experts with their encompassing information, research experience, data has transformed to several publications globally in well reputed indexed Journals (11–18),(19),(20),(21),(22,23),(24),(25),(26–30). This investigation is required to examine the anthropometric relationship between upper limb and body height. Single arm can be used for

stature estimation. The aim of this research study was to evaluate the stature from upper arm length in undergraduate student's residents.

MATERIALS AND METHODS

The research was carried out in 60 female students studying undergraduate dental speciality at Saveetha Dental College. This student study was approved and permitted by SRB of Saveetha Dental College. The height was measured using the standard framework of measurement and the upper arm length was measured by using a tape. The length is taken from the acromion process of scapula to the tip of the mid finger.

Statistical Analysis:

Statistical investigation was carried out with the help of software SPSS (version 23.0.) To correlate the data regression analysis was performed.

Equation of Regression analysis is intended with the help of the formula,

$$y = a + bx$$

Where 'y' is the height, x is arm length, 'a' and 'b' are constant standards from the result.

RESULTS

Mean value of arm length (x) was found to be 75.016 (cm). The mean value of height (y) was 162.25 (cm). The correlation coefficient (r) was found to be 0.824. All the analysed values are represented in Table 1.

The linear regression equation can be intended by,

$$\text{For height, } y = 56.692 + 1.407x$$

The correlation coefficient was found to be 0.8244, which indicated that it has a strong correlation. That means the arm length can be used for measuring the stature of an individual. The scatter plots showing linear regression analysis indicating good positive correlative association among the length of arm with the height of the individual (Figure 1).

Table 1: Shows the different variables of the data used for regression analysis, indicating the mean value of arm length (x), the mean value of height (y), the correlation coefficient (r), number of participants (n) and a and b are constant values from the result.

Parameters	Details
n	60
Mean value of arm length (x)	75.0166
Mean value of height (y)	162.25
Correlation coefficient (r)	0.8244
a	56.6924

b	1.407
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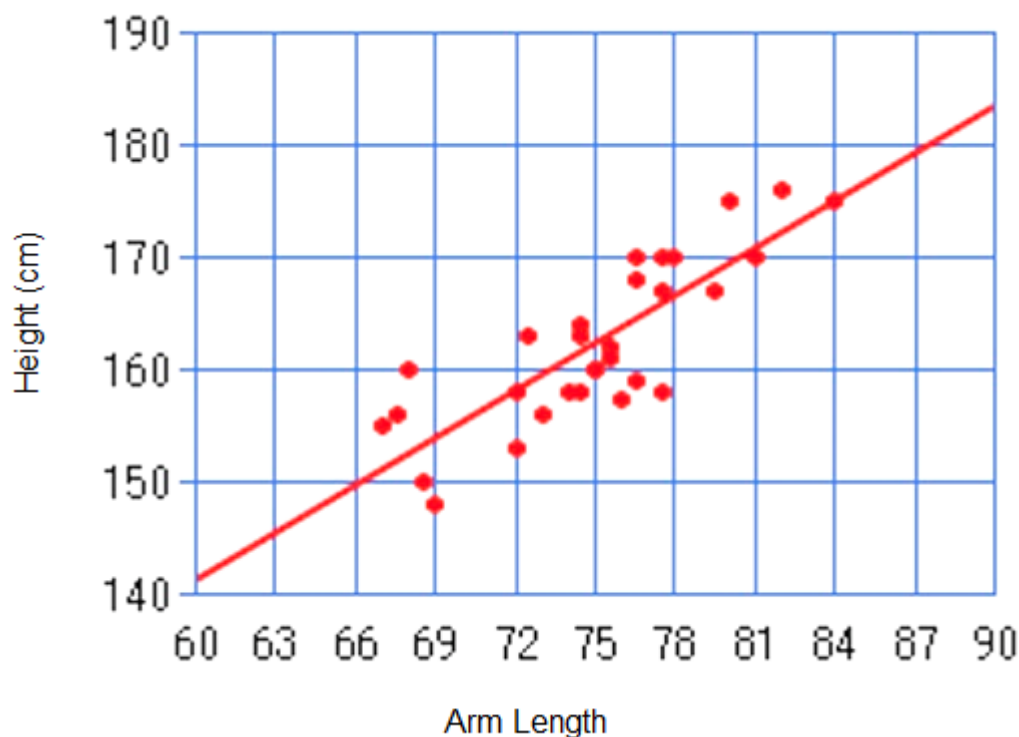


Figure 1: Shows the correlation coefficient (r) using mean of arm length and the mean of height. The x-axis signifies the length of the arm and the y-axis denotes the height of the individual (cm). The scatter plots showing a linear regression analysis indicating a strong positive association between the two variables ($r=0.8244$), the arm length with the height.

DISCUSSION

In the present study about estimating the height of the person from upper arm length, it shows that there is a strong correlation between the two parameters so the stature can be estimated from upper arm length. A stature estimation from the upper limb was done in male cadaver and the formula for height prediction from the right humerus bone is $y=50.60+3.70x$ and from the left humerus bone is $y=40.11+3.75x$ which is different from the formula we got (31).

Estimating the stature using various anthropometric human measurements in the Kori population was done by Renu Kamal et al.,. This study shows that stature can be measured by using different anthropometric measurements like foot length, knee length, etc (32). A study was shown by Soorya Ganesh et al., for estimating the stature from odontometric measurements like maxillary intercanine distance, mandibular intercanine distance. They found that mandibular intercanine can be used for measuring the stature than maxillary intercanine distance (7,33).

For Iranian adults, the mean upper limb length is 71.14 (34). Whereas in our research evaluation studies the mean value of upper arm length is 75.016. Nivesh et al., estimated the stature from physiognomic aspect of facial length and facial length on morphology in South Indian population (35). Rushabh et al., conducted a study in the South Indian population to estimate the stature from nasal height, breadth and depth and found that there is a strong correlation between these parameters (36).

Limitations of the study: The present study has been limited to only 60 female students which indicates the sample size is less. More samples can be included in future studies and even it can be done in both sexes and of different age groups.

Future Scope: In future studies on undergraduate students, the research evaluation need to be performed in males in a large population and also the research has to be extended to find the association among bizygomatic width and stature that can be used to determine the width of missing tooth.

CONCLUSION

In forensic, medico-legal investigations and natural disasters the identification of sex of the individual plays a key role. In determining the sex the stature of the individual serves as a key feature. In such scenarios with the remnant of body parts like the upper limb the stature can be estimated. There is a good correlation among height and arm dimension. Thus we conclude that the stature can be estimated by using the upper limb. This technique will be very useful for identifying the individual during major accidents or any mass disaster.

AUTHOR CONTRIBUTIONS

Author 1: Binigha. M, carried out the study by collecting data and drafted the manuscript after performing the necessary statistical analysis and in the preparation of the manuscript.

Author 2: Karthik Ganesh Mohanraj, aided in conception of the topic, designing the study and supervision of the study, correction and final approval of the manuscript.

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CONFLICTS OF INTEREST

None declared.

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