

Estimation of Stature of Individual with the Help of Head Length and Head Breadth

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Abstract: Stature is the natural height and built of a body or person. Stature has been one of the most important factor in the description of the human body characteristics. Various types of parameters are used while estimating stature of human body. Prediction of Stature with the help of head length and head breadth appear to be significant to forensic Science experts, anthropologists, archeologists and demographers. The objectives of the study were to establish correlation of head length and head breadth with height.

Material & Methods: This study was conducted on 240 medical, paramedical students and staff in age group of 20-50 of UPUMS Saifai, Etawah, UP, India. Head length and head breadth of subjects were measured by Vernier caliper in similar anatomical position and at fixed time to avoid diurnal variation. Correlation and Regression analysis were carried out to establish relationship of head length and head breadth with the height.

Results: Statistical significant positive correlations between head length and the height for male ($r=0.3318$; p -value <0.00001) and for female ($r=0.3255$; p -value $=0.002368$), and between head breadth and the height for male ($r=0.178$; p -value $=0.0267$) and for female ($r=0.2566$; p -value $=0.017762$) were observed respectively. Regression equations for stature were also derived.

Conclusion: The findings of study suggest that both head length and head breadth can be successfully used for stature reconstruction.

Keywords: Head length, Head breadth, Stature, Anthropology, Stadiometer.

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I. Introduction

Stature is the natural height and built of a body or person. Stature has been one of the most important factors in the description of the human body characteristics. Various types of parameters are used while estimating stature of human body. Assessing height of an individual from measurement of different parts of the body has always been one of the most interests of anthropologists and forensic medical experts.

Stature or body height is one of the most important parameters to determine the physical identity of an individual. There is a definite biological relationship of stature with the all body parts such as extremities, head, trunk, vertebral column etc. [1] Stature estimation become an important necessity in recent time due to natural disasters like earthquakes, tsunamis, cyclones, floods and man-made disasters like terror attacks, bomb blasts, mass accidents, wars, plane crashes etc. [2] Sometime only skull is brought for examination and this is most common in our region where victims are attacked by wild animals in deep forests. [3] Cranial dimensions have been shown to be a reliable means in estimating stature in Italians [4], Japanese [5] and South Africans [6]. All these studies appear to be significant to forensic science experts, anthropologists, archeologists and demographers.

Many factors like racial, ethnic and nutritional factors play an important role in human development and growth and therefore affect the stature. [7] No two individuals are the same in all their measurable traits, even genetically identical twins, differ in same aspects. [8]

A large number of studies have been done on stature estimation using the length of bones such as femur, tibia, humerus, radius, height from finger length etc. The purpose of this study is to estimate that which parameter is better for stature estimation, from length and breadth of head.

II. Material and Methods

This study was conducted in the Department of Anatomy, Uttar Pradesh University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India. Ethical clearance was obtained from the ethical committee of the college prior to the study. This study was a Cross-Sectional study. The study was conducted on 240 medical,

paramedical students and staff of age group of 20 to 50 years of age in UPUMS Saifai, Etawah, UP, India. Any subject having any significant diseases, orthopedic disability and paralysis was excluded from the study. Subjects not giving consent to participate in the study were also excluded from the study.

The researcher obtained the permission from the UPUMS, Saifai. The length and breadth of head were measured by Vernier Caliper, and height of individual was measured by Stadiometer. Vernier caliper capable of measuring of the nearest 0.02mm and Stadiometer capable of measuring nearest 0.1 cm. All data was entered into SPSS Software V.23.0. Data was analyzed and correlation coefficient was also calculated.

Figure 1: Vernier Caliper



Figure 2: Stadiometer



be turned inwards and fingers horizontally pointing downwards. Anthropometer was placed in straight vertical position in front of the subject with head oriented in eye-ear-eye Plane (Frankfurt Plane). The movable rod of the Anthropometer was brought in contact with vertex in the mid saggital plane.

Figure 3: Measurement of Maximum Head Length



Figure 4: Measurement of Maximum Head Breadth



Figure 5: Measurement of Height



III. Observations and Result

Table 1: Gender wise measurements and analysis of Stature

Stature	Minimum (cm.)	Maximum (cm.)	Mean (cm.)	SD (cm.)
Male (n=155)	149.2	188.8	168.92	6.18
Female (n=85)	134.9	173.8	156.35	5.99

(SD=Standard deviation)

Table 2: Gender wise measurements and analysis of Head Length and Head Breadth

Parameters	Minimum (cm.)	Maximum (cm.)	Mean (cm.)	SD (cm.)	r	p-value
Maximum Head Length (Male)	16.712	21.324	19.29	0.73	0.3318	<0.00001
Maximum Head Length (Female)	16.412	21.178	18.50	0.82	0.3255	0.002368
Maximum Head Breadth (Male)	13.368	18.534	15.15	0.72	0.178	0.0267
Maximum Head Breadth (Female)	13.02	16.42	14.72	0.74	0.2566	0.017762

(r=Pearson's correlation coefficient, p-value=Probability)

Regression Analysis:

Simple Linear Regression Formula: $H=a+bP$

H=Height (cm.), a=constant (cm.), b=Regression coefficient, P=Parameter (cm.)

Table 3: Gender wise regression analysis

	Head Length (cm.)		Head Breadth (cm.)	
	Regression Formula	Standard Error	Regression Formula	Standard Error
Male	$H=114.63+2.81P$	0.646804	$H=145.87+1.52P$	0.680262
Female	$H=112.31+2.38P$	0.758982	$H=125.79+2.08P$	0.858416

Figure.6: Height in erect position and Head Length in Male

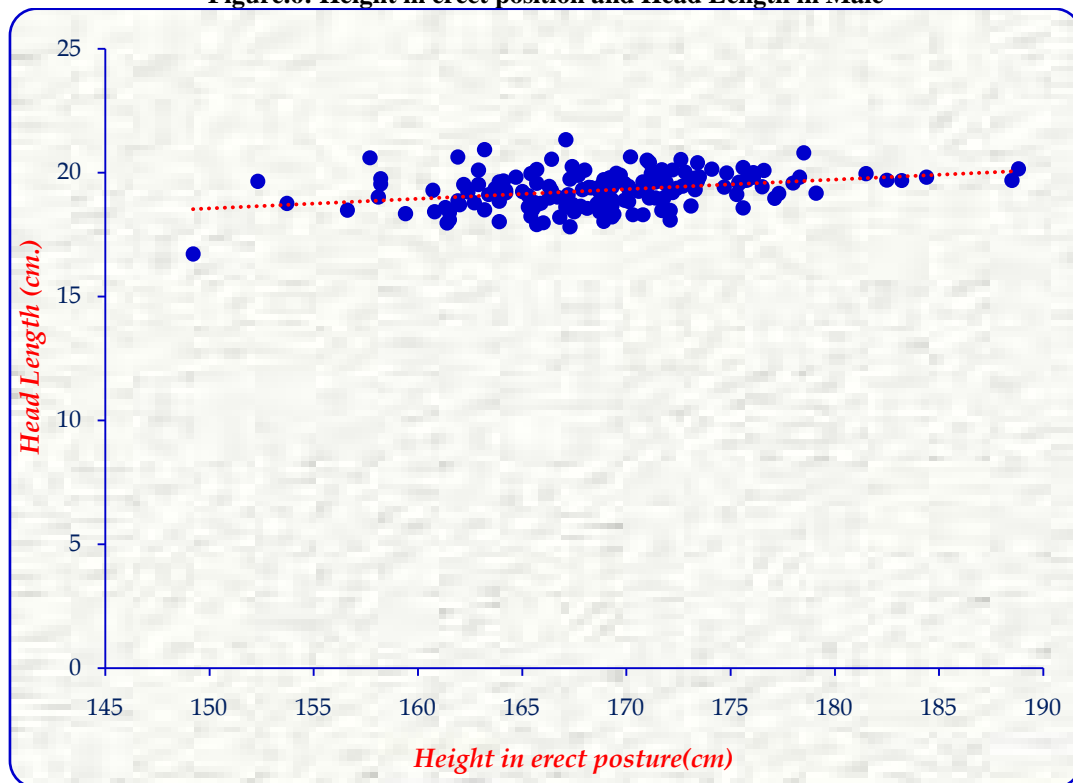


Figure.7: Height in erect position and Head Length in Female

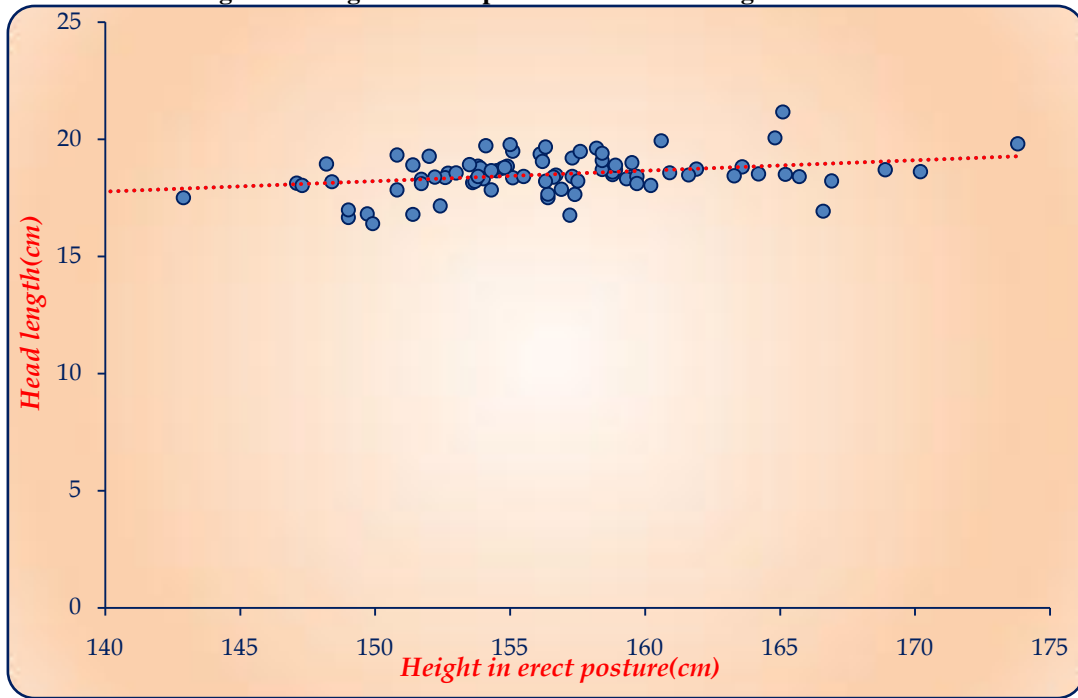


Figure.8: Height in erect position and Head Breadth in Male

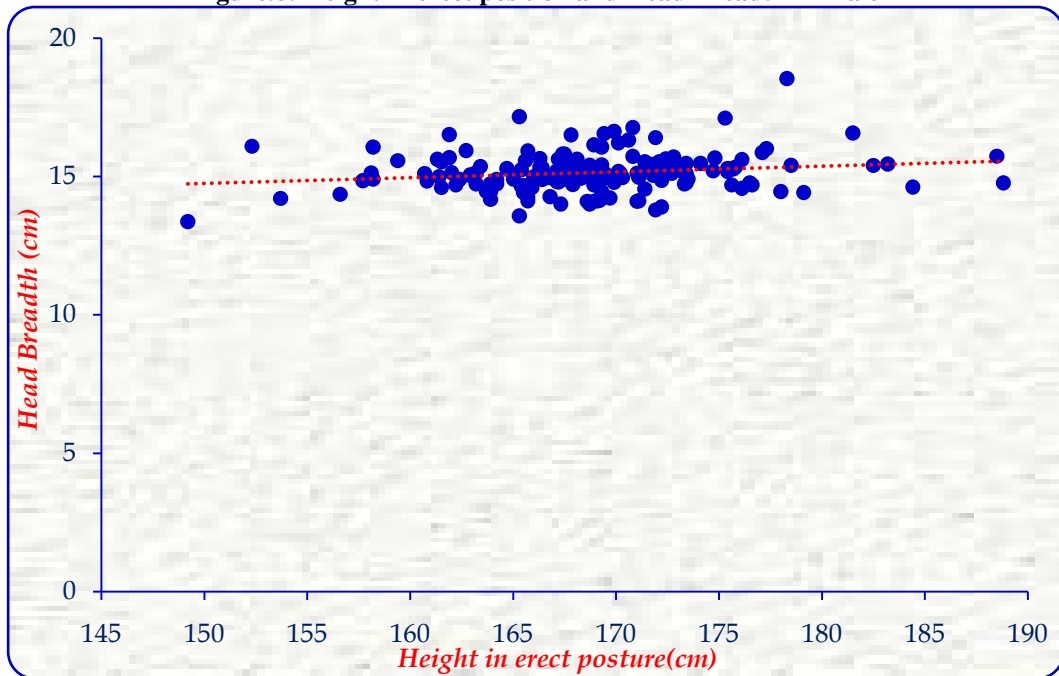
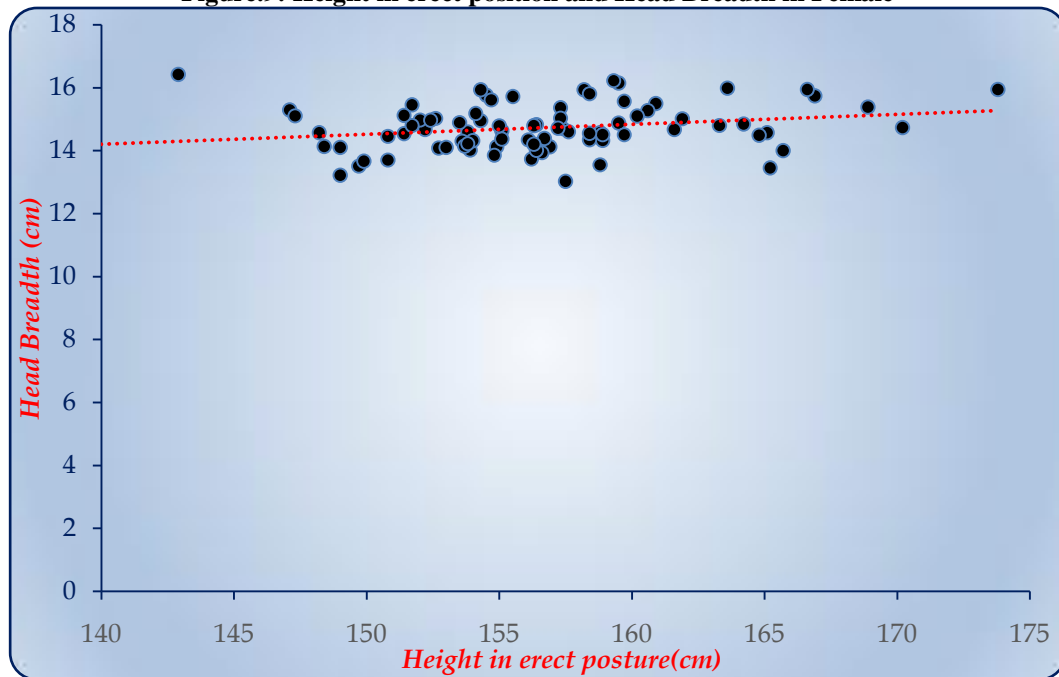


Figure.9: Height in erect position and Head Breadth in Female



Calculation of Height-

(1) From Head Length in Male

$H=a+bP$
 $a=114.63, b=2.81, P=19.22$
 $H=114.63+2.81 \times 19.22$
 Calculated Height=168.72 cm.
 Measured Height=168.7 cm.

(3) From Head Breadth in Male

$H=a+bP$
 $a=145.87, b=1.52, P=15.004$
 $Y=145.87+1.52 \times 15.004$
 Calculated Height=168.71 cm.
 Measured Height=168.7 cm

The estimated statures, calculated with the help of regression for male and female are found approximate to their measured values.

(2) From Head Length in Female

$H=a+bP$
 $a=112.31, b=2.38, P=19.418$
 $H=112.31+2.38 \times 19.418$

(4) From Head Breadth in Female

$H=a+bp$
 $a=125.79, b=2.08, P=14.824$
 $H=125.79+2.08 \times 14.824$
 Calculated Height=156.57 cm.
 Measured Height=156.4 cm.

IV. Discussion

Determination of human stature from the different body parts is an important parameter in medico-legal and anthropological examination. The present study provides valuable new data pertaining to the head length and head breadth and its correlation with the stature in adult Indian population. The average height of adult males within a population is significantly higher than that of adult females. In the present study, males show higher mean values in each anthropometric dimension as compared to females, which may be attributed to the early maturity of girls than boys. A general linear regression model was found to be most promising and validating in both male and female.

Correlation between head length and head breadth with height in male with correlation of 0.3318 and 0.178 respectively interpreting that head length may be good tool for estimation of height in male but head breadth has low correlation and so it may provide just an idea regarding estimation of height in male. Pearson's correlation was used to predict the significant relationship between the height and head length, and between height and head breadth of the subjects. This indicates a high significant ($p < 0.00001$) relation between head length and the height in case of male, and relation between head breadth and the height is also significant ($p = 0.0267$) in case of male .

Correlation between head length and head breadth with height in female with correlation of 0.3255 and 0.2566 respectively interpreting that head length may be good tool for estimation of height in female but head breadth has low correlation and so it may provide just an idea regarding estimation of height in female. Here are also significant relation between head length ($p=0.002368$) and of head breadth ($p=0.017762$) with height in case of female. According to Lal and Lala [9] regression coefficient (b) is a better guide for calculation of height of an individual when the identity of the individual is not known.

Table 4: Comparison of regression coefficient of our study with other studies in different populations

Study	Region	Male		Female	
		Head Length	Head Breadth	Head Length	Head Breadth
Present study	Different parts of India	2.81	1.52	2.38	2.08
Wankhede KP et al [3]	Central Indian region	2.63	0.57	1.49	2.33
Ilayperuma I [10]	Sri Lankan	3.69	3.84	3.86	3.33
Purohit N et al [11]	Western Rajasthan	4.080	1.038	3.075	- 0.366

V. Conclusion

One hundred fifty five adult male and eighty five female subjects have been studied for their stature, head length and head breadth. Statistically significant correlation is present among the stature and these measurements. This study shows that there is a definitive and good correlation between the height and head length, and low correlation of height with head breadth in both sexes. The regression equations have been derived from these measurements. The regression equation for reconstruction of stature from length and breadth of head is $H=a+bP$ where, H=Height, a=Constant, b=Regression Coefficient and P=Length of Parameter.

The data provided in the present study will be of paramount importance to anthropologists to find racial differences and in medico-legal cases when only parts of deceased or Indian, anywhere in the world are available. This study is done in individuals distributed in different part of India. India is a country of different races so there is a lot of variation in the estimates. Hence there is a need to conduct more studies among people of different regions & ethnicity, so that stature estimation becomes more reliable & identity of an individual is easily established.

Conflicts of Interests: None

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