Original Article

ESTIMATION OF STATURE FROM HEAD LENGTH & HEAD BREADTH IN UNDERGRADUATE MEDICAL STUDENTS: AN ANTHROPOMETRIC STUDY

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ABSTRACT

Background
Height is a significant parameter for growth and development of an individual. The aim of our study is to estimate stature from Head Length (HL) and Head Breadth (HB) in living and to derive the correlation and regression formulae between them.

Methods
This is a descriptive study. A total of one hundred and ninety four medical students, presently studying at Devdaha Medical College and Research Institute, aged between eighteen and twenty four years were selected as the subjects for the present study. Two skull measurements namely head length and head breadth were taken by following standards- Anthropometric methods and technique and the Standing height was measured using a stadiometer.

Results
The Regression equation for stature of males using head length is $153.02+0.75HL$ and using head breadth is $141.65+1.67HB$. The regression equation for stature in females using head length and breadth are $100.837+3.081HL$ and $112.23+3.002HB$ respectively.

Conclusion
From our study we conclude that there is a weak positive correlation between height and head length in both males and females. The data obtained may be useful in anthropological research, forensic, genetic research, as well as in medical clinical practice.

Keywords: Anthropometry, Head Breadth, Head length, Height

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INTRODUCTION

Cephalometry is one of the important part of anthropometry in which dimensions of head and face are measured. Stature is an important parameter in medico-legal aspects. It is important when highly decomposed bodies or only facial remains of skull are brought for medico-legal examination and this is most common in our region where victims are attacked by wild animals in deep forests which makes difficult to identify deceased. In such medico legal examination stature estimation is important including age, sex, race, etc. Each race requires its own formula for stature estimation because racial and ethnic variations exist in population of different geographical regions. The climate and dietary habits of the people of different regions of Nepal are variable. Hence opinions based on the result of studies done in one population cannot be entirely applicable to other population. Considering this scenario the aim of the present study is to estimate the stature from skull anthropometry in this region. Present study will be undertaken to determine stature from maxillo-facial anthropometry in Nepal using head length and head breadth. There are variations in the length of limb bones relative to stature and according to race, sex, age, side of the body, climate, heredity and nutrition[1]. Many studies have been conducted on stature from percutaneous measurements of various body part including arm, leg, feet, etc.[2-5] Considering this scenario there is a need of systematic study for stature estimation from fragmented and dismembered skull remains.

METHODS

This is a cross-sectional descriptive study conducted in the Department of Anatomy, Devdaha Medical College and Research Institute, Nepal from 7th December 2023 to 25th January 2024. It was carried out in 194 (males=130 and females=64) randomly selected asymptomatic, healthy living Nepalese medical students who were in the age group of 18 to 24 years. This age group was selected because generally stature at 18 years accepted as an adult6 and multiplication factor more or less remains constant in this group[7]. Ethical approval was taken from the Institutional Review Committee of the institute (IRC-DMCRI-24/2023). Informed consents were taken from all the participants. The students with skeletal deformities, physical disabilities, past history of skeletal injuries or diseases affecting bones and joints and those who could not stand erect were excluded.

The Standing height was measured using a stadiometer against the wall on barefoot, with their heels together and theheels, buttocks and back touching the stadiometer. The Head Length (HL) is the distance between the glabella and farthest projecting point in the mid-sagittal plane, on back of the head (Occiput) with the help of spreading caliper. Glabella is the most forward projecting point in the midline of the forehead at the level of supraorbital ridges above the nasofrontal suture.

The Head Breath (HB) is taken from the the maximum transverse diameter between two fixed points over the parietal bones with the help of spreading caliper. Both measurements were taken with spreading caliper. All the above measurements were taken by author at a fix time between 2 to 4 pm only to eliminate the discrepancies due to diurnal variation. Selection and information bias were minimized as much as possible because all the measurements were taken thrice and the mean value was obtained. The data was collected in a preformed proforma and tabulated in Microsoft Excel spreadsheet. Statistical analysis was done using Statistical Package for Social Sciences (SPSSTM) software version 20.

RESULTS

Simple linear Regression analysis in the form of equation $Y = a + bx$, where Y is stature and head length and head breadth are independent variable (X) and adjusted R^2 were calculated for Height and head length and for height and head breadth. Prediction equations were then developed subsequently. The descriptive statistics for height, head length and head breadth are shown in Table 1, 2 and Table 3.

Table 1: Descriptive statistics for height, head length (HL) and head breadth (HB) (in cm).

Sex of Students	Variable	N	Mean	SD	Minimum	Maximum	Median
Male	Height	130	167.02	5.93	146	190	167.50
	HL	130	18.67	.78	16.75	22.60	18.6000
	HB	130	15.11	.61	13.40	16.70	15.1000
Female	Height	64	155.9641	7.27650	145.00	179.00	154.6000
	HL	64	17.8942	.88684	14.58	19.40	17.9000
	HB	64	14.5681	.56186	13.20	16.30	14.5000

N- Total number of subject, SD - Standard

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deviation

Average height, HL and HB of male respectively 167.02, 18.67, 15.11 is greater than female 155.96, 17.89, 14.56 cm respectively. The male height is ranging from 146cm to 190 cm and female were 155cm to 179cm.

Table 2: Statistical analysis with derivation of regression equation

sex	Variable	b	Adj. R^2	P value	SEE	a	Regression Equation
Male	HL	0.750	0.002	0.259	5.92	153.022	Height= 153.02+0.75HL
	HB	1.67	0.23	0.047	5.13	141.65	Height= 141.65+1.67HB
Female	HL	3.081	0.127	0.002	6.79	100.837	Height= 100.837+3.081HL
	HB	3.002	0.038	0.045	7.86	112.23	Height = 112.23+3.002HB

b – Regression coefficient, r – correlation coefficient, a – intercept, SEE – standard error of estimate, HL – head length, HB – head breadth.

The height of male is 0.75 times increases if increase of a unit of Head length and 1.67 times in increasing a unit of head breadth. Similarly Female height is 3.08 times increases if one unit of increment of head length and 3.003 times increases in one unit of head breath which are statistically significant (p = 0.002, 0.045 respectively).

DISCUSSION

Stature / height varies with ethnic group / populations and is determined by the genetics of an individual, geographical location, environment and climatic conditions.[8, 9] In our study the correlation of height with head length and head breadth amongst Nepali medical students. Regression equations were derived to predict the height. We choosed Medical students because of easy availability of the subjects. The regression analysis is considered as the best criteria for stature estimation from fragmented body remains[10]. In the study, mean HL in males and females were 18.19 and 17.05 and HB were 13.48 and 12.81 respectively[11] and our study shows mean HL in male and female were 18.67and 17.89 and HB were 15.11in males and 14.5681 in females respectively. The biological profile of an individual is of great importance in the field of Anthropology and stature estimation is one of the most relevant parameters in building it [12]. In the study done in Mangalore showed the range of height was (149 - 178) cm in males and (142.5 -169.5) cm in females, head length was in

the range of (13- 19.5) cm in males and (13 – 17.5) cm in females and head breadth was from (11 – 16.5) cm in males and (10 – 13.5) cm in females[13] and in our study the range of height seen in this study was (146- 190) cm in males and (155 -179) cm in females, head length was in the range of (16.75- 22.60) cm in males and (14.58 –19.40) cm in females and head breadth was from (13.40- 16.70) cm in males and (13.20 – 16.30) cm in females. One study showed that there was no significant correlation between stature and skull parameters[14].The correlation coefficient of stature for skull parameters (HL, HB, and HC) was found to be non-significant. In the study done in South Indian Population, mean HL in males and females were 18.62 ± 0.55 and 17.77 ± 0.44 and HB were 13.62 ± 0.52 and 13.22 ± 0.27 respectively[15]. Similarly the study done in South India Population, the mean of the stature of the female is 151 cm, of head length is 17.6 and of head breadth is 13.2cm. The mean of the stature of males is 164.6 cm. The mean of head length is 18.43 cm and head breadth is 13.3 cm.[16] Some studies have reported that there is a definite correlation between head length and height of an individual.[17-19]

CONCLUSION

From our study we conclude that there is a weak positive correlation between height and head length in both males and females. The data obtained in our study may be useful as a reference for craniometric analyses that will be further useful in anthropological research, forensics, genetic research, medical clinical practice (reconstructive surgery) and in cosmetology. This study will serve as a basis of comparison for future studies in Nepali population.

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