

A study of correlation between stature and hand length in students of Maharashtra

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Abstract

Introduction: Stature can be defined as natural height of a person in erect position. Stature can be estimated from hand length. The hand length can be used as an alternative measure to stature when stature cannot be measured directly due to deformity like kyphosis, lordosis and scoliosis, contractures or missing legs. **Aims and objective:** To study the correlation between stature and hand length in students of Maharashtra. **Material and methods:** The present study was conducted on 200 students (100 male and 100 female). Stature and hand lengths of both the hands were measured using standard measuring instruments. The data was analyzed and compared in both the groups. **Results:** The mean stature was 163.02 ± 8.42 cm in males and 162.80 ± 8.01 cm in females. Stature and hand length had a significant positive correlation in both males and females. The correlation coefficient with right hand length was $r=0.829$ and $p=0.0001$ and with left hand length was $r=0.824$ and $p=0.0001$ in males. While in females the correlation coefficient with right hand length was $r=0.743$ and $p=0.0001$ and with left hand length was $r=0.734$ and $p=0.0001$. **Conclusion:** Thus in the end we found that there is strong correlation between stature and hand length and the linear regression analysis of the obtained data has provided the regression equations for nearly accurate estimation of stature.

Key words: stature, hand length, correlation.

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INTRODUCTION

Stature can be defined as natural height of a person in erect position. It is determined by many factors such as genetic and environmental factors. Stature estimation has immense medico-legal importance where identifying the deceased from few body parts is much of a problem. Assessment of height from different parts of the body by anthropometric study of skeleton is an area of interest to Anatomists, Anthropologists and to Forensic experts. Anthropometry is a series of systematized measuring techniques that express quantitatively the dimensions of the human body and skeleton¹. It is a known fact that various factors which include age, sex,

nutritional status, environment, gender and physical activity influence stature and body dimensions. Racial and ethnic variations are also known to exist in the population. In a country like India where racial and ethnic variations in different regions are well known, a region wise study becomes necessary. Therefore, different normograms become necessary for different population groups. Reconstruction of stature using norms of other population is bound to give incorrect results².

Stature can be estimated from hand length³. The hand length can be used as an alternative measure to stature when stature cannot be measured directly due to deformity like kyphosis, lordosis and scoliosis, contractures or missing legs. In these cases, the original stature of those people can be estimated by multiplying the dimension of hand lengths of respective sexes or ethnic groups with respective multiplication factor. The multiplication factor can be obtained by dividing the stature by the hand lengths⁴. Thus the present study was undertaken to study the correlation between stature and hand length.

AIMS AND OBJECTIVE

To study the correlation between stature and hand length in students of Maharashtra.

MATERIAL AND METHODS

The present study was conducted among the students of Maharashtra. Following inclusion and exclusion criterion was used to select the study subjects.

Inclusion criteria

Apparently healthy and asymptomatic males and females between 18 to 25yrs were selected.

Exclusion criteria

- Individuals with any obvious skeletal deformity or limb defects (Congenital or acquired)
- Individual with any metabolic or developmental disorders which could have affected the general or bony growth

By using above mentioned inclusion and exclusion criteria total 200 students of both the sexes were selected for the present study (100 male and 100 female).

Informed written consent was taken from all the subjects. Stature was measured using stadiometer while hand lengths were measured by sliding Verniercaliper. Stature was measured as vertical distance from the vertex to the floor. Measurement was taken by making the subject to stand erect on horizontal resting plane bare footed with shoulder blades and buttocks touching the stadiometer. The arms were hung freely by the sides with the palms turned inwards and fingers horizontally pointing downwards. The head of subject was oriented to eye-ear-eye plane (Frankfurt plane). Stadiometer was placed behind the subject in straight vertical position which has movable rod and the movable rod was brought in contact with the vertex in mid sagittal plane. It represents the stature in centimeter to nearest 0.1 centimeters.

Hand length was measured from midpoint of the distal wrist crease to the tip of the middle finger. The subjects were asked to place their hands supine on a flat hard horizontal surface with fingers extended and adducted, following which the hand length was measured. Care was taken to see that there was no abduction or adduction at the wrist joint. i.e., the forearm was directly in line with the middle finger. Hand lengths were taken independently on left and right sides of each individual

using a sliding caliper capable of measuring to the nearest 0.01 mm.

The data obtained were analysed by using statistical software named “GraphpadInstat, version 3, California, Sandiago”. The significance was tested through t-test; p value < 0.05 was considered as significant and p ≤ 0.01 was considered as strongly significant. The results were presented separately for males and females. The Pearson Correlation Co-efficient was calculated. Regression equations were calculated for various combinations to reach the best possible estimate of stature.

RESULTS

Table 1: Age and Sexwise distribution

Variable	Mean age	S.D.
Male	19.92	±1.62
Female	19.71	±1.68

It was observed that the age ranged between 18-25 years for both male and female group. The mean age was 19.92±1.62 years in males and 19.71±1.68 years in females.

Table 2: Height and hand length distribution (cm)

	Variable	Range	Mean	S.D.
Male	Height	144.20-188.10	163.02	8.42
	RHL	14.82-20.37	17.74	1.11
	LHL	14.63-20.39	17.71	1.16
Female	Height	143.30-182.00	162.80	8.01
	RHL	15.51-19.83	17.70	1.15
	LHL	15.32-19.92	17.68	1.16

(RHL-Right Hand Length, LHL-Left Hand Length)

In the present study it was observed that the mean height in the males was 163.02 ± 8.42 cm and mean of right hand length was 17.74 ± 1.11cm whereas mean left hand length was 17.71 ± 1.16cm. In females the mean height was 162.80 ± 8.01cm. The mean of right hand length was 17.70 ± 1.15cm whereas left hand length was 17.68± 1.16cm.

Table 3: Correlation between the stature and hand length

	Parameters	Pearson correlation (r)	Sig.(2.tailed) (p)
Male	RHL	0.829	0.0001*
	LHL	0.824	0.0001*
Female	RHL	0.743	0.0001*
	LHL	0.734	0.0001*

*Significant

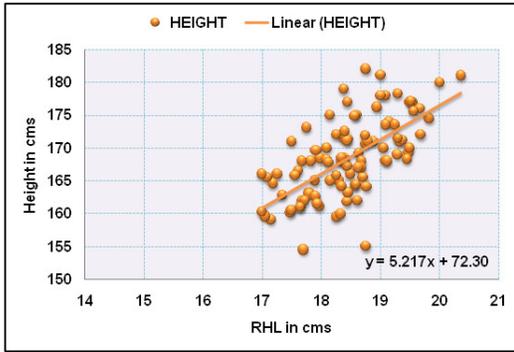


Figure 1: Correlation between Height and RHL in Males



Figure 2: Correlation between Height and LHL in Males

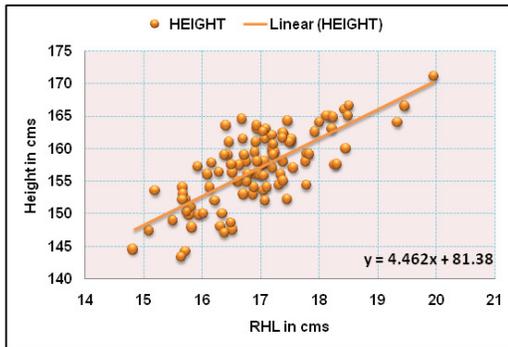


Figure 3: Correlation between Height and RHL in Females



Figure 4: Correlation between Height and LHL in Females

Table 4: Regression Equations for estimation of stature in Males and females

Sex	RIGHT HAND	LEFT HAND
Male	Y=5.217 (RHL)+ 72.30	Y=5.236 (LHL) + 71.91
Female	Y=4.462 (RHL) +81.38	Y=4.404 (LHL) + 82.64

Linear regression analysis was used to prepare the equation to estimate stature (height) in male and female by using hand length. The equations have a constant and multiplication factor in the form of $y = a + bx$. (y = stature in present study, a =constant, b = hand length, x =multiplication factor)² i.e.,

Stature= Constant + [multiplication factor × hand length]

The multiplication factor is first multiplied with the hand length and then added to the constant to get the stature.

DISCUSSION

The aim of the present study was to assess the reliability and accuracy of using hand length measurements to estimate stature in Maharashtrian population. It was observed that the mean age of male participants was 19.92 ± 1.62 years and 19.71 ± 1.68 years in females. It was observed that the stature in males was greater than in females. The mean stature (height) in males was 163.02 ± 8.42 cm and in females it was 162.80 ± 8.01 cm. These results were comparable with almost all the previous studies Abdel Malek A.K. *et al* (1990)⁶, Jasuja O.P. *et al* (2004)⁴, Kewal K *et al* (2007)⁷, Tanuj K. *et al*

(2008)⁸, Ilayperuma I *et al* (2009)⁹, Nur-Intaniah Ishaket *al* (2012)¹⁰, Mitra A *et al* (2012)¹¹ and Krishnan K. *et al* (2012)¹² which showed that the mean stature was greater in males than females. Stature is an inherent characteristic and males are constitutionally taller than females. In females the pubertal growth spurt occurs early, but the growth stops early under the influence of oestrogen which causes early fusion of epiphysis. In males although the growth spurt occurs later, they continue to grow for a longer period under the influence of testosterone. In the present study, the right hand length of males ranged from 14.82 - 20.37 cm with a mean of 17.75 ± 1.11 cm and left hand length ranged from 14.63 - 20.39 cm with a mean of 17.71 ± 1.16 cm. In females the right hand length ranged from 15.51 - 19.83 cm with a mean of 17.70 ± 1.75 cm and left hand length ranged from 15.32 - 19.92 cm with a mean of 17.68 ± 1.16 cm. Various studies conducted on hand dimensions in different adult populations report larger hand dimensions in males than females. Agnihotri A.K. *et al* (2008)¹³ in a Mauritian population, Rastogi P. *et al* (2009)¹⁴ and Kanchan K. and Rastogi P. (2009)¹⁵ in adult North and South Indian population, Sanli S.G. *et al* (2005)¹⁶ in a Turkish population, Krishan K. and Sharma A (2007)⁷, in a North Indian population reported larger hand length in males than females. It was observed that the right hand length was higher than left in both the sexes. Similar results were observed by Rastogi P. *et al*¹⁴. Variations were also noted in the hand dimensions of same sex in different study populations. Anthropometric

parameter like hand length is genetically determined and hence is known to vary between different ethnic groups. The correlation (r) between stature and hand length in males and female group was also calculated. It was observed that correlation between hand length and stature in males was $r=0.829$ and $r=0.824$ on right and left hand respectively. And the correlation was statistically significant with p value of 0.0001. While in females correlation between hand length and stature was $r=0.743$ and $r=0.734$ on right and left hand respectively with p value of 0.0001. Hand length in both the sexes showed higher correlation coefficient with stature. This means that stature can be predicted with good accuracy using hand length in both sexes. Similar finding were also reported by Saxena *et al* (1984) in Nigeria¹⁷, Abdel-Malek *et al* (1990) in Egypt⁶, Sanli *et al* (2005) in Turkey¹⁶, SyedaZamila *et al* (2009) in Bangladesh⁵, Ilayperuma *et al* (2009) in Sri Lanka⁹ and Rastogi *et al* (2008) in India¹⁹. In the present study it was also observed that the correlation between stature and hand length was greater on right side in both the sexes. Thus estimation of stature based on right hand length is more valuable than left. The correlation was higher in males than in females in the present study which is similar to the results obtained by Saxena (1984)¹⁷. In the present study, the linear regression equations were formulated for estimation of stature from hand length in both the genders. Linear regression equations were also derived by Jasuja O.P. *et al* (2004)⁴, Sanli S *et al* (2005)¹⁶, Krishnan Ket *et al* (2007)⁷, Rastogi P *et al* (2008)¹⁹ and Ilayperuma I *et al* (2009)⁹. But variability in multiplication factors in our study and the above mentioned studies was present. This may be because of difference in the genetic and geographical composition in the above mentioned studies and present study.

CONCLUSION

Thus in the end we found that there is strong correlation between stature and hand length. And the linear regression analysis of the obtained data has provided the regression equations for nearly accurate estimation of stature.

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