



ESTIMATION OF STATURE FROM CEPHALO FACIAL DIMENSIONS BY REGRESSION ANALYSIS IN PUNJAB POPULATION

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ABSTRACT The forensic anthropology mainly focus on identifying the individuality of a person by personal identification, whether it be with a living person, a dead body, partially decomposed or mutilated body, or skeletonized remains. All body parts have a distinct and proportionate biological relationship with stature, and this relationship aids in the computation of stature from severed and disfigured body parts during forensic investigation. The present study comprised of total 1000 (500 F and 500M) young and healthy students in the age range 18-26 years, of different courses in the Department of Anatomy, Sri Guru Ram Das Institute of Medical Sciences and Research, Amritsar in collaboration with the Department of Forensics, Sri Guru Ram Das Institute of Medical Sciences and Research, Amritsar. The subjects were studied for the following parameters: stature, Maximum Head Length and Bigonial Diameter. The measurements were tabulated and statistically analyzed. Mean $\pm$ Standard deviation height in males was 168.09 ± 7.09 and that in females were 158.87 ± 5.21 . Mean $\pm$ Standard deviation of HL and BD in males was 17.67 ± 0.88 , 9.49 ± 0.63 and in females it was 17.11 ± 0.94 , 9.0924 ± 0.60 . Pearson's correlation coefficient was significant for HL and BD in both genders. The current investigation has led to the conclusion that the maximum head length and Bigonial diameter can be used to estimate height. Additionally, the regression analysis demonstrated that cephalic measurements provide a more accurate estimate of stature when other extremities and body parts are not accessible for testing, this additional method is used.

KEYWORDS : Anthropology, stature, bigonial diameter, maximum head length

INTRODUCTION

The population of humans is fundamentally made up of different varieties of human. (Devi & Mohanraj 2017) An important anthropometric parameter that clarifies each person's depiction of their body is Stature. The resolution of origin, sex, and natural height is known as forensic determination. (Kamal & Yadav 2016, Krishan RN et al 2016, Prenetha & Yuvraj 2022) Age, sex, and stature are the primary characteristics of identification. (Ozaslan et al 2003, Bidmos & Asala 2005) Studies on estimating stature from various bodily parts, such as the head, face, and trunk, as well as the arms and legs, hands, and feet, intact vertebral column, have been done. (Krishan Kewal 2008, Ozaslan et al 2006, Simmons et al 1990, Holland TD 1992, Zviagin & Eremenko 2004) This is possible because stature has a definite and a proportional biological relationship with each and every part of the human body. This relationship helps a forensic scientist to calculate stature from mutilated and dismembered body parts with the aid of linear regression equations. (Ozaslan et al 2006, Ilayperuma I 2012)

For more than a century, the anthropometric technique—which is popular among anthropologists and has been embraced by medical scientists—has been used to assess body size. The discovery of an isolated lower extremity and the height of the individual to whom it belonged had complicated efforts to identify some of the deceased as the frequency of mass tragedies increased. Despite the necessity of this kind of research, there aren't many systematic investigations that look for broken and dismembered human remains. (Ozaslan A et al 2003, Swami S.I et al 2015) Patil and Mody used a radiographic lateral cephalogram of the skull to estimate stature by regression analysis.

It is a well-known fact that due to dietary, climatic, and ethnic variances, each race needs a unique stature assessment. Therefore, research findings from one community cannot be fully applied to another. (Siddiqui & Shah 1994) Thus, systematic research from this area is required. In light of this, the current study's goal is to measure stature in Punjabi population using cranio-facial anthropometry.

MATERIAL AND METHOD

A total 1000 young and healthy students, comprising 500 male and 500 females in the age group of 18-26 years were studied. The study was done in anatomy department with collaboration of forensic department at Sri Guru Ram Das Medical Institute of Science and Research, Amritsar on the MBBS, BDS, Paramedical, and Nursing students of all the years.

Inclusion criteria:

1. Normal healthy adult males and females in the age group of 18 – 26 years.
2. Subjects born by Punjabi parents and brought up in Punjab.

Exclusion criteria:

1. Those having any obvious congenital physical abnormality, history of any facial surgical procedures, old fractures/ trauma, or any significant disease, metabolic or developmental disorders that could affect the general or bony growth.

Written and informed consent was taken from every subject prior to measurements.

Somatometric Measurement:

Maximum head length: It measures the straight distance between the glabella and the opisthocranium.

Bigonial diameter: Is the maximum breadth of the lower jaw between two gonion points on the angles of the mandible.

Stature: It is vertical distance between vertex and the floor.

Equipment: The measurements were taken with help of an anthropometric rod, sliding calliper, spreading calliper.

Data Analysis

The Data collected were recorded and subjected to statistical analysis like Mean, Standard Deviation (S.D.), Karl Pearson's Correlation Coefficient (r) used to establish the relationship between the variables considered, Regression Analysis and Standard Error of Estimate; and were analyzed using Statistical Package for Social Sciences (SPSS) for Windows XP-Professional

Thereafter, a hypothetical regression equation was formulated using the regression coefficient as follows:

$$S = a + bx$$

Where, s= stature i.e. the dependent variable.

a= the regression coefficient of dependent variable.

b= the regression coefficient of independent variable.

x= any cephalo-facial measurement i.e. the independent variable.

The regression formulae were calculated independently by using computerized regression analysis of the parameters with stature to

derive the regression coefficients 'a' and 'b'. The suitable values of constants 'a' and 'b' were then substituted in the standard equation of regression. Standard Error of Estimate (SEE) was calculated for each and every regression equation.

RESULTS

TABLE – 1

Sample Size

Group	No of objects
Male	500
Female	500

Table 1 shows the sample size of research. In the present study, data on facial anthropometry of 1000 students (500 male and 500 female) was collected.

Table – 2 Descriptive Statistic Of Cranio Facial Measurement (cm) Of Punjabi Population Showing Mean And Standard Deviation In Male And Female

Measurement	Mean $\pm$ S.D. (Male)	Mean $\pm$ S.D. (Female)
Age	20.43 $\pm$ 1.81	19.5 $\pm$ 1.53
Maximum head length	17.67 $\pm$ 0.88	17.11 $\pm$ 0.94
Bigonial diameter	9.49 $\pm$ 0.63	9.09 $\pm$ 0.60
Stature	168.09 $\pm$ 7.09	158.87 $\pm$ 5.21

Table 2 presents the average mean value standard deviations of age 20.43 $\pm$ 1.81 in males and 19.50 $\pm$ 1.53 in females, MHL 17.67 $\pm$ 0.88 in males and 17.11 $\pm$ 0.94 in females, BD 9.49 $\pm$ 0.63 in males and 9.09 $\pm$ 0.60 in females, and stature 168.09 $\pm$ 7.09 in males and 158.87 $\pm$ 5.21 in females.

Table – 3 Pearson Correlation Coefficients Between Stature And Facial Measurements In Males

Measurements	Pearson correlation coefficient (r) Male	p- value	Pearson correlation coefficient (r) Female	p- value
Maximum head length	0.24**	.000	0.41**	.000
Bigonial diameter	0.27**	.000	0.39**	.000

**significance at (P < 0.01).

Table 3 shows the correlation coefficients between stature and the two craniofacial measurements in Punjabi population. The result shows that all the measurements exhibited a significant correlation with stature (P < 0.01). The highest correlation coefficient is exhibited by Maximum Head Length (r = 0.41) and the least by Bigonial diameter (r = 0.39) in females. But in the males Bigonial diameter (r = 0.27) shows highest correlation coefficient while Maximum head length (r = 0.24) has lowest.

Table – 4 Regression Equations For Estimation Of Stature (cms) From Facial Measurements In Males

Regression equation	SEE
Ht = 133.7 + 1.94 (Max Head Length)	6.89
Ht = 138.49 + 3.11 (Bigonial diameter)	6.82

Table 4 show regression equation to calculate stature from cephalofacial measurement measurement Maximum Head Length and Bigonial Diameter by substituting the values of cephalo-facial measurement in male. The standard error of estimate (SEE) is least for bigonial diameter.

Table – 5 Regression Equations For Estimation Of Stature (cms) From Facial Measurements In Females

Regression equation	SEE
Ht = 119.86 + 2.27 (Max Head Length)	4.75
Ht = 128.13 + 3.38 (bigonial diameter)	4.79

Table 5 show regression equation to calculate stature from cephalofacial measurement measurement Maximum Head Length and Bigonial Diameter by substituting the values of cephalo-facial measurement in female. The standard error of estimate (SEE) is least for maximum head length.

DISCUSSION

The present study comprising of 1000 (500 Male and 500 Female) young healthy students. The parameters studied are Height, MHL and BD. When compared among sexes, it was found that values were higher for male and the differences were statistically significant. The result of present study showed that the stature can be estimated from the cephalic dimensions by applying regression equation. Positive correlation was found between stature and MHL in males as well as female subjects which were statistically significant. Similarly significant correlation exists between stature and BD in female subjects and also in male it was statistically significant. In present study, mean MHL in males and females were 17.67 and 17.11 and BD was 9.49 and 9.09 respectively. The difference between mean head length and bigonial diameter of male and female subjects i.e. gender difference was statistically significant (p < 0.05) which coincides with that of previous studies [Table6]

Table – 6 Pearson Correlation Coefficients Between Stature And Facial Measurements In Males

Author	Place/ Year	Age	Gender	Mean Head length	Bigonial diameter
Krishan K10	North India/ 2008	18-30	M	17.83 $\pm$ 0.89	-----
Llayperuma I9	Sri lanka/2010	20-23	M	18.02 $\pm$ 1.12	-----
			F	17.19 $\pm$ 1.01	-----
Agnihotri AK et al.,2	IndoMauritian/2011	20-28	M	18.66 $\pm$ 0.79	10.55 $\pm$ 0.76
			F	18.13 $\pm$ 0.91	9.90 $\pm$ 0.84
Ewunonu EO et al.,7	South Eastern Nigeria/ 2013	12-45	Both	18.82 $\pm$ 0.80	-----
Kumar M et al., 14	Haryana/2013	18 and above	M	18.75 $\pm$ 1.4	11.45 $\pm$ 1.104
			F	17.75 $\pm$ 0.84	10.33 $\pm$ 0.753
Singh R23	UP/2013	17-26	M	17.0 $\pm$ 0.7	-----
			F	16.0 $\pm$ 0.8	-----
Shah T et al., 20	Gujarat/2015	21-50	M	17.79 $\pm$ 1.52	
			F	16.01 $\pm$ 1.60	
Wankhede KP et al.,25	Central India/2015	18-24	M	18.5 $\pm$ 0.72	
			F	17.53 $\pm$ 0.81	
Kamal R et al.,13	Kori Population of North India /2016	20-40	M	18.43 $\pm$ 1.05	
			F	17.63 $\pm$ 0.8	
Thoudam BD et al.,24	Manipuri Muslims /2017	20-60	M	19.41 $\pm$ 0.04	
Parshad AK et al.,4	Madhya Pradesh /2019	18-25	M	18.19 $\pm$ 0.81	
			F	17.05 $\pm$ 0.66	
Adefisan IE et al.,1	Houses of Nigeria/ 2021	18-55	M	19.95 $\pm$ 1.74	9.98 $\pm$ 1.16
			F	22.64 $\pm$ 0.68	9.98 $\pm$ 1.04
Present study	Punjab /2023	18-26	M	17.67 $\pm$ 0.88	9.498 $\pm$ 0.63
			F	17.11 $\pm$ 0.94	9.0924 $\pm$ 0.60

CONCLUSIONS

Craniofacial variables are useful for the estimation of sex and stature in cases of limited resources and when incomplete skeleton or human remains are brought for forensic examinations. Present study proves that stature could be estimated using Maximum Head Length and Bigonial Diameter (cranio facial dimensions) and also found that the mean values of males were higher than those of females.

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