ORIGINAL ARTICLE

Determination of Stature from Correlation between Height and Hand Length and Hand Breadth in Female Population

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ABSTRACT

Aim: To determine stature of adult females from the correlation between the height and length and breadth measurements of hands.

Study design: Cross sectional study.

Place and duration of study: Department of Forensic Medicine & Toxicology, Peshawar Medical College, Peshawar from 1st March 2019 to 30th June 2019.

Methodology: Eighty two female population of KPK aged between 21 to 60 years. The height of participants was measured with a stature meter whereas, measuring tape and Vernier caliper were used to measure hand length and breadth respectively.

Results: The mean length of right hand was recorded to be 170.8mm while mean breadth was 76.7mm. The highest correlation was observed to be exhibited by right hand length (r=0.5) and the lowest by right hand breadth **Conclusion:** The stature could be successfully estimated in females if only the hand length or breadth measurement is available.

Keywords: Stature, Height, Hand length, Hand breadth

INTRODUCTION

Determination of stature is one of the most widely used methods for establishing personal identity.¹ An individual con be identified on basis of his age, sex, height and race.² With a rise in calamities, accidents, mass disasters and catastrophes it has been of utmost importance to devise a system of identification that could help the anatomists, anthropologists and forensic scientists to manage the crime scene with proper identification of victims and corpses³. By this procedure, it will be easier to short list the corpses needed to be identified which can then be further processed by more definitive methods of identification such as DNA fingerprinting and dactylography⁴.

Regression analysis is done that enables to devise a regression equation either linear or multiple for estimating stature from the hand length or hand breadth in the respective population⁵. Stature could be determined by means of 2 methods, anatomical and mathematical. The former method is used when the whole body skeleton is available while the later establishes personal identity by derivation of regression equations and multiplication factors from the different body parts that helps to determine stature when only a part of the body such as hand or foot are available⁶.

In present study we have derived linear regression equations that will help to establish personal identity by determining stature of a person if any of his hands either right or left are available⁷. Since the stature and general built of a person is population specific and depends upon various nutritional and environmental factors, it is advisable to use regression models that have been obtained by data generated from the same race or population⁸.

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MATERIALS AND METHODS

This cross sectional study was conducted at Peshawar Medical College, Peshawar from 1st March 2019 to 30th June 2019. The anthropometric measurements were hand length, hand breadth, and height. A total of 82 female participants who were enrolled age ranging from 21 upto 60 years. Height for age and weight for age and height tables were used to identify cases for inclusion. Participants with no obvious bone malformation were included. Bone abnormality and bone deformity were excluded. The study procedure was explained to the participants and informed consent was obtained. Height was measured in Frankfurt horizontal plane with the help of stature meter. A measuring tape was used to take hand length measurements while hand breadth was measured using digital Vernier caliper.⁹ Measurements were taken according to the anthropometric techniques described by Valois¹⁰.

Data was entered and analyzed using SPSS-20. Results were drawn as arithmetic mean and standard deviations. Karl Pearson's correlation coefficient was derived for various hand dimensions. The significance of results was tested using Student's t-test. P value of less than 0.05 was considered as significant. Linear regression analysis was undertaken to derive predictive equations for estimation of stature using the different parameters.

RESULTS

It has been observed that the values for Hand length were greater than those for Hand breadth. The mean length of right hand was recorded to be 170.8mm while mean breadth was 76.7mm (Table 1). Value of correlation coefficient derived for length measurements were higher than those for breadth measurements. The highest correlation was observed to be exhibited by right hand length(r=0.5) and the lowest by right handbreadth(r=0.04)

[Table 2]. The standard error of estimate explains the degree or amount of diversion of estimated stature from the actual recorded stature of a person. In the current study, it ranges from ±0.8 to ±1.8 in female population. It has been observed that the value of standard error of estimate is lesser when hand length is concerned so hand length could serve as a better predictor to estimate stature than hand breadth (Table 3). It was found that the mean values of estimated stature were much closer to the actual stature since regression equations have been derived from measures of central tendency. However, the minimum and maximum values of estimated stature showed variations with that of actual stature. The minimum and maximum values of stature estimated from hand length were found to be much closer to the minimum and maximum values of the actual stature (Table 4).

Table 1: Descriptive Statistics for stature and measurements (mm) of length and breadth of hands

Variable	Mean±SD	
Stature	1593.8±66.5	
Right hand length (RHL)	170.8±7.3	
Left hand length (LHL)	169.8±7.3	
Right hand breadth (RHB)	76.7 ±4.0	
Left hand breadth (LHB)	75.6 ±8.9	

Table 2: Correlation between stature and anthropometric measurements of hands

Variable	Value of r	P value
Right hand length	0.5	0.000
Left hand length	0.42	0.000
Right hand breadth	0.04	0.63
Left hand breadth	0.05	0.63

Table 3: Linear regression equations for estimation of stature (mm) from measurements of hand length and breadth

Regression Equation	±SEE
S=881.5+4.2(RHL)	±0.88
S=944.12+3.8(LHL)	±0.91
S=1536.3+0.75(RHB)	±1.8
S=1525.4+0.9(LHB)	±1.8

Table 4: Comparison of actual stature and stature estimated (mm) from measurements of hand dimensions

Estimated stature using regression equations for	Minimum estimated stature	Maximum estimated stature	Mean estimated stature
Right hand length	1532.5	1687.9	1598.9
Left hand length	1548.3	1673.7	1589.3
Right hand breadth	1593	1609.05	1593.9
Left hand breadth	1583.6	1611.8	1593.4
Actual Stature	1343	1701	1593.8

DISCUSSION

In past, researchers have successfully estimated stature of a person from hands and feet¹¹, sternum¹², arm span¹³ and leg span. In the present study we have calculated regression models that would help in estimating stature of a female, if either of the hand length or breadth is known. There has been a need of gender specific regression equations in male and female population in order to estimate stature from isolated body parts. This fact has been attributed to the age of puberty that tends to occur 2 years earlier in females than males¹⁴. In our study, statistically significant bilateral differences were observed in measurements of length and breadth of right and left hands in female population¹⁵.

A positive correlation was found between height and both the length and breadth dimensions of hands similar to study done by Moizuddin et al¹⁶. Moreover since no significant difference in multiplication factors was observed bilaterally so in case measurement of only one hand is available and dexterity could not be identified, we could use the regression model for any of the sides to estimate stature¹⁷. Moreover the values of correlation coefficient for length measurements were higher as compared to breadth measurements¹⁸. Since no similar research has been found to be done in our country, we have compared our results with the population having similarities in race and culture with our population such as Kashmir, Iran and India. A study in Kashmir determined left hand length as the most highly correlated parameter to estimate stature in females¹⁹. A study among Iranian adults by Mahikazadeh at al¹³ also showed that strong correlation exists between hand length and stature (r=0.78). The results obtained in Indian population $(r=0.37)^{20}$ were also similar to those in our study (r=0.42).

CONCLUSION

The stature could be successfully estimated in females if only the hand length or breadth measurement is available. Moreover, hand length has been found to be the most reliable determinant to estimate stature. We have derived linear regression models that could be used to determine stature of a female, when only part of the body i.e., hand is available.

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