

Cephalic Index and Head Shape in Various Castes of Hadoti Region

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Abstract

Introduction: Cephalic index (CI) is a very useful anthropologically to find out racial and sexual differences and it is affected by geographical, gender, age, and racial factors.

Aims: To study and comparison of CI and Head shape in various castes of Hadoti region and its comparison with other Indian and Foreign studies.

Materials and Methods: Head length and head breadth and CI were measured in 400 subjects of both sexes of various castes of Hadoti. The CI was measured as the ratio of the maximum breadth of head to its maximum length. Determined on the basis of international anatomical description of CI: Head shape according to the range of CI (%), i.e., dolicocephalic (<74.9%), mesocephalic (75.79.9%), and brachicephalic (80-84.9%)

Result: Out of all the communities studied the mean CI is highest among Meena (77.83) and lowest among Brahmin (76.95). The majority of the population in each caste belong to mesocephalic head shape (60% Baniya, 62.85% Brahmin, 50% Jat, 55.71% Meena, and 59.16% Others).

Conclusion: This study showed that both mean head length and mean head breadth was higher in male than female which shows sexual dimorphism. However, the mean CI of female was significantly higher than those of male ($P < 0.05$). The majority of the population (57.75%) belong to mesocephalic head shape.

Key words: Anthropometry, Cephalic index, Head breath, Head length

INTRODUCTION

Human physical variability has been a subject of great interest for the scientists for a very long time and anthropometry evolved as a standard scientific technique for measuring human body dimensions.¹ Ethnologists classified Indian population on the basis of anthropometric data collected from a various population of Indian subcontinent.¹ So far, many studies have been conducted in various parts of India applying the techniques of anthropometry.² This is a humble beginning toward

undertaking an anthropometric study on head of various Castes of Hadoti region.

The study of intra- and inter-population variations in different morphological characters have long been an interest of anthropologists. The dimensions of the human body are affected by ecological, biological, geographical, racial, gender, and age factors. On the basis of the above factors, anthropological studies have been conducted on the age, gender, and racial groups in certain geographical zones.³

Cephalometry is a branch of anthropometry in which the anatomical dimensions of head and face are measured. Cephalometric studies can be carried out by various methods such as photogrammetry, ultrasound, computed tomographic scanning, magnetic imaging, optical surface scanning, and cephalometry. Out of all, cephalometry continues to be the most versatile technique in the

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investigation of the craniofacial skeleton because of its validity and practicality.⁴

This study was conducted in Hadoti region of Rajasthan in view of its importance in anthropometric indices in diagnostic knowledge between the patient and normal populations and in the medico-legal cases of forensic medicine. The cephalometric results can also be of great assistance while evaluating patients in various fields of medicine like medical imaging, pediatrics, craniofacial surgery⁵ and also for studying growth trends in various castes/races within a defined geographic zone.⁶ Anthropometric study of head is useful in designing various equipment of head and face such helmets, headphones, and goggles by formulating standard sizes.⁷

The observations and findings of this study will provide a platform for similar extended cephalometric studies based on various communities/castes/races of particular geographic zones.

MATERIALS AND METHODS

The study was carried out in major communities (Brahmin, Baniya, Jat, Meena and Others) of Hadoti region which is still occupying particular locations of various districts in different regions.

The 400 subjects of both sexes who belonged to 21-50 years of age and who were not having any history of inter-caste, inter-religion marriage of their parents' up till at least 3 generations were included in the study.

A written consent of the subjects was taken after an explanation about aims and objectives of the study in locally palatable language.

The method used for assessing cephalic index (CI) was Hrdlicka's method.⁸ The head length was measured with spreading calipers from glabella toinion. The head breadth was measured as the maximum transverse diameter between the two fixed points over the parietal bones. All measurements were taken in millimeters. All measurements were taken with the subject sitting on a chair, in a relaxed mood, and the head in the anatomical position.

CI was calculated as biparietal diameter/length of cranium $\times 100$.

The head shape according to the range of CI (%), i.e., dolicocephalic (CI $\leq 74.9\%$), mesocephalic (CI = 75-79.9%), brachicephalic (CI = 80-84.9%), and hyperbrachicephalic (CI = 85-89.9%).

Data Analysis

The data were entered into the computer and analyzed using NCSS statistical package. The differences in means of CI, head length, and head breadth were tested for statistical significance by independent sample *t*-test.

RESULTS

From the collected data, statistics was analyzed and observations and results are presented in tabulated form (Tables 1-4 and Figure 1).

According to Table 1:

- The mean head length was highest among Brahmin (175.98 mm) and lowest among Meena (170.14 mm)
- The mean head breadth was highest among Brahmin (136.39 mm) and lowest among Meena (132.45 mm)
- The mean CI was highest among Meena (77.83) and lowest among Brahmin (76.95).

According to Table 2, the mean CI was 76.60 and 78.37 in male and female population, respectively, which shows that the mean CI in female was 2-3 points higher than

Table 1: Mean cephalometric parameters in various castes of Rajasthan

Caste	Sex	Number	Mean HB \pm SD (mm)	Mean HL \pm SD (mm)	Mean CI \pm SD (%)
Baniya	M	40	135.75 \pm 5.35	176.32 \pm 6.26	77.04 \pm 3.04
	F	30	134.26 \pm 3.82	172.21 \pm 5.25	78.01 \pm 2.35
	Total	70	135.0 \pm 4.58	174.26 \pm 5.75	77.52 \pm 2.69
Brahmin	M	40	137.35 \pm 4.60	178.92 \pm 4.49	75.68 \pm 2.34
	F	30	135.43 \pm 3.96	173.03 \pm 3.82	78.27 \pm 1.82
	Total	70	136.39 \pm 4.28	175.98 \pm 4.15	76.95 \pm 1.95
Jat	M	40	136.75 \pm 5.94	175.77 \pm 6.20	76.69 \pm 3.10
	F	30	134.33 \pm 5.19	170.67 \pm 5.84	78.81 \pm 3.34
	Total	70	135.54 \pm 5.56	173.22 \pm 6.02	77.75 \pm 3.22
Meena	M	40	133.30 \pm 6.40	172.82 \pm 5.90	77.04 \pm 3.17
	F	30	131.60 \pm 5.66	167.46 \pm 5.45	78.63 \pm 3.57
	Total	70	132.45 \pm 6.03	170.14 \pm 5.67	77.83 \pm 3.37
Others	M	70	135.01 \pm 4.82	176.50 \pm 5.66	76.56 \pm 2.94
	F	50	132.54 \pm 4.60	169.68 \pm 4.48	78.12 \pm 2.66
	Total	120	133.78 \pm 4.71	173.09 \pm 5.07	77.34 \pm 2.80

SD: Standard deviation

Table 2: Mean cephalometric parameters in both genders

Sex	Number	Mean HB \pm SD (mm)	Mean HL \pm SD (mm)	Mean CI \pm SD (%)
Male	230	135.73 \pm 5.52	177.07 \pm 5.81	77.60 \pm 2.97
Female	170	134.43 \pm 4.75	171.61 \pm 5.01	78.47 \pm 2.79
P value		<0.05 (significant)	<0.05 (significant)	<0.05 (significant)
Total	400	135.08 \pm 5.03	174.34 \pm 5.31	78.04 \pm 2.63

SD: Standard deviation

male. The mean CI of Hadoti region population was as shown in Table 3.

According to Table 3 and Figure 2:

- In Baniya caste, 57.5% male are mesocephalic, 25% are dolicocephalic and 17.5% are brachicephalic, whereas in female 63.33% are mesocephalic, 20% are dolicocephalic and 16.67% are brachicephalic. The majority of male (57.5%) and female (63.33%) belong to mesocephalic head shape.
- In Brahmin caste, 55% male are mesocephalic, 37.5% are dolicocephalic and 7.5% are brachicephalic, whereas in female 73.33% are mesocephalic, 10% are dolicocephalic and 16.67% are brachicephalic. The majority of male (55%) and female (73.33%) belong to mesocephalic head shape.
- In Jat caste, 52.5% male are mesocephalic, 32.5% are dolicocephalic and 15% are brachicephalic,

whereas in female 46.67% are mesocephalic, 10% are dolicocephalic, 36.67% are brachicephalic and 6.67% are hyperbrachicephalic. The majority of male (52.5%) and female (46.67%) belong to mesocephalic head shape.

- In Meena caste, 60% male are mesocephalic, 22.5% are dolicocephalic and 17.5% are brachicephalic, whereas in female 50% are mesocephalic, 16.67% are dolicocephalic, 36.67% are brachicephalic and 6.67% are hyperbrachicephalic. The majority of male (60%) and female (50%) belong to mesocephalic head shape.
- In other caste, 54.28% male are mesocephalic, 30% are dolicocephalic, and 15.71% are brachicephalic, whereas in female 66% are mesocephalic, 10% are dolicocephalic, and 24% are brachicephalic. The majority of male (52.5%) and female (46.67%) belong to mesocephalic head shape.

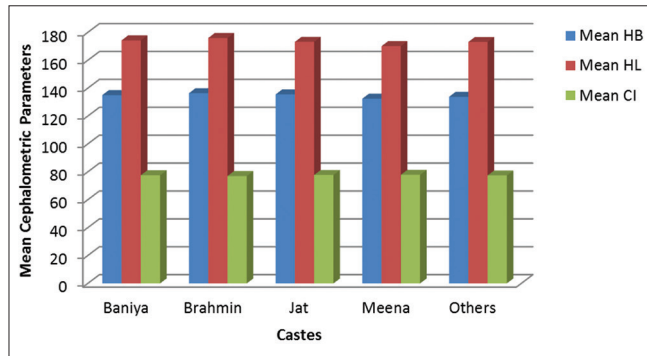


Figure 1: Mean cephalometric parameters in various castes

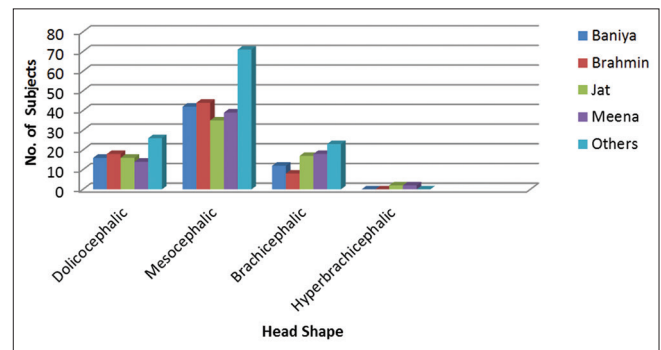


Figure 2: Mean head shape in various castes

Table 3: Different type of mean head shape in various castes

Caste	Sex	Number	Dolicocephalic (%)	Mesocephalic (%)	Brachicephalic (%)	Hyperbrachicephalic (%)
Baniya	M	40	10 (25)	23 (57.5)	07 (17.5)	00 (0)
	F	30	06 (20)	19 (63.33)	05 (16.67)	00 (0)
	Total	70	16 (22.85)	42 (60)	12 (17.14)	00 (0)
Brahmin	M	40	15 (37.5)	22 (55)	03 (7.5)	00 (0)
	F	30	03 (10)	22 (73.33)	05 (16.67)	00 (0)
	Total	70	18 (25.71)	44 (62.85)	08 (11.42)	00 (0)
Jat	M	40	13 (32.5)	21 (52.5)	06 (15)	00 (0)
	F	30	03 (10)	14 (46.67)	11 (36.67)	02 (6.67)
	Total	70	16 (22.85)	35 (50)	17 (24.28)	02 (2.85)
Meena	M	40	09 (22.5)	24 (60)	07 (17.5)	00 (0)
	F	30	05 (16.67)	15 (50)	11 (36.67)	02 (6.67)
	Total	70	14 (20)	39 (55.71)	18 (25.71)	02 (2.85)
Others	M	70	21 (30)	38 (54.28)	11 (15.71)	00 (0)
	F	50	05 (10)	33 (66)	12 (24)	00 (0)
	Total	120	26 (21.16)	71 (59.16)	23 (19.16)	00 (0)

Table 4: Distribution of mean head shape gender wise

Sex	Number	Dolico-cephalic (%)	Meso-cephalic (%)	Brachi-cephalic (%)	Hyperbrachi-cephalic (%)
Male	230	68 (29.56)	128 (55.85)	34 (14.78)	00 (0)
Female	170	19 (11.17)	103 (60.58)	44 (25.88)	04 (2.35)
Total	400	87 (21.75)	231 (57.75)	78 (19.50)	04 (1)

According to Table 4, the majority of male (55.85%) and female (60.58%) belonged to mesocephalic head shape in Rajasthan.

DISCUSSION

The mean CI in various castes of Hadoti region was 78.04. The mean CI in male was 77.60 and in female was 78.47 (Table 4). This finding is slightly higher than Bhils study with 76.98 (Bhargava and Kher, 1960).⁹ However, lower than Barelhas with 79.80 (Bhargava and Kher, 1961)¹⁰ and Gujarati males with 80.42 (Shah and Jadhav)¹¹ of Indian group (Figure 3).

When compared with other groups such as European (81.19),¹² North of Europe (79.72) (Garcia and Lips, 1986b),¹³ Chile (81.51) (Garcia and Lips, 1986a),¹⁴ Iran 80.4 (Golalipour, 2007),¹⁵ South of Iran (82.4) (Vojdani, 2009),¹⁶ Ijaw (80.98) and Igbo (79.04) tribes community (Oladipo and Olotu, 2006),¹⁷ Baysela state, Nigeria (78.68) Eroje and Fawehinmi¹⁸ (2008) study in Port arcourt, Nigeria with 79.80 it is lower but higher when compared to Abolhasanzadesh and Farahani¹⁹ study in Tehran – Iran with 75 (Figure 3).

The CI of females in this study was 78.47. This finding is quite similar with IIayperuma²⁰ (2011) study on Sri Lankan female with 79. In females, the dominant type of head shape was mesocephalic (60.58%). Which is quite similar with Bhasin²³ (2006).

In this study, the mean CI was 78.04 which is slightly higher than the mean CI (76.94) of Salve *et al.* (2011)²¹ for Andhra Pradesh. But in our study, we recorded caste of subjects. These subjects belong to caste, community, scheduled caste, scheduled tribes, etc. This may be the reason for the difference between the mean CI of this study and the mean CI of Salve *et al.* (2011) for Andhra Pradesh. Our results are almost nearer to that of Salve *et al.* (2011),²²

Bhargav and Kher (1960) for Bhils of Central India 76.98 (Figure 3).

The shape of head was mesocephalic in 57.5%, dolicocephalic in 21.75%, brachycephalic in 19.50%, and hyperbrachycephalic only in 1% subjects of Hadoti. The majority (57.5%) belong to mesocephalic.

In this study, dominant type of head shape in males was mesocephalic (55.85%) and the mean CI was 77.60 (mesocephalic). The finding of mesocephalic is similar to study done on Indian males, Bhasin²³ (2006), Shah and Jadhav¹¹ (2004) in Gujarati (41%), del Sol¹⁴ in Chile (66%) which showed mesocephalic head shape is common.

The other dominant type of head shape in present study was dolicocephalic (29.56%) which is lower than Bhatia *et al.* (1995)²⁴ in which 58.5% of population was dolicocephalic and higher than Iranian group 7.5% in South Iran (Vojdani *et al.*),¹⁶ 1.5% in North Iran (Golalipour, 2006b),²² 9% in Tehran (Abolhasanzadeh and Farahani),¹⁹ 7% in Indian Gujarati (Shah and Jadhav)¹¹ and about 2% in IX Region of Chile (del Sol).¹⁴

In this study, least common type of male head shape was brachycephalic (14.78%). However, this was dominant type observed in on Fars males in North of Iran (52%) (Golalipour, 2006b),²² South Iran (34.3%) (Vojdani *et al.*).¹⁶

In Hadoti, 14.78% male and 25.88% female were brachycephalic. This shows that there is tendency toward dolicocephalic to brachycephalisation. Comparing previous records of CI with recent work proves tendency toward “brachycephalization” - evidence of continuous growth of brain more in the lateral direction.²⁵ Furthermore, in tropical zones head form is longer (dolichocephalic) but in temperate zones the head form is more round (mesocephalic or brachycephalic).²⁶ Since India is in the partly in temperate and tropical zone, the present classification shows tendency to brachycephalization from dolichocephalic.

CONCLUSION

The mean CI of medical students was 78.04. The CI in female was 2-3 points higher than the male in present study which shows sexual dimorphism. The majority of subjects of Hadoti (57.5%) belong to mesocephalic. In Hadoti, 14.78% male and 25.88% female are brachycephalic. This shows that there is tendency toward dolichocephalic to brachycephalization. The data and result of this study are statistically significant ($P < 0.05$). CI is very useful anthropologically to find out racial and sexual differences, give a clue to genetic transmission of inherited characters,

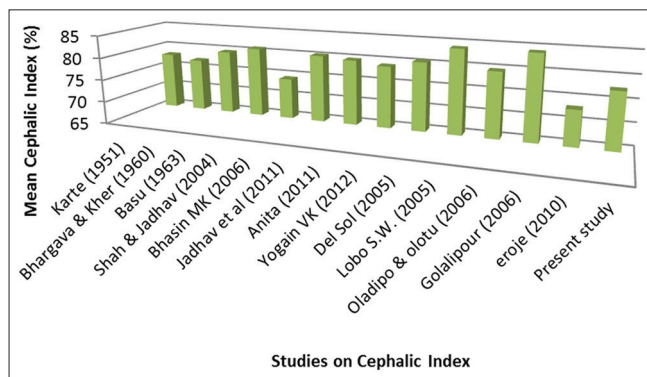


Figure 3: Comparison of mean cephalic index (CI) with other studies

useful in designing various equipment of head and face such as helmets, headphones, and goggles by formulating standard sizes. These cephalometric data can be useful for forensic medicine experts, plastic surgeons, anatomist, anthropologist, oral surgeons and for clinical and research purpose. This study will serve as the basis of comparison for future studies on Hadoti population.

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