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Original Research Article

Study of Cranial Anthropometric Indices in Adult Population of Uttarakhand, India

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ABSTRACT

Background: Anthropometric measurements especially craniofacial measurements are important for determining various head and face shapes. These anthropometrics studies are conducted on the age, sex and racial/ethnic groups in certain geographical zones. This helps in better understanding the frequency distribution of human morphologies and comparison of different race. Present study was aimed to establish data on craniometry on Adult Population of Uttarakhand, India.

Methods: Present study was conducted in Department of Anatomy, Shridev Suman Subharti Medical College & Hospital, Dehradun, Uttarakhand, India. Study was carried out on 400 adult subjects (200 males and 200 females) with their age 18 yrs. and above. Head lengths were measured from glabella to the inion and head breadth was measured below the nasion to the gnathion and cephalic indexes were calculated.

Results: The percentage means of cephalic index in males and females were 74.11% and 77.59% respectively. Male population is predominantly dolicocephalic with 58% and female population is mesocephalic with 49% while the rarest type of head shape observed in this study is the hyperbrachycephalic type.

Conclusion: From present study, it can be concluded that parameters like head length and breadth shows sexual dimorphism as both the parameters were more in males than females. Present study also shows that it is not necessary that if head is longer in certain populations it will be broader also.

Keywords: Cephalic Index, Head lengths, Head breadth, Anthropology.

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INTRODUCTION

Appraisals of accurate anthropometric measurements of human skulls have been discussed in the field of medical anthropometry for decades. In the past, various methods have been carried out in determining the racial traits by studying cranial capacity, cranial index and observations like Craniometry. Craniometry is the technique of measuring the bones of skull.[1,2]

Anthropometric measurements especially craniofacial measurements are important for determining various head and face shapes. These anthropometrics studies are conducted on the age, sex and racial/ethnic groups in certain geographical zones.[3-6] This helps in better understanding the frequency distribution of human morphologies and comparison of different race. The most important of cephalometric dimension are height and breadth of head that they used in cephalic index determination. Cephalic index is very useful anthropologically to find out racial and sexual differences.[3,5]

Craniofacial anthropometrics has become an important tool used by genetic counsellors and in reconstructive surgery. In genetic counseling it is necessary to identify dysmorphic syndromes as

accurately as possible. The diagnosis of many dysmorphic syndromes is based not only on advanced cytogenetic and molecular techniques, but also on recognition of subtle morphological anomalies in craniofacial region. Dysmorphic characters are usually reported by clinicians in descriptive terms such as "microcephaly" "wide-set eyes" and "large mouth". However, such description is subjective. Anthropometrical measurements can overcome these problems. Measurements taken from a patient can be compared with the values obtained in the normal population, and deviations from the normative values can be evaluated. For instance, anthropometrical data can help in early diagnosis of rather common syndromes. Evaluation of asymmetry is of great importance in the diagnosis of craniosynostoses.

Various research groups have investigated the intra- and interrater variabilities of cranial measurements[7-9], with measurements by standardized calipers being the most common anthropometric tool.[10-12] The accuracy of caliper measurements has usually been checked by averaging three measurements[13,14] by a well-trained

examiner. Tests for inter- and intra-observer variability require repeated measurements by the trained examiners[10,15] and should follow a standardized measurement program. [16]

Nevertheless, only few studies present normal values on healthy individuals in some particular population. Present study was aimed to establish data on craniometry on Adult Population of Uttarakhand, India. The data was compared with previous published data and attempted to find out correlation in the observations if any.

MATERIALS AND METHODS
Present study was conducted in Department of Anatomy, Shridev Suman Subharti Medical College & Hospital, Dehradun, Uttarakhand, India. Study was carried out on 400 adult subjects (200 males and 200 females) with their age 18 yrs. and above. Subjects showing cranial abnormality and those who are below 18 yrs, were excluded from the study. The measurements were taken thrice and mean was calculated to ensure accuracy.

Parameters: The subjects were asked to sit on a chair in relaxed condition with their heads in anatomical position and the measurements taken using a spreading calliper using stretched anatomical landmarks.

Following parameters were measured
- Head Length: It was measured from glabella to the inion.
- Head Breadth: It was measured below the nasion to the gnathion.

From above parameters cephalic index was calculated as per following formula.

Cephalic Index = Head length x 100 / Head breadth

Above indices were determined on the basis of international anatomical descriptions.[3] Depending upon these indices the types of head shapes were classified as given by Williams et al, 1995)[3]:

Head shape	Range of Cephalic Index (CI) (%)
Dolicocephalic	< 74.9
Mesocephalic	75 –79.9
Brachycephalic	80 – 84.9
Hyperbrachycephalic	85 – 89.9

RESULTS
A total of 400 subjects were studied out of which 200 were males and 200 were females, the mean and standard deviations of head length, head breadth and cephalic index obtained from the subjects are present in table 1. The percentage means of cephalic index in males and females were 74.11% and 77.59% respectively.

Results obtained based on the cephalic indices showed that the male population is predominantly dolicocephalic with 58% and female population is mesocephalic with 49% while the rarest type of head shape observed in this study is the hyperbrachycephalic type. (Table 2)

Table 1: Showing details of present study population.

S. No.	Parameter	Males (mean ±SD)	Females (mean ±SD)	P Value
1.	Head Length	185.72 ± 7.49	175.48 ± 7.93	<0.001
2.	Head Breadth	140.13 ± 6.85	136.73 ± 7.02	<0.001
3.	Cephalic Index	74.11 ± 5.03	77.59 ± 6.32	<0.001

Table 2: Showing types of heads on the basis of cephalic index in present study.

S. No.	Type	Range	Male %	Female%
1.	Dolichocephalic	<74.9	116(58%)	71(35.5%)
2.	Mesocephalic	75-79.9	63(31.5%)	98(49%)
3.	Brachyphalic	80-84.9	18(9%)	25(12.5%)
4.	Hyperbrachycephalic	85-89.9	3(1.5%)	6(3%)

DISCUSSION
When anthropometric methods were introduced into clinical practice to quantify changes in the craniofacial framework, features distinguishing various races/ethnic groups were discovered. To treat congenital or post-traumatic facial disfigurements in members of these groups successfully, surgeons require access to craniofacial databases based on accurate anthropometric measurements. Normative data of facial measurements are indispensable to precise determination of the degree of deviations from the normal. The human body dimensions are affected by ecological, biological, geographical, racial, gender and age factors.[28-30]

This study focused on craniofacial anthropometrical measurements of healthy population of Uttarakhand region (India) having no obvious dysmorphological features and no known family history of genetic defects. The present study has been compared with the previous studies of head length and head breadth. It has been seen that population of Latvia and various studies conducted

for population of Nigeria show that head length in both the males and females of these regions is higher than the study population. This population when compared for head breadth shows that the population of Latvia and Nigeria Ibibios has broader heads but North Eastern Nigerian have almost similar dimensions to study population.

The mean breadth in present study was 140.13 mm in males and 136.73 mm in females. The head breadth of present study when compared with populations of Malaysians, Japanese and Sri Lankans, it was found that they have broader heads as seen in table 4. Present study when compared with Indian studies conducted on Gujarati males (Sindhi, Patel, Rabari and Bheels) and the students conducted on Punjabi students in Punjab shows that they have broader heads.

The mean head length in present study was found to be more in few previous studies as shown in table 3.[22,25-28] Differences in these parameters can be attributed to genetic, geographical with

Malaysian, Japanese and Sri Lankans. Genetic factors could be responsible for the increased head breadth in some population groups. Whereas, in certain populations the heads are broader than the present study but the lengths being smaller than the present study. It shows that it is not necessary that if head is longer in certain populations it will be broader also.[17]

Table 3: Comparison of findings of various studies with present study.

S. No.	Study	Region	Sex	Head Length (Mm)	Head Breadth (Mm)
1.	Sanjay Gupta[17]	North India	M	186.88	139.51
			F	177.74	136.19
2.	Nagle E[18]	Lativa	M	193.1	154.2
			F	183.3	145.8
3.	Raji J M[19]	Nigeria (North-Eastern)	M	190.8	137.0
			F	183.9	135.7
4.	Maina M B[20]	Nigeria	M	191.11	135.9
			F	183.53	135.47
5.	Oladipo G S[21]	Nigeria (Ibibos)	M	190.6	152.0
			F	188	147.0
6.	Ngeow WC[22]	Malasian Malays	M	184.1	155.0
			F	173.4	149.4
7.	Mahajan A[23]	Punjabi Students	M	185.8	156.8
			F	179	147.2
8.	Hossain MG[24]	Japanese adult females during	M	179.07	155.0
			F	180.12	147.8
9.	Iiperuma I[25]	Sri Lanka	M	180.5	147.8
			F	175	141.11
10.	Shreshtha O[26]	Nepal (Rai)	M	179.6	-
			F	171.32	-
		Nepal (Limbu)	M	180.01	-
			F	171.94	-
11.	Jadhav HR[27]	Guajarati Males	Sindhi	185.6	153.4
			Patel	185.6	150.1
			Rabar	182.2	146.4
			Bheel	179.6	136.7
12.	Akhtar Z[28]	Bangladeshi Garo	M	174.9	-
13.	Present Study	Uttarakhand, India	M	185.72	140.13
			F	175.48	136.73

CONCLUSION

From present study, it can be concluded that parameters like head length and breadth shows sexual dimorphism as both the parameters were more in males than females. Present study also shows that it is not necessary that if head is longer in certain populations it will be broader also. Caliper measurements provide highly precise information on the main morphometrical features, with repeatability and low intra- and inter-observer variabilities. It is essential that such measurements are performed following a standardized protocol.

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