



ORIGINAL ARTICLE

Correlation of Height with head circumference and length in Female population of Upper Punjab.

Fozia Bibi¹, Mashooque Ali², Muzaffar Munir³, Shaiqa Ramzan⁴, Muhammad Saad Abdullah⁵, Salman Khan⁶

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ABSTRACT... Objective: To determine the relationship between head length, head circumference, and height in females of upper Punjab because cranial measurements are a more accurate and dependable way of estimating stature. **Study Design:** Descriptive Cross-sectional. **Setting:** Upper Punjab CMH Kharian Medical College. **Period:** May 2022 to May 2023. **Material & Methods:** This descriptive cross-sectional research involved n=382 females in upper Punjab who were between the ages of 20 and 25. A distributing calliper and a non-elastic tape were used to measure the head's length and circumference, respectively. A common height measuring tool was used to measure height. The female's height and head circumference were both measured in centimetres. The collected data were analysed to determine the relationship between head circumference and height as well as head length and height. For the statistical information, Pearson's correlation coefficient was used, and data were analysed. **Results:** Head length and height were shown to be significantly positively correlated ($r=0.518$, $p<0.001$). Height and head circumference were shown to have a substantial positive connection ($r=0.344$). **Conclusion:** In the current research, it was found that in females from upper Punjab, there had been a substantial positive association between height and head length, showing that head length is a trustworthy predictor in estimating height. Additionally, there was a significant positive relationship between females' head circumference and height.

Key words: Correlation, Females, Head Circumference, Head Length, Height, Measurement.

INTRODUCTION

One significant anthropometric measure for identifying somebody is body height. It's crucial in cases of natural disasters to be able to identify a person from mangled body parts. The physiological relationship between body height and every component of the body of a person, including the head, face, trunk, hands and feet, is clear and proportionate.¹ One can determine one from the other by using the correlation between the measures of body height and head length.

Several research^{2,3} associates have sought to estimate height by measuring different long bones, with varying degrees of effectiveness. The technique that each research associate developed to determine stature from long bones is unique. Every single part of the human body, including the head, face, trunk, hands and feet,

has a clear and proportionate biologic link with stature.

For medical and academic reasons, the evaluation of adult female head circumference in neurodevelopmental disorders is important. In the majority of paediatric medical tests, measuring occipitofrontal head circumference (HC) is a crucial component. Microcephaly and macrocephaly are linked to numerous disorders.⁴ The initial thing we typically do as soon as we are worried about a newborn with a big head is to determine whether or not a parent possesses a large head because investigations have demonstrated that up to 55% of the normal variance in head size is hereditary.⁵ Typically, the only thing that might be performed is to take measurements of parents' heads and make an educated prediction regarding their size.⁶

1. MBBS, M.Phil, CHPE, Senior Demonstrator Forensic Medicine, CKMC Kharian Cantt.
2. MBBS, PCAM, DMJ, Associate Professor Forensic Medicine, AMC Rawalpindi.
3. MBBS, M.Phil, Medical Officer Forensic Medicine, RHC Mirhan, Layyah.
4. MBBS, M.Phil, Senior Demonstrator, Forensic Medicine, CPMC, Lahore.
5. MBBS, M.Phil, CHPE, Associate Professor Anatomy, CKMC, Kharian Cantt.
6. MBBS, General Duty Medical Officer, CMH, Abbotabad.

Correspondence Address:
Dr. Fozia Bibi
Department of Forensic Medicine
CKMC Kharian Cantt.
fozia776@gmail.com

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Since the link between height and various body parts varies depending on ethnicity, racial background, ageing and gender, there currently is no generally applicable formula for estimating body height from various parts of the body. The researchers were unable to locate any study that compared head length to height concerning the females of upper Punjab.

To determine body height from head length, the current work seeks to determine the relationship between head length and body height. Also to determine the relationship between height and head circumference in upper Punjabi females.

MATERIAL & METHODS

In the present descriptive cross-sectional investigation, n=382 Upper Punjab Forensic Medicine, CKMC Kharian Cantt women between the ages of 20 and 25 participated. The Ethical Review Board of the College gave its clearance for the study's execution. (ERB No: RES02/ 02 May 22)

Due to accessibility, women from upper Punjab were chosen, and women between the ages of 20 and 25 have been included considering bone growth typically stops after adolescence. Previous to the operation, informed consent was obtained from the girls after they had been fully told about the treatment.

Inclusion Criteria

The investigation only included females, aged 20 to 25 years with typical craniofacial skeletons and statures.

Exclusion Criteria

Females with development abnormalities, cranial bone anomalies, and a record of craniofacial trauma and operations had to be removed from the course of study.

The height (HT) measurement made by an anthropometer is a measurement of the distance from the vertex to the ground. By placing a gentle upward force on the mastoid bones while urging the patient to remain tall, take a long breath, and calm down, women should stand on a horizontal

surface with their heels closed and extend their upper bodies to the utmost extent possible.⁷ The female's back ought to be as erect as attainable, that can be done by adjusting the posture and rounding or relaxing the shoulders. The medial border of the patient's feet will be positioned at an angle of about 60 degrees, and it is important to keep an eye on the heels to ensure sure they don't lift off the floor. The broadest section of the head is measured as the head circumference (HC).⁸ The tape should be placed directly over the ears, almost touching them, and lined across the forehead so that it covers the brows.

Information was gathered using a convenience (non-probability) sampling strategy. Centimetres (cm) were used for determining the height, head length, and circumference of the head. The collected data were evaluated statistically using the latest version 25 of SPSS to determine the link between head length and height as well as between head circumference and height and to create a regression model for calculating height from head length. Statistics were judged meaningful at $P < 0.05$. The equation for regression is $y = a + bx$, whereby a stands for intercept/constant, b for slope, x for mean head length, and y for height.

RESULTS

There were 382 upper Punjabi women in total who took part in the study. For all females in upper Punjab, the frequency, mean, and standard deviation of height, head length, and head circumference are shown (Table-I). The head circumference can vary from 51.0 cm to 61.0 cm, whereas the head length is in the 17.9 cm to 16.4 cm range.

Descriptive Statistics					
	N	Mini- mum	Maxi- mum	Mean	Std. Deviation
Height	382	150.0	170.8	159.971	4.9833
Head Length	382	15.0	17.9	16.454	.5529
Head Circumference	382	51.0	61.5	55.937	2.1628
Valid N (listwise)	382				

Table-I. Descriptive statistics of variables

The average height, head circumference, and standard deviation for all the females were determined to be respectively 159.94.98 cm, 16.40.55 cm, and 55.92.16 cm.

For computing height and head length, data was analysed. The relationship between height and head length was successfully determined using Pearson’s correlation coefficient. A statistically meaningful value was defined as one with a $p < 0.01$.

Correlations			
		Height	Head Length
Height	Pearson Correlation	1	.518**
	Sig. (2-tailed)		.000
	N	382	382
Head Length	Pearson Correlation	.518**	1
	Sig. (2-tailed)	.000	
	N	382	382

** . Correlation is significant at the 0.01 level (2-tailed).

Table-II. Correlation of height with head length in females

In females from upper Punjab, there was a positive and substantial association between head length and height.

To calculate head circumference and height, statistics were analysed. The correlation between height and head circumference has been determined using Pearson’s correlation coefficient. Statistics have been defined as meaningful at $p < 0.01$.

Correlations			
		Height	Head Circumference
Height	Pearson Correlation	1	.344**
	Sig. (2-tailed)		.000
	N	382	382
Head Circumference	Pearson Correlation	.344**	1
	Sig. (2-tailed)	.000	
	N	382	382

** . Correlation is significant at the 0.01 level (2-tailed).

Table-III. Height and females' head circumference correlation

Height and mean head circumference were found to have no or very little connection, and this was statistically noteworthy ($r = 0.344$). Females from upper Punjab’s association of height with head length likewise showed a statistically significant correlation link. It is discovered that there is a very strong link between height and head circumference, which indicates that head circumference is frequently used to determine a woman’s height. This could prove useful in the identification of many unidentified bodies in medicolegal situations.

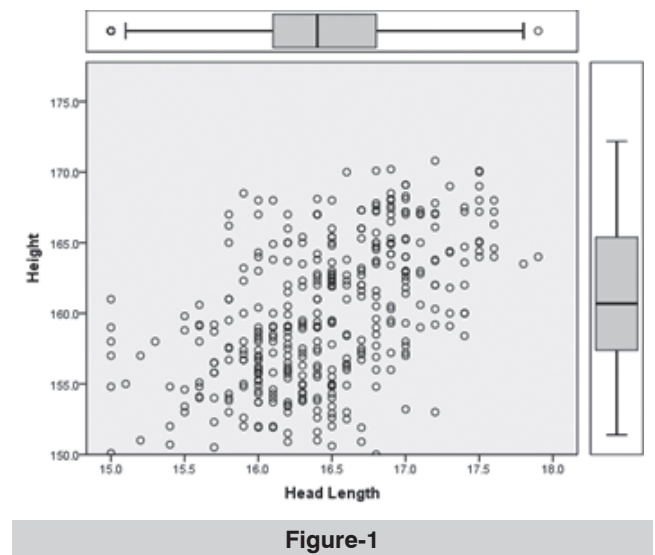
The regression equation $y = a + bx$ was used to calculate the predicted height by entering in the values of the regression constant (a) and regression coefficient (b) from Table-III and the measurement value of the mean head length (x) from Table-I. All age groupings’ recorded and predicted heights have been determined to be substantially equal for each sex.

**Regression Equations:
For Height with Head Length as Independent variable:**

$$\text{Height} = 98.5 + 4.66 \times \text{Head length}$$

For Height with Head Circumference as Independent variable:

$$\text{Height} = 62.5 + 0.7 \times \text{Head circumference}$$



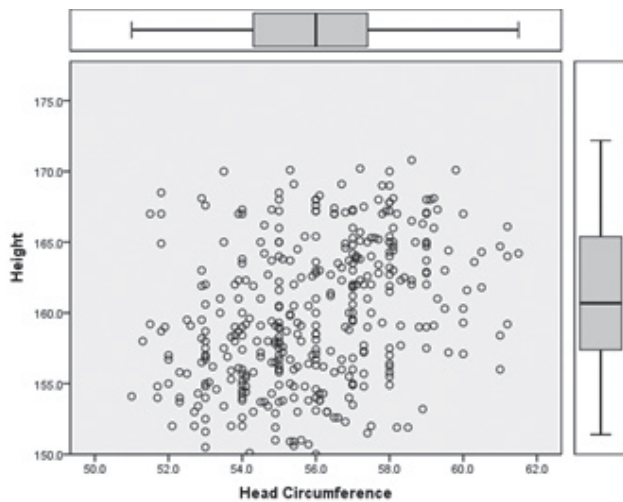


Figure-2

DISCUSSION

Numerous experiments^{7,8} have been done to determine height from various body parts. To estimate height, several studies have employed arm measurements while others have used craniofacial measurements. Numerous research^{9,10} has additionally been done on the association between a person's height and head circumference.

The present research used the regression equation to determine the height from head length and head circumference. For a very long time, researchers, anatomists, anthropologists, and medicolegalists have been interested in the dimensional correlations between the various body parts and the entire body. It is important to remember that anthropometric data can be influenced by some variables, including genetics, nutrition, geography, physical activity, and different racial groups.

In the current study, it was found that head length had a strong and substantial positive association with height whereas there had been no discernible difference between upper Punjabi women's measured and estimated heights. Our research, which discovered a link between head length and height of 0.51, showed similarities with studies⁸ done by medical students from Punjab, ($r = 0.52$) and several districts of Gujarat ($r = 0.53$). The results of this research were congruent with

one research⁹ on young people and members of two distinct ethnic groups, in which it was found that there was a strong relationship between body height and head circumference, length, and width.

In the current study, it was discovered that among higher Punjabi females, there was little to no correlation between height and head circumference. According to a study¹⁰, of 252 teenagers from north India, there is a substantial correlation between head circumference and stature. Their head circumference to height correlations coefficient was $+0.781$, which is higher than Pearson's coefficient and indicates a very strong positive association between the two. Another research¹¹ evaluated adult females' height and head circumference $+0.278$ and found a substantial positive association between the two. According to a study¹², head length and height of people show a significant positive correlation ($+0.53$), while another study¹³ found a high positive link ($+0.52$).

Our research was in line with study¹⁴ in which students' stature for both sexes was positively correlated with head length from nasion to inion, with a correlation coefficient of 0.507 in males and 0.440 in females and a $p < 0.001$. The results of the current investigation were similar¹³ to those of an investigation conducted among medical students from diverse backgrounds, which revealed a substantial positive association between height and both head length and head breadth. According to the results of our research, cranial dimension, or head length, is an independently significant indicator of height. This finding was also supported by the research done on 60 patients in Ghaziabad.

In contrast to a study performed on people between the ages of 18 and 25 in India¹⁵, the current study's correlation coefficient ($r = 0.72$) showed a weakly positive association between height and head length ($r = 0.26$). Our research did not support the findings of a study¹⁶ conducted on adult females, which found no significantly significant association between head length and height ($r = -0.02$). This research contrasts with

one that was done in India¹⁵ with female medical pupils, where it was found that head length had a minimal bearing on estimating height.

Our research did not agree with an investigation on the Indo-Mauritian community¹⁷, where it was discovered that cephalo-facial measurements could not be used to accurately estimate stature. Our investigation revealed no overlap with an investigation done on 100 healthy people¹⁸, which did not demonstrate a favorable relationship between head size and stature.

CONCLUSION

The results of the current study revealed a substantial positive association between head length and height, suggesting that head length can serve as a trustworthy predictor of height using the regression equation. Additionally, the research found a moderately strong positive correlation between head circumference and height in Upper Punjabi girls. As a result, head circumference can also be used to predict someone's height. These kinds of investigations support the finding of a person in medicolegal situations.

In cases of homicides, crashes, or catastrophic events, it is crucial to be able to predict a person's height from partial and deteriorated cranial remains. In forensics and anthropological studies, it is crucial for predicting height from fragmentary and decomposed skull remains. If one of the parameters is known, the remaining variables can be known through using the model of regression.






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AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Fozia Bibi	Substantial contributions to study design, acquisition of data, Manuscript writing, Has given final approval of the version to be published.	
2	Mashooque Ali		
3	Muzaffar Munir		
4	Shaiqa Ramzan		
5	Muhammad Saad Abdullah		
6	Salman Khan		