



## **Estimation of stature from cranial dimensions among the students of SGT University**

**\*<sup>1</sup>Gautam P, \*<sup>2</sup>Aneja SP, \*<sup>3</sup>Saha S, \*<sup>4</sup>Perwaiz AS**

<sup>\*1to4</sup>Department of Anatomy, Shree Guru Gobind Singh Tricentenary Medical College, SGT University, Gurugram

Corresponding author: Gautam. P

### **ABSTRACT**

Numerous anthropologists, anatomists, and forensic scientists are particularly interested in estimating stature from measurements of various body regions due to its significance. When estimating height from bone pieces is necessary for archaeological research or forensic investigations following major disasters. The estimation of a person's height using cranial dimensions is accurate and dependable. The study's objective is to determine average population head length and head breadth in SGT Medical College, Gurugram, in order to estimate personal stature. A total number of 300 subjects comprising of 150 male and 150 female within the age group 17-24 years was selected for this study. Stature of each individual was measured by using measuring tape. Maximum head length and maximum head breadth of each individual was measured by spreading caliper. The mean and standard deviation of all variables were computed separately for males and females. The correlation coefficient of stature with head length in males is 0.284 and in females is 0.305 & stature with head breadth in males is 0.408 and in females is 0.293. They all established definite correlation with each other. The study came to the conclusion that, like other body parts, cephalic dimensions can also be used to estimate stature. Both these parameters namely head length and head breadth are highly reliable and significant for the estimation of stature. The calculated regression formula show good reliability and applicability of estimate stature.

**KEYWORDS:** Head Length, Head Breadth, Correlation Coefficient, Stature

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### **INTRODUCTION**

Estimating a person's stature from their skeleton or from amputated limbs or sections of limbs has apparent importance in the process of identifying a person after a murder, an accident, or a natural disaster, especially when forensic identification is involved. Each and every aspect of the human body has a clear and proportional biological link with stature [1]. The estimation of a person's height using cranial measurements is accurate and dependable. The length of skull is approximately one eighth of the stature of the person [2].

In clinical practice, population and age-specific data on cranial measurements gives an indication of a person's growth and development, pharmacodynamic parameters, and any abnormalities in cranial size and shape. (3) Although studies on estimating length from long bones and certain body dimensions have been proposed, there are few studies on estimating stature from cranial dimensions [4]. The goal of this study is to assess stature by measuring the head's length, breadth, and connection to one another. The study's objectives were to determine the relationship between stature, head length, and head breadth as well as to develop a formula for estimating height using cranial anthropometry and correlate the values among normal population in SGT Medical College, Gurugram.

### **MATERIALS AND METHODS**

The study was conducted on 300 students of which 150 male & 150 female, in age ranged of 18-25 years from SGT medical college, Gurugram after obtaining the ethical clearance from all the subjects. All of the research participants were in good health and had no visible symptoms of a spine or head deformity. The nutritional and socioeconomic status were not assessed (5). All measures were made in the afternoon to avoid diurnal variations, which have been documented in an individual's stature [6]. Measurement was taken with the help of standard anthropometric instrument i.e. spreading caliper with blunt ends in centimetres to the millimeter. Maximum anteroposterior head length and maximum head breadth was measured by using the spreading calliper was held in front of the subject so that its joint was in the middle of the subject's sagittal plane. With the aid of a measuring steel tape, the subjects' height was

measured by having them stand straight on a horizontal plane with their heads in the Frankfort plane, barefoot and with the backs of their shoulders and buttocks contacting the wall. Fingers were pointed downward and the palm of the hand was turned inward.

The skulls' external linear measurements are mentioned below:

1. **Maximum head length:** It is determined by measuring the straight distance between the most prominent part of the occipital bone and the most prominent point on the frontal bone, which is called the glabella.



FIG-1 Measurement of Head length

2. **Maximum head breadth:** It is characterized as the maximum distance between the parietal bone's lateral most points (3).



FIG-2 Measurement of Head breadth

## RESULTS

All the analysis was done by using statistical software namely SPSS. The mean and standard deviation of all variables were computed separately for males and females. All parameters' correlation coefficients with stature were obtained. To determine the link between the stature and head measurements, a linear regression analysis was carried out and regression equations were generated. Using the Z- test, the results' significance was evaluated. P-value < 0.01 was seen as being extremely significant.

**Table-1** Mean value for stature, head length and head breadth among male & female students.

Trait	Male	Female	p- value
Height	170.04±6.841	157.48±4.926	<0.01
Head length	18.23±0.681	17.27±0.586	<0.01
Head breadth	14.644±0.563	13.74±0.605	<0.01

**Table-2.** Correlation coefficient (r value) of stature and head measurements

Trait	Males(r value)	Females
	0.284	0.480
Stature with head breadth	0.305	0.293

**Table-3** Independent linear regression analysis for predicting the stature using the head length and head breadth in both sexes

Study group	Regression equation	r2 value
Males	Stature=117.85+2.86(HL)	0.080656
	Stature=84.66+5.832(HB)	0.2304
Females	Stature=113.24+2.56(HL)	0.093025
	Stature=114.58+2.385(HB)	0.085849

**TABLE-4.4** Comparison of actual stature & stature estimated from cranial measurement in students

Estimated stature using regression equation	Minimum estimated stature	Maximum estimated stature	Mean estimated stature
Actual stature	152 M	188 M	170.04 M
	146 F	173 F	157.48 F
Maximum head length	16.2 M	19.9 M	18.23 M
	15 F	19 F	17.27 F
Minimum head length	12.4 M	15.8 M	14.08 M
	12.5 F	16 F	13.74 F

The regression equation derived for each of the parameters are as follows:

Estimation of stature in male from head length

$$X = 117.85 + 2.86Y$$

Estimation of stature in male from head breadth

$$X = 84.66 + 5.832Y$$

Estimation of stature in female from head length

$$X = 113.24 + 2.56Y$$

Estimation of stature in female from head breadth

$$X = 114.58 + 2.385Y$$

Figures (3-6) show scatter plots and linear regression lines illustrating the correlation between stature and cranial dimensions.

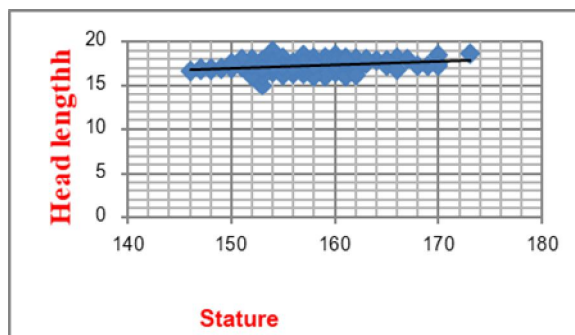


Fig.3 A scatter plot and regression line showing how male's head length (mm) relates to his stature.

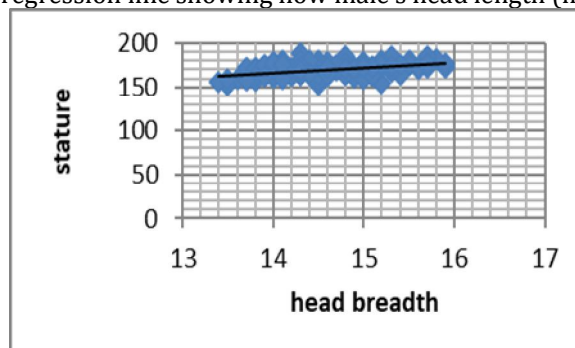


FIG-4. Male stature and head breadth (mm) relationship shown via a scatter plot and regression line.

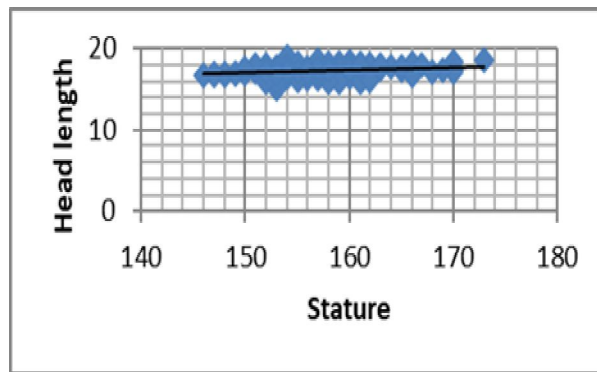


FIG-5. Female stature and head length (mm) relationship shown via scatter plot and regression line.

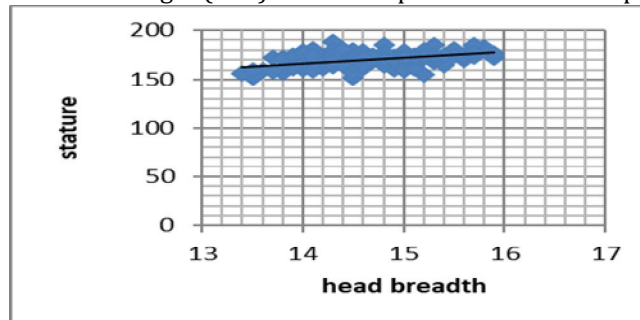


FIG-6. Female stature and head breadth (mm) relationship shown via a scatter plot and regression line.

## DISCUSSION

Based on the clear biological relationship between stature and all body parts, estimation of a person's height from different body parts is seen to be a crucial technique for identifying them [4]. This study gives important information on skull size and its relationship to stature in the adult population of Gurugram. In the present study the mean head length of male is 18.23 whereas in the previous studies the mean head length was observed by Isurani was 18.0 in Sri lanka, by Asha A.R. in north Indian male was 18.26 and in south Indian male was 18.17, by Kewal krishan was 17.83. The mean head length of female in the present study is 17.27 where as in the previous studies, observed by Isurani was 18.0 in Sri lanka by Asha A.R. in North Indian female was 17.51 and in south indian female was 17.50. The mean head breadth of adult male observed by Isurani was 14.0 in Sri lanka, by Asha A.R. in north Indian male was 15.11 and in south Indian male was 14.73, by Kewal Krishan was 13.91 where as in present study it is 14.64. The mean head breadth of adult female observed by Isurani was 13.61 in sri lanka, by Asha A.R. in north Indian female was 14.52 and in south Indian female was 14.63 , where as in present study cranial breadth was 13.74[8]. The mean stature of adult male observed by Isurani was 162.95 in Sri lanka, by Asha A.R. in north Indian male was 168.86 and in south Indian male was 169.62 ,by Kewal krishan was 172.31 where as in present study mean stature of male was 170.04. The mean stature of adult female observed by Isurani was 152.48 in sri lanka, by Asha A.R. in north Indian female was 156.39 and in south Indian female was 156.82 ,and mean stature of female in present study was 157.48. In the previous study of Isurani, Both in males and girls, there was a statistically significant and positive association between stature and measured cephalic dimensions. In the male stature with head length is 0.715 and stature with head breadth is 0.312. In the female, stature with head length is 0.312 and stature with head breadth is 1.478. According to the research of Asha K.R, the correlation coefficient of head length ranged from +0.151 in north Indian males to +0.412 in South Indian females. The correlation coefficient of head breadth ranged from +0.165 in North Indian males to +0.303 in south Indian females. Thus significant positive correlation coefficient was evident in all groups for head length and breadth. In the study of Kewal Krishnan the correlation coefficient of stature with head length 0.775 and stature with head breadth is 0.682. In the current study, the correlation coefficient between stature and head length in men is 0.284, that between stature and head breadth in men is 0.408, and that between stature and head length in women is 0.293. They all established definite correlation with each other.

## CONCLUSION

According to the current research, cephalic dimensions can be used to estimate stature just like they can for other body parts. Both these parameters namely head length and head breadth are highly reliable and significant for the estimation of stature. On correlating stature with head length and head breadth both

established definite correlation & regression formula show good reliability and applicability of estimate stature. When extrimities are not known, a regression equation built from these factors might be used as a backup method to estimate stature. However, these studies' findings are only applicable when a complete skull is evaluated. It will be useful in forensic investigations and anthropological research when estimating stature from fragmentary and deteriorating cranial remains is essential for determining the identify of an elusive person.

#### CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest. The research received no specific grant from any funding agency in the public, community, or non-for profit sectors.

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