Original Article

Determination of Stature from Correlation between Height and Hand Length and Hand Breadth in General Male Population of Khyber Pakhtunkhwa Pakistan

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ABSTRACT

Objective: To determine stature of a person from the correlation between his height and length and breadth measurements of his hands.

Study Design: Cross sectional study.

Place and Duration of Study: This study was conducted at the Department of Forensic & Medicine, Peshawar Medical College Peshawar from March 2019 to June 2019.

Materials and Methods: The study was carried out among general population of KPK including 82 male participants aged between 21 to 60 years. The height was measured with a stature meter. Length of hands was measured using a measuring tape, while breadth of hands was measured by Vernier caliper.

Results: The linear regression equations were derived and the values of minimum, maximum and mean of anthropometric measurements were substituted in those equations in order to calculate the estimated stature.

Conclusion: Hand length is the most reliable parameter to estimate stature. We have derived linear regression models that could be used to determine stature of a male person, when only part of the body i.e. hand is available.

Key Words: Stature, Height, Hand length, Hand breadth.

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INTRODUCTION

Stature estimation from the body parts and remnants has been one of the most widely used methods for identification of unknown corpses.[1] Whenever the establishment of identity of an individual is concerned, the four basic criterion are age, gender, stature and race.[2] It has always been of utmost importance for anthropologists and anatomists to determine the correlation between the whole body and the various body parts.[3]

There is a relationship between the whole body and the body parts that enabled the researchers to derive linear regression equations that help in determining stature when the dimensions of hands are known.[4]

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Stature estimation of an individual could be done with two commonly used methods: The anatomical method (when the complete body skeleton is available) and the mathematical method (using linear and multiple regression equations).[5]

In present study we have derived linear regression equations that will help to determine stature of an individual if the length or breadth measurements of his hands are known. Regression models derived from data generated from certain race cannot be applied to the other races and groups.[6,7] Therefore, it is required to produce population-specific regression equations.

MATERIALS AND METHODS

This cross sectional study was conducted at Department of Forensic & Medicine, Peshawar Medical College Peshawar from 1st March 2019 to 30th June 2019. Demographic data were obtained including name of the family, and occupation. The anthropometric measurements were hand length, hand breadth, and height. Convenience sampling was done in the cross sectional study among 82 male participants who were employees of Peshawar Medical College ranging in age from 21 upto 60 years. Height for age and weight for age and height tables were used to identify cases for inclusion. Subjects with no apparent bone deformity were included. Bone abnormality and bone deformity

were excluded. Height was measured with the help of stature meter. Anthropometric length measurements were recorded in millimeters with the help of a measuring tape and a vernier caliper to measure breadth of hands.[8] Measurements were taken according to the anthropometric techniques described by Valois.[9] The data was entered and analyzed through SPSS-20.

RESULTS

It has been observed that the values for hand length were greater than those for Hand breadth (Table 1). Table 2 depicts the correlation coefficients between stature and anthropometric measurements of hands. Correlation coefficients for length measurements were higher than those for breadth measurements. In males, the highest correlation was observed to be exhibited by right hand length(r=0.6) and the lowest by hand breadth (r =0.31). The standard error of estimate (SEE) explains the degree or amount of diversion of estimated stature from the actual stature of a person. In the current study, it ranges from ±0.7 to ±1.54 in male population. The reliability in the estimated stature is considered maximum when SEE is lesser in value. The hand length has been observed to have lesser values of SEE on right and left sides and hence it could serve as a reliable index to predict stature (Table 3).

Table No.1: Descriptive statistics for stature and measurements (mm) of length and breadth of hands

Variable	Mean±SD
Stature	1726.5±164.9
Right Hand Length	182.9±8.2
Left Hand Length	182.9±7.9
Right Hand Breadth	85.7±4.5
Left Hand Breadth	84.8±4.8

Table No.2: Correlation between stature and anthropometric measurements of hand

Variable	Value of r	P value
Right hand length	0.6	0.000
Left hand length	0.58	0.000
Right hand breadth	0.31	0.0042
Left hand breadth	0.31	0.0042

Table No.3: Linear regression equations for estimation of stature (mm) from measurements of hand length and breadth

Regression equation	± SEE
S=847.4+4.8(RHL)	±0.7
S=866.7+4.7(LHL)	±0.74
S=1338.2+4.53(RHB)	±1.54
S=1373.8+4.15(LHB)	±1.43

Table 4 shows the comparison of actual and estimated stature from length and breadth measurements of hands. The linear regression equations were derived and the values of minimum, maximum and mean of anthropometric measurements were substituted in those equations in order to calculate the estimated stature. 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. In the current study, 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 No.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	1633.6	1821.8	1725.32
Left hand length	1614	1830.2	1726.3
Right hand breadth	1681.1	1797.5	1726.4
Left hand breadth	1680.4	1793.8	1725.7
Actual Stature	1584	1859	1726.5

DISCUSSION

Studies have shown that fusion of ossification centres in wrist and elbow joints by the age of 18 years and complete union in distal end of radius occurs in 20 years.[11,12] This supports the age range we have selected for our study population. Since stature and anthropometric measurements show variations between both genders[13] and among different populations[14], there is always a need to derive gender specific regression equations in order to estimate stature from isolated body parts in males and females seperately.[15,16]

In the current study statistically significant bilateral differences were observed in measurements in males except bilateral hand length measurements (p=0.8).[17]

The derived multiplication factors showed minimal differences bilaterally. Thus, in case only a hand of an individual is available for identification and the anatomical side cannot be justified, any multiplication factor either for right or left sides can be utilized to estimate stature.

In our study, the correlation coefficients for length measurements were greater than those for breadth measurements.[18] The highest correlation between stature and anthropometric measurements in males was exhibited by right hand length.[19] A study among Iranian adults as well as in Australian population also showed that strong correlation exists between hand length and

stature(r=0.78)[20,21] In our study, the lowest correlation with stature was exhibited by hand breadth in male population.[22]

The least standard error of estimate (SEE) in our study was observed for hand length so hand length can serve as a reliable index to estimate stature efficiently.[23]

Mean values of estimated stature were very closer to those of actual stature. Yet we compared our results with populations having similarity in terms of race and culture with our population like Iran and Kashmir and found much similar results as ours. In a study conducted in Iranian population, strong correlation was found between the stature and hand length similar to current study.[20]Similar findings were reported by Khan et al in a study in Kashmir, that showed right hand length to be the most highly correlated parameter to estimate stature of a person.[24].

CONCLUSION

We have determined linear regression models that could be used to determine stature of a person from his hand length or hand breadth, when only part of the body i-e hand is available. Among all the variables, hand length is the most reliable parameter to estimate stature in males.

Author's Contribution:

Concept & Design of Study:	Sadia Syed
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Final Approval of version:	Sadia Syed

Conflict of Interest: The study has no conflict of interest to declare by any author.

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