

# A model for the estimation of personal stature from Hand length in school children of Bidar, Karnataka

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## Abstract

The stature prediction occupies relatively central position in the anthropometric research. Estimation of stature of an individual from the amputated limbs has obvious significance in the personal identification in the events of murders, accidents or natural disasters. The present study is undertaken to measure the stature from hand length of school children. The objective of the study is to predict stature from hand length with the help of multiplication factor. A total number of 220 school children of 6-10 year of age (110 boys and 110 girls) are observed for their personal stature. Height is measured by measuring tape and hand length is measured by using sliding caliper. In boys mean height is 116.90 cm with S.D. (4.82) and in girls mean height is 115.55 cm with S.D. (4.95). Mean hand length for boys is 12.98 cm with S.D. (0.87) and for girls it is 12.09 cm with S.D. (1.05) is found. The multiplication factor is calculated. For boys the multiplication factor is 9.01 and for girls it is 9.59. From the present study we found multiplication factor which is helpful for estimation of stature from hand length of school children.


**Keywords:** School children, Hand length, Personal stature, Multiplication factor.

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## INTRODUCTION

Stature provides insight into various features of a population including nutritional health and genetics. Stature is considered as one of the parameters for personal identification. Estimation of stature is an important parameter in forensic investigation and is considered as one of the important factors of forensic anthropology<sup>1</sup>. The stature prediction occupies relatively a central position in the anthropometric research. Stature or body height is one of the most important and useful

anthropometric parameter that determine the physical identity of an individual. Stature, age, sex and ancestry facilitate and help in identification of the individual, Stature can be estimated from skeletal remains body parts owing to the established relationship between stature and different part of the body. The need to establish the identity of body part remains may arise in cases of mass disasters like terrorist attacks, mass murders, transport accidents, tsunamis, floods, earthquakes. Anthropologist observes and compares the relationship between body segments to highlight variations between ethnic origins<sup>2</sup>. Estimation of body size such as height and weight in children's are required for assessment of growth, nutritional status, calculating body surface area and predicting pulmonary function of children<sup>3</sup>. Measurement of height is important for determination of basic energy requirement, standardization and measures of physical capacity and for adjusting drug doses. The dimensions of the hand and foot have been used to determine age, sex and stature of an individual. Ryan and Bidmos studied the evolution of the accuracy of direct and indirect methods in stature reconstruction<sup>4</sup>. Stature reconstruction is

important as it provides a forensic anthropological estimate of the height of a person in the living state, playing a vital role in the identification of individuals. Krishan *et al* studied the limb symmetry and its effect on estimation of the stature<sup>5</sup>. Kanchan *et al* established the relationship between hands and feet its value in personal identification in mass disasters<sup>6</sup>. In some situation the exact height cannot be determined directly because the patient is unable to stand as a result of neuro- muscular weakness, deformities of axial skeleton such as kyphosis, lordosis, and scoliosis, lost of lower limb and in patient who have undergone amputation<sup>7</sup>. In such patients, height does not reflect the body size and the use of height measurement by prediction equation is likely to produce error. In such circumstances, an estimate of height has to be computed based on another body parameters<sup>8</sup>. The hand length was found to be most reliable alternative and the hand length can be used as a basis for estimating age related loss in height. The reconstruction of body stature has been a subject of study since the beginning of the nineteenth century in the specialized areas of forensic anthropology which deals with the application of methods and technique of analyzing skeletal remains<sup>9</sup>. The most important application of anthropology at field level include biological anthropology, epidemiology, clinical application and in metabolic research<sup>10</sup>. The western standards may not be applicable to all as anthropometric measurements<sup>11</sup>. They may for instance be too generous for people of Asian origin or too stringent for Polynesian adults. It is therefore agreed that different formulae will be required for calculating stature from different segments in different populations, with different age group.

## MATERIAL AND METHODS

**Study design:** Cross-sectional study

**Study period:** 1<sup>st</sup> Jan to 31<sup>st</sup> March 2016

**Study centre:** The Honey Bees Public School Bidar

**Sample size:** All students (110 boys and 110 girls) in the age group of 6-10 years and those (parents) given verbal consent. Data collection and analysis: By predesigned and pretested questioners and analysis was made with the help of MS- Excel. The stature is measured as the vertical distance from the vertex to floor by using simple measuring tape. Measurement is taken by making the subject stand erect on a horizontal resting plane barefooted having the palms of hand turn inwards and fingers pointing downwards<sup>12</sup>. Then the measuring tape brought in contact with vertex in the mid-sagittal plane. The length of hand is measured by using sliding caliper. The subject is asked to place his hand on a table with the fingers together and thumb abducted. Then measurement is taken from the level of tip of the most distal point on

the styloid process of the radius to the tip of middle finger<sup>13</sup>. The measurements are recorded in centimeters to the nearest 0.1 cm. Multiplication factor is calculated According to the Lal and Lata<sup>14</sup>

1. Multiplication factor= stature divided by hand length.
2. The multiplication factor can be obtained by making ratio of the stature to hand length.

Each multiplication factor is the ratio of the stature to the respecting physical measurements. A mean multiplication factor was then calculated for each measurement. These mean multiplication factor is used for estimating the stature from those variables.

## RESULT AND DISCUSSION

The stature estimation has been considered as one of the important parameters of anthropology and will assist in establishing the biological profile of a person. In the present study, in boys mean height and mean hand length is 116.90 cm with S.D. (4.82) and 12.98 cm with S.D. (0.87) respectively where as in girls mean height and mean hand length is 115.55 cm with S.D.(4.95) and 12.09 cm with S.D.(1.05) respectively (Table 1 and 2 ). In the present study in boys the multiplication factor between stature and hand length is 9.01 and in girls the multiplication factor between stature and hand length is 9.59 (Table no. 3). For example:

1. Hand length of a boy is approx. 12 cm then height of that boy will be:  $9.01 \times 12 = 108.12$  cm.
2. Hand length of a girl is approx. 12 cm then height of that girl will be  $9.59 \times 12 = 115.08$  cm.

So we can predict Height from Hand length by very simple method. The same study was done by Dr. Shroff *et al* in 1979 in Marathwada region<sup>15</sup> in same age group children. In his study mean height in boys was 118.89 cm and mean hand length was 13.89 cm. The multiplication factor was 8.56. So Dr. Shroff *et al* study shows more values of height and hand length in boys as compared to our study. Whereas in girls same study shows mean height 117.79 cm and mean hand length 13.18 cm with multiplication factor 8.94. So Dr. Shroff *et al* study shows more values of height and hand length in girls as compared to our study. Multiplication factor between hand length and stature is slightly more in our study than Dr. Shroff *et al* study in both sexes. Various factors like regional, environmental, genetic, socioeconomic and racial factor may be responsible for the difference. The Study carried out by Dr. Vijay Kumar R. Waghmare *et al*<sup>16</sup> in male adults in Maharashtra found same findings with multiplication factor 9.96 of right side and 9.34 of left side. The Study done by Samira Hussein *et al*<sup>17</sup> in Christian garo tribal Bangladeshi adult female shows multiplication factor 9.33 in males and 9.37 in females.

Another method A Linear Regression method is used to calculate stature from hand length by A.O. Ibegbu *et al*<sup>18</sup> in Nigerian school children of same age group and their result shows the mean value of Height and Hand length in male children was 120 cm and 14.06 cm respectively where as mean value for of Height and Hand length in female children was 121 cm and 14.30 cm respectively.

Variety of factors such as age, race, gender and nutritional status affect human development and growth. Therefore different monograms are required for different population. The present study is a first attempt which documents norms for height and hand length relationship in a child between 6-10 yrs by using multiplication factor in Bidar district of Karnataka.

**Table 1:** Mean s.d and range of height at different age groups for boys and girls. (in cm)

Age group in years	Boys			Girls		
	Mean	S.D	Range	Mean	S.D	Range
6 – 7	115.00	2.05	112 – 117.50	112.18	3.53	108.70 - 116.30
7 – 8	116.79	5.19	112 – 126.30	113.75	5.92	110 – 116.30
8 – 9	117.60	6.04	110 – 126.30	116.34	5.53	105 – 123.80
9 – 10	118.23	6.03	112.50 – 135	119.94	4.82	111.20 - 130
Mean	116.90	4.82		115.55	4.95	

**Table 2:** Mean s.d and range of hand length at different age groups for boys and girls (in cm)

Age group in years	Boys			Girls		
	Mean	S.D	Range	Mean	S.D	Range
6 – 7	12.33	0.47	12 – 14.5	11.13	0.54	10.5 - 12
7 – 8	12.57	1.15	11 – 15	11.55	0.78	10.5 – 13
8 – 9	13.43	1.10	13 – 15.5	12.18	1.47	10. - 14.5
9 – 10	13.60	0.77	11.5 – 15.5	13.50	1.47	11 – 16
Mean	12.98	0.87		12.09	1.05	

**Table 3:** Multiplication factor for different age groups for boys and girls

Age group in years	Boys	Girls
6 – 7	9.3268450933	10.0790655885
7 - 8	9.2911694511	9.8484848485
8 – 9	8.7565152643	9.5517241379
9 - 10	8.6933823529	8.8844444444
Mean	9.016925	9.590875

## CONCLUSION

The present study focus on measurement of stature from hand length in the school children of age group 6-10 Yrs. The present study is done to estimate stature from hand length using multiplication factor in children. It is very simple method to calculate multiplication factor and to estimate the stature, if we could recognize child's hand. Some amount of comparisons with the other population contributes to understanding the relative status of our population in the context of the anthropometric variations around the world. The present study also encourage others in taking up further research in a field. This study will provide baseline information for Bidar Karnataka population. This study may be helpful for those who work in the field of Forensic medicine, for Paramedical staff, for security expert's, anthropologist and in mass disasters by using simple Multiplication factor method.

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