ESTIMATION OF BODY STATURE FROM VARIOUS PARAMETERS OF HAND – AN ANTHROPOMETRIC STUDY IN CENTRAL INDIAN POPULATION

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ABSTRACT

Introduction: Stature or body height is one of the most important and useful anthropometric parameters that determine the physical identity of an individual. The study was done to estimate stature from the hand parameters. Anthropometric technique commonly used by anthropologists and adopted by medical scientists has been employed to estimate stature for over a hundred years. Stature provides insight into various features of a population including nutrition, health and genetics; geographical location, environment and climatic condition.

Materials and methods: The present study was conducted on a sample of 400 medical students (200 males and 200 females) within the age group of 17-25 years from LN Medical College Research Center Bhopal over a period of 2 year. Apparently healthy, asymptomatic males and females students.

Result: In our study the mean age of the male and female study subjects was 21.59±6.39 years and 19.83±5.44 years respectively. Male: Female ratio was 1:1. Mean stature in male subjects was 169.17±15.78 cm. In this study maximum height reported was 179.5 cm, while minimum height was 153.6 cm. The range in stature of male was from 153.6 to 179.5 cm. Mean stature in female subjects was 154.63±12.91 cm. In this study maximum height recorded was 171.1 cm, while minimum height was 145.0 cm. The range in height of female subjects was from 145.0 to 171.1 cm.

Conclusion: However, hand length was more reliable in estimating stature in both male and female subjects. These results will be of immense benefit to forensic studies and bio anthropology.

Keywords: Middle Finger Length (MFL), Palmar Length(PL), Hand length(HL), Stature.

INTRODUCTION

Stature or body height is one most important and useful anthropometric parameter that determines the physical identity of an individual. Stature prediction occupies relatively a central position in

Palmar Length, hand length and stature were measured. The parameters were measurements for both left and right side were measured separately, for each individual.

Instruments Used: Following instruments were used:

Sliding Caliper - It was used for hand measurements. It consists of a long straight bar, a long arm fixed to one end and a sliding sleeve with long arm parallel to first one.

Stadiometer - It was used to measure vertical height of the subjects. It consists of platform on which the subject stands a long vertical bar which was scaled in millimeters and an adjustable horizontal bar for measuring the highest point of the subject.

Retractable tape: It is a flexible ruler used to measure length or distance. It consists of a metal strip with linear measurement markings. It is a common measuring tool. Its design allows for a measure of great length to be easily carried in pocket or toolkit and permits one to measure around curves or corners.

Landmarks and Techniques involved in taking anthropometric measurements:

Stature: It is the vertical distance between the highest point on the vertex and platform of stadiometer. The subject was made to stand erect, bare foot on a level platform against the stadiometer bar with his/her back and hips touching the bar, the feet were close to each other and the heals touching the bar, arms hanging by the side. The head of the subject was resting without any strain in the Orbito-meatal plane or Frankfurt's plane i.e., trigone and the infraorbital margin of both the sides lie in the same plane.

Figure 1: Stadiometer: Measurement of vertical height

MIDDLE FINGER LENGTH (MFL): The distance from the tip of the middle finger to the flexion line at the most proximal point of the middle finger.

Figure 2: Measurement of Middle Finger Length (MFL):

PALMAR LENGTH (PL): The distance from the transverse flexion line of the wrist joint to the flexion line at the most proximal point of the middle finger.

Figure 3: Measurement of Palmar Length

HAND LENGTH (HL): The distance between the tip of the middle finger to the mid-point of the 1st crease line of the wrist.

Figure 3: Measurement of Hand Length

RESULTS

In table 1, the mean age of the male and female study subjects was 21.59±6.39 years and 19.83±5.44 years respectively. The range of the age in male subject was 17 to 25 years. While in this study maximum age for female subject was 25 years, whereas minimum age for female subject was 17 years. The range of the age in female subject was 17 to 25 years.

Table 1: Distribution of anthropometric parameters for age in male and female study subjects.

Variables	Age in years	
	Male	**Female**
Mean	21.59	19.83
SD	6.39	5.44
Range	17-25	17-25

The above table shows age of male was 21.59 and female were 19.83 years.

Table 2: Distribution of gender

Gender	Frequency	Percentage
Male	200	50
Female	200	50
Total	400	100

The above table shows Male: Female ratio was 1:1.

Table 3: Descriptive statistics and comparison of right and left dimensions (cm).

Gender	Parameter	Right side		Left side		t-Test	
		Mean	SD	Mean	SD	t-Value	p-value
MALE	Hand Length	18.65	0.84	18.73	0.91	0.47	0.812
	Palmar Length	10.72	0.55	10.73	0.57	2.21	0.369
	Middle Finger	7.93	0.44	7.96	0.52	0.16	0.047
FEMALES	Hand Length	16.86	0.81	16.93	0.81	2.24	0.347
	Palmar Length	9.70	0.55	9.72	0.55	0.75	0.578
	Middle Finger	7.32	0.44	7.33	0.44	2.65	0.215

Table 4: Comparison of height among sex wise.

Stature (Total Height)	Mean	SD	p-value
Males (cm)	168.67	15.78	0.051
Females (cm)	155.84	12.91	

The above table shows Mean stature in male subjects was 168.67 cm and female was from 155.84 cm.

Table 5: Showing Correlation between various parameters of hand in both males & females.

Gender	Parameter	Stature	p-value
MALE	Hand Length	0.81	<0.0001
	Palmar Length	0.73	<0.0001
	Middle Finger Length	0.89	<0.0001
FEMALES	Hand Length	0.94	<0.0001
	Palmar Length	0.84	<0.0001
	Middle Finger Length	0.78	<0.0001

Table 6: Linear regression equations for stature (cm) estimation from hand dimensions of male.

Equation	R	R2	SEE	p-value
S = 117.524 + 6.66*RTMFL	0.405	0.164	5.829	0.000*
S = 112.113 + 7.27*LTMFL	0.463	0.214	5.653	0.000*
S = 108.963 + 7.285*RTPL	0.405	0.164	5.829	0.000*
S = 131.312 + 4.621*LTPL	0.285	0.081	6.112	0.000*
S = 87.498 + 4.431*RTHL	0.545	0.297	5.347	0.000*
S = 91.041 + 4.231*LTHL	0.544	0.296	5.351	0.000*

Table 7: Linear regression equations for stature (cm) estimation from hand dimensions of female.

Equation	R	R2	SEE	p-value
S = 98.184 + 7.299*RTMFL	0.561	0.314	3.990	0.000*
S = 101.378 + 6.786*LTMFL	0.510	0.260	4.144	0.000*
S = 112.271 + 5.069*RTPL	0.416	0.173	4.381	0.000*
S = 103.076 + 6.322*LTPL	0.475	0.226	4.241	0.000*
S = 81.15 + 4.14*RTHL	0.644	0.414	3.688	0.000*
S = 86.446 + 3.846*LTHL	0.598	0.358	3.862	0.000*

DISCUSSION

Stature estimation is useful when height cannot be measured directly due to deformities such as kyphosis, scoliosis. The human hand, for instance, is considered the most used and flexible part of the body and has been of great scientific significance to investigators in the field of anthropometry, ergonomics, and orthopedic surgery. With the alarming rate of disasters such as plane crash, terror attacks, earthquakes all over the world, estimation of stature from the hand and its dimensions becomes necessary in identification of victims especially since this is required during medico-legal examinations. [11]

Our study showed the existence of sexual dimorphism in hand dimensions. These sex differences in physical characteristics are often related to hormonal, genetic, and environmental factors. [12] We observed that the male had higher values of hand length and handbreadth than their female counterparts, and these dimensions were all statistically significant ($P < 0.05$). This finding is in consonance with that of Numan. [13] who conducted a study on major ethnic groups in Nigeria namely Igbo, Hausa, and Yoruba. They reported significantly higher values of hand length in male when compared to female. In that work, Hausa male had longer hands than Igbo and Yoruba males. It is also noteworthy that the values of length of the hand reported by Numan [13] for Hausa, Igbo, and Yoruba males were all higher than those obtained for male in our study.

In our study, Mean stature in male subjects was 169.17±15.78 cm. In this study maximum height reported was 179.5 cm, while minimum height was 153.6 cm. The range in stature of male was from 153.6 to 179.5 cm. Mean stature in female subjects was 154.63±12.91 cm. In this study maximum height recorded was 171.1 cm, while minimum height was 145.0 cm. The range in height of female subjects was from 145.0 to 171.1 cm. The mean stature found by different authors in India in different regions or states is slightly different [14] and this can be explained by the different genetic constitution, environmental factors and nutrition in different population groups.

In the present study mean RHL was found to be more than mean LHL in female subjects (18.75 and 16.78 respectively). In this study mean hand length (16.73) in females was found to be lower

than other studies, Pal A et al. [14] The findings in this study were found similar to studies of Sunil et al.

In the present study mean palmar length (PL) was found to be more in male study subjects than females (10.71 cm and 9.64 cm). The findings of the present study were found similar to study of Krishan and Sharma A et al. The mean HB in the present study for males (8.39±0.20 cm) was found to be similar to Ilayperuma et al, et al (8.42±4.04). [15,16]

In our study we observed that the hand dimensions of the males are more than the hand dimensions of females and this difference was statistically highly significant (p<0.001). This finding is in agreement with various studies conducted on hand dimensions in different adult populations – Krishan and Sharma. [15] Variations were also noted in the hand dimensions of same sex in different study populations. Anthropometric parameters like hand dimensions are genetically determined and hence are known to vary between different ethnic groups.

Their study also showed that the Igbo female has longer hands than Hausa and Yoruba female, and all the dimensions of length of the hand obtained from the three ethnic groups were higher than that of the Cross River female obtained in the present work. Their findings were confirmed by Ilayperuma. [16] in their work on Sri Lankans who also reported significantly (P < 0.01) higher mean values of hand length and breadth in males when compared to female. The results obtained in the current study is also in agreement with the findings of Ozaslan et al. [17] who reported significantly higher mean values of hand length and breadth in male than in the female subjects of Turkish descent in their study. Thus, their result also reaffirmed the existence of sexual dimorphism in hand dimensions.

However, we observed that the values obtained for all the Nigerian populations studied previously as well as our State subjects in the present study were higher than those obtained for the Sri Lankans and the Turks. This difference could be explained by the fact that, all the Nigerian populations studied belong to the Negroid race. [18]

Our work has also shown that there is positive correlation between stature and dimension of the hands in our State subjects. This is in agreement with results reported on some other populations in Nigeria. Positive correlation between the hand dimensions and stature was reported by Ibeachu et al. [19] in three major ethnic groups in Nigeria. In their study, male and female subjects from Hausa, Igbo, and Yoruba had positive correlation with stature. This was confirmed by Hasegawa. [20] also confirmed this finding when he reported that all the dimensions of the hands studied in Northern Nigerian subjects showed positive correlation with stature. The result obtained in the present study is in consonance with that of Ozaslan. [17] for Turkish subjects. They reported that the hand length had the higher correlation than the handbreadth. Other studies carried out on foreign population such as Bengali adult females and Bangladeshi female also confirm the existence of positive correlations between hand dimensions and stature.

SEE is an important parameter which shows the relation between real values and estimated values. This study has also revealed that hand length in male and female subjects was more reliable in estimation of stature in our State. The regression equation for hand length had the lowest values of SEE. This agrees with the values obtained by Numan.[13] for major ethnic groups in Nigeria. Our values were lower than those they obtained for Hausa, Igbo, and Yoruba subjects. In their study, the Hausa males had the regression equation with the lowest SEE, followed by Yoruba and Igbo males, respectively. For the female subjects, the Yorubas had the equations with the lowest SEE, followed by Hausa and Igbo, respectively. Regression equations for stature estimation were formulated by Ozaslan.[17] who reported that the equation that used hand length as the variable had the lowest SEE when compared to other hand dimensions studied, which is in agreement with our findings in the present study. However, the stature estimation equations obtained in our study should be authenticated by forensic experts for it to serve as a tool in the estimation of stature.

CONCLUSION

In the present study positive correlation and statistical significance was observed in all the parameters of the hand with stature. A strong positive correlation was observed in the Tip of MFL to 1st crease line with stature. So this can be a reliable parameter for the estimation of stature. Thus the data of this study has crucial and essential for practical use in medico-legal investigations and anthropometric studies.

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