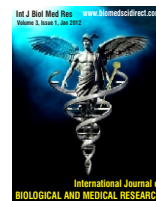


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Original article

Study of correlation between Human height and hand length in residents of Mumbai

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ABSTRACT

The height is an important aspect of human personality. To determine the height, from a body part can be useful for forensic and medico legal cases. Aim: To analyze the correlation between hand length and height in Mumbai Population. Methods: The present study was done on 298 individuals residing in Mumbai. To find out the correlation between height and hand length, the subjects were divided into 6 groups according to the height and hand length and each subject was assessed. Results: Height of any age group is 9.08 - 9.03 times more than the length of hand. As the age group increases the mean length of hand also increases. Conclusion: Definite proportion exists between the height and hand length in an individual at all ages, irrespective of the sex. Height of an individual is 9 times the height of hand length.

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1.Introduction:

Genes and environmental factors are responsible for the height achieved by the individuals. Growth – the vital process is measured by measuring the height of a person, which itself is a sum of the length of certain bones and appendages of the body & represent certain relationship with form of proportions to the total stature. This relationship is very useful anthropologically to find racial differences and medico-legally, when only parts of the deceased body are available [1]. Ascertaining sex and estimation of stature from incomplete skeletal and decomposing bodies is a recurring theme in physical anthropology and forensic science[2-5]. Amirshaybani et al (2000) found that hand length can be a good predictor of the body surface area independent of the sex of the individual [6]. Thus the aim of this study is to find out the correlation between hand length and height in Mumbai Population

2.Material and Method:

The measurements from 298 individuals residing in Mumbai were studied in Department of Anatomy Terna Medical College Navi Mumbai. The subjects were divided into groups as per their age and sex:

Group 1: included children upto age of 1 year in which there were 20 females & 20 males.

Group2: included children only of age 11 years in which there were 20 females & 20 males.

Group3: included children only of age 12 years in which there were 20 females & 20 males.

Group4: included children only of age 13 years in which there were 20 females & 20 males.

Group5: adults above the age of 30 years in which there were 20 females & 20 males.

Group6: included students of first MBBS of age groups 17 to 19 years in which there were 52 females & 46 males.

All the subjects were examined for a) Height - was measured on stadiometer (Fig – 1, 2), except in babies. They were made to stand against the wall and height was measured. The measurements were taken at a fixed time to eliminate diurnal variation and by the same person to avoid personal error in methodology.

b) Hand Length - nails were trimmed and measurement were taken on ruled paper between proximal and distal points of hand.

Proximal Point - was marked on the distal flexion crease of wrist - as under :

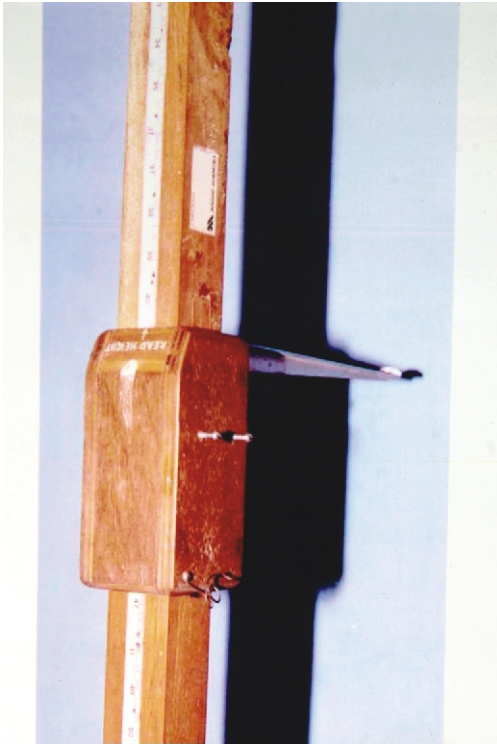
The 2 limbs of axial triradius were extended on the distal flexion crease of the wrist. Mid point of the base of this triangle was marked on the flexion crease as the proximal point (Fig – 3). Distal Point - was taken as the point of maximum curvature on the outline of the middle finger.

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Figure 1 - Standiometer**Figure 2 - Measurement of Height by Standiometer.****2.1.Measurement of Palm**

Procedure was explained to the subjects. They were given practice before taking actual measurement. The subject sat erect on the chair before a table, Elbow semi flexed and held in close contact with the body. Hands pronated and in line with the forearm. Proximal point was

marked on both the hands using marking ink. (Fig - 3). Lined foolscap double paper was spread on the table, both hands rested on the table, extended at the angle of 90° with the wrist. Edge of the paper was placed under the forearms in such a way the it was in contact with the forearm one inch proximal to the proximal flexion crease of the wrist (Fig-4). Both the hands were slowly lowered on the paper simultaneously. Fingers were gently spread to achieve natural relaxed position. Dorsum of the wrists were gently pressed by the observer to get the impression of marking ink on the proximal point. Curve of the tip of the middle finger was marked with the pencil having good sharp tip taking care to hold it at right angles to the finger (Fig - 5). Summit of the curve was taken as distal point. Distance between the proximal and distal points was measured with a ruler(Fig 6). The same ruler was used for all measurements in all the subjects. Statistical significance of difference between the groups was calculated by using Students "t" test. A difference between the two groups was considered to be significant when $p < 0.005$.

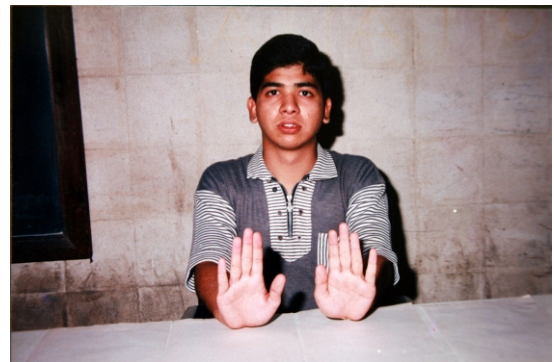
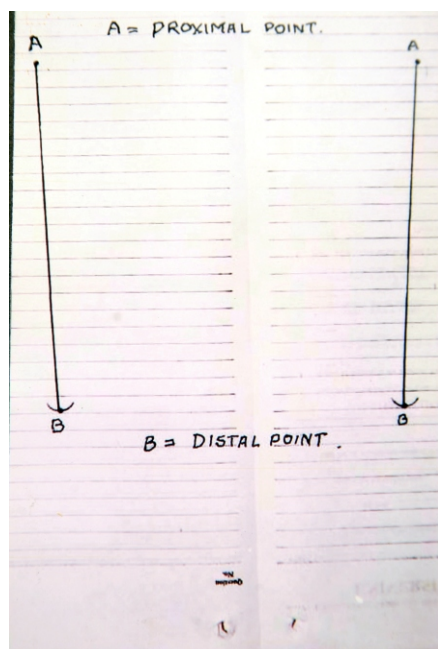
Figure 3 - Marking of Proximal Point.**Figure 4 - Impression of Proximal Point on Paper****Figure 5 - Marking of Distal Point**

Figure 6 – Distance between Proximal & Distal Points

3.Result and discussion:

In the present study shows that mean height of age group one year in male child was 68.35 ± 2.32 cm. and female child was 69.1 ± 1.97 cm. Mean height of age group eleven years in male child is 132.75 ± 5.95 cm. and female child is 132.77 ± 5.97 cm, group twelve years in male child is 135.22 ± 5.91 cm. and female child is 138.85 ± 7.80 cm, group thirteen years in male child is 137.57 ± 6.22 cm. and in female child is 139.15 ± 7.27 cm, age group seventeen to nineteen years in male child is 171.23 ± 6.07 cm and in female child 156.81 ± 5.25 cm and in age group above thirty years in male child is 164.72 ± 7.19 cm. and in female is 150.78 ± 2.90 cm (table1). Mean length of hand in male child of one year was 8.57 ± 0.48 cm. and female child is 8.66 ± 0.31 cm, male child of eleven years was 14.64 ± 0.98 cm. and in female child was 14.65 ± 0.97 cm, male of age group of twelve years was 14.87 ± 0.63 cm and in female child was 15.79 ± 1.09 cm, age group thirteen years in male child was 15.58 ± 0.98 cm and in female child 15.46 ± 1.02 cm, Male of age group of seventeen to nineteen years was 18.64 ± 0.89 cm and in female child was 17.1 ± 1.18 cm and in age group above thirty years in male was 18.10 ± 0.99 cm and in female was 16.74 ± 0.88 cm.(Table2). Our study reveals that mean height of case who belong to one year of age group were 8.55 times more than length of hand. As age increases the mean length of hand also increases. In the age group 17-19 years the height is 9.19 times more than length of hand. This shows that height of any age group is 9.08 - 9.03 times more than the length of hand. (table3). As age groups increase the mean length of hand also increase, there is direct relation between length of hand and age groups. In this study mean length of hand of females were slightly on higher side up to 12 years of age but different was not significant. Danborn found that the relationship between hand and foot length and height is strongly significant ($P < 0.001$). When hand and foot were correlated the relationship

between hand and foot length was higher in the females than the males, but when hand and foot lengths were compared to height the relationship was stronger in the males than in the females. Multivariate analysis was conducted to see if the height of subjects could be predicted from the lengths of right and left hands and feet. This proved to be effective and provided valuable predictive equations that enable the prediction of height for both males and females, with higher prediction ability in the females than the males[7]. This finding is in agreement with reports from Turkish sample 5, 8 and Indian sample 9,1,

Table 1 :Mean height of study cases according to Age-Groups

Age Groups (years)Upto-1	Male	Female
Upto-1	68.35 ± 2.32	69.1 ± 1.97
11	132.75 ± 5.95	132.72 ± 5.97
12	135.22 ± 5.91	138.85 ± 7.80
13	137.52 ± 6.22	139.15 ± 7.27
17 to 19	171.23 ± 6.07	156.81 ± 5.25
Above 30	164.72 ± 7.19	150.78 ± 2.90

Table 2. Average length of Hand according to Age-Groups

Age - Group In Years	Mean Length of Hand ($\bar{X} \pm SD$)	
	Male	Female
1	8.57 ± 0.48	8.66 ± 0.31
11	14.64 ± 0.98	14.65 ± 0.97
12	14.87 ± 0.63	15.79 ± 1.09
13	15.58 ± 0.98	15.46 ± 1.02
17- 19	18.64 ± 0.89	17.11 ± 1.18
> 30	18.10 ± 0.99	16.74 ± 0.88

Table 3:Mean ratio of Height and Length of hand according to Age-Groups

Age Groups (years)	Male	Female
Upto-1	8.55 ± 0.49	8.68 ± 0.33
11	9.08 ± 0.34	9.07 ± 0.33
12	9.09 ± 0.26	8.81 ± 0.41
13	8.84 ± 0.37	9.01 ± 0.31
17 to 19	9.19 ± 0.32	9.20 ± 0.58
Above 30	9.12 ± 0.44	9.03 ± 0.41

4.Conclusion

The mean height of female up to age-group of 13 years were on higher side as compared to male students. But among the 17 - 19 years and 30 years of group cases of male had more height than female. As age groups increase the mean length of hand also increase, there is direct relation between length of hand and age groups. Definite proportion also exists between the height and hand length in an individual at all ages, irrespective of the sex. Height of an individual is 9 times the height of hand length.

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