

Original article

A study of Cephalic index among the young age group of West Bengal in relation to sex and geographical factors

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Abstract:

Background Human body is undergoing evolution constantly over time. Cephalometry is a branch of Anthropometry in which the anatomical dimensions of the head and face are measured. By convention, skulls with CI below 75 are classified as Dolicocephalic, skulls with CI between 75.0 to 79.9 are called Mesaticephalic and skulls with CI 80.0 or greater are called Brachycephalic The present study of CI was done among the young population group of West Bengal in relation to sex and geographical factors and targets specifically students of West Bengal

Procedure :Observational study , conducted over a period of one and half years, at Department of Anatomy, Nil RatanSircar (NRS)Medical College and hospital in West Bengal, over 200 students of age 17-20 years with normal health, from different districts of West Bengal studying at NRSMCH.Students from other states and those with any history of bone diseases like Rickets and Osteomalacia. The following formula was used: Cephalic Index = Head breadth ÷ Head Length × 100

Conclusion: The mean overall CI was 81.09 ± 3.42 which implies that the dominant head shape among students of West Bengal is brachycephalic. In both males and females the dominant head type is brachycephaly and the rarest type is dolichocephaly. This is in contrast with previous studies where mesaticephaly was the predominant type.

Keywords: Cephalic index, West Bengal students, brachycephaly

Background

The traditional view of race is that it is one of the major zoological divisions of mankind, regarded as having a common origin and exhibiting a relatively constant set of physical traits. Early anthropologists classified man largely through geographical origins and recognized physical traits. The four traditional races were :

1. Caucasoid, geographically from Europe, North Africa, middle east, Indian subcontinent, parts of Central Asia
2. Negroid, geographically represented by Sub Saharan and West African groups
3. Mongoloid races are represented geographically by groups in East Asia, South Asia, Southeast Asia and Polynesia
4. Finally,Australoid races are represented by groups in Australian Aborigines, Maori , Pacific islanders, Fijians and Papuans (1)

Human body is undergoing evolution constantly over time. Cephalometry is a branch of Anthropometry in which the anatomical dimensions of the head and face are measured. Cephalometry continues to be the most versatile technique in the investigation of the craniofacial skeleton , because of its validity and practicability.(2)

Cephalic index was calculated using the following formulae:

$$\text{Cephalic index(CI)} = \text{Head breath/Head length} \times 100 \text{ (3)}$$

By convention, skulls with CI below 75 are classified as Dolicocephalic, skulls with CI between 75.0 to 79.9 are called Mesaticephalic and skulls with CI 80.0 or greater are called Brachycephalic.

The present study of CI was done among the young population group of West Bengal in relation to sex and geographical factors and targets specifically students of West Bengal. Different regions of our state shows a mixed population like Brahmins, Kayasthas, tribals etc. In a tertiary care hospitals like ours the student population can be said to be representative of different population groups from various regions of the state.

Aims and Objectives

In the present study we intend to study the CI in a group of students from different casts and from various regions of the state, between 17-20 years of age, and also to compare the findings among various districts of the state and particular geographic zones

Procedure

Study setting: Department of Anatomy, Nil RatanSircar (NRS)Medical College and hospital in West Bengal

Time lines: March 2015 to August 2016

Definition of problem: Students, both male and female, age group 17-20 years from different regions in west Bengal

Study variables: Age, sex of the subjects included in the study, and the geographical factors affecting CI

Inclusion criteria: Students of age 17-20 years with normal health, from different districts of West Bengal studying at NRSMCH

Exclusion criteria: Students from other states and those with any history of bone diseases like Rickets and Osteomalacia

Sample size: Two hundred students

Study design: observational descriptive study

Method of data collection: Students were asked to sit in a relaxed state, straight and looking forward. Head measurements were determined using spreading callipers. The study was carried out after getting ethical committee clearance

Result

200 students from different districts of West Bengal were enrolled for the study. Age range for male and female both was 17-20 years. The number of male candidates was 148(74%) and the number of female candidates was 52(26%).

The number of students of Mesaticephalic group was 58 (29%).The number of students of Dolicocephalic group was 27(13.5%). The number of students of Brachycephalic group was 68(34%) and the number of students of Hyperbrachycephalic group was 47(23.5%) . (Table1)

The number of students who belonged to general caste was 126(63%).The number of candidates who belonged to schedule caste was 47(23.5%), schedule tribe was 6(3%) and OBC was 21(10.5%).(Table 2)

Among the total number of 200 students studied the CI range from 67.06 to 94.03. The mean CI was 81.09 with standard deviation(SI)of 5.40 and standard error(SE) 0.38.

Of the 148 male candidates studied the CI range from 67.06 to 94.03. The mean CI was81.2 ,SD 5.23 and SE 0.42.

Of the 52 female candidates studied the CI range from 68.71 to 93.19. The mean CI was 80.76 with SD 5.88 and SE 0.81.

Out of 126 general caste students studied the minimum and maximum CI were 67.06 and 93.19 respectively, SD was 5.54 with SE of 0.49.

Again out of 47 schedule caste candidates studied the minimum CI was 68.07, maximum CI was 94.03, with SD 5.46, and SE of 0.79.

For the of six schedule tribe candidates studied, the minimum CI was 72.72, maximum CI was 86.84; SD 5.77, SE being 2.35. For the 21 OBC students the parameters were respectively 71.15, 90.84, 4.47 and 0.97 respectively.

The maximum of the candidates belonged to the district of North 24 Pgs. Among these students ten were brachycephalic followed by Hyper- and Mesaticephalic types (eight for each), The least number of candidates (five) were dolicocephalic.

The second most contributory district was Burdwan, which had same number of mesati- and brachycephalic candidates (nine or 4.5% each). This district also showed 2.5% hyperbrachy and 1.5% dolicocephalism. The third most contributory district was the South 24 Pgs. Here the number of brachycephalic, mesaticephalic, hyperbrachycephalic and dolicocephalic candidates were 8, 7, 5 and 3 respectively.

Table – 1 (Distribution as per skull type)

CI group	Frequency	Percent
Mesaticephalic	58	29.0
Dolicocephalic	27	13.5
Brachycephalic	68	34.0
Hyperbrachicephalic	47	23.5

Table – 2 (Distribution as per caste)

Caste	Frequency	Percent
General	126	63.0
SC	47	23.5
ST	6	3.0
OBC	21	10.5

Table – 3 (Different skull types in the two sexes)

CEPHALIC INDEX	MALE	FEMALE	TOTAL
MESATICEPHALIC	47	11	58
DOLICOCEPHALIC	16	11	27
BRACHYCEPHALIC	51	17	68

Discussion

Cephalic Index or Index of breadth is the useful tool for identification and was first identified by Swedish Professor of Anatomy, Anders Reztus (1796 – 1860) who used physical anthropology to classify ancient human remains found in Europe [2]. Cephalic Index was calculated using the following formula:

$$\text{Cephalic Index} = \text{Head breadth} \div \text{Head Length} \times 100[3]$$

By convention, skulls with CI below 75 are classified as Dolicocephalic, skulls with CI between 75.0 to 79.9 are called Mesaticephalic and skulls with CI 80.0 or greater are called Brachycephalic. Cephalic Index is very useful anthropologically to find out racial and sexual differences. Studies on Cephalic Index have been carried out in India and abroad. In the nineteenth century some authors used the CI to establish the superiority of one race over another [3]. Comparison of changes in the Cephalic Index between parents, offsprings and sibling can provide a clue to the genetic transmission of inherited characters [4]. In view of the aforementioned advantages of determining the Cephalic Index, this study (on Cephalic Index) was done among the young population group of West Bengal in relation to sex and geographical factors.. The observations and findings of this study will provide platform for similar extended Cephalometric studies based on various communities/castes/races of particular geographic zones. In India, various studies have been performed on the North Indian, West Indian and South Indian populations. However there is relative paucity of literature on Cephalic Indices in the East Indian populations, hence our study targeted specifically students of West Bengal.

Crania of different populations show different cranial indices. Bhargav and Kher in 1960 found mean CI as 76.9 in Bhil population [5] and further Bhargav and Kher in 1961 found it to be 79.80 among Barelias population in central India [6]. Kate BR found mean CI of sickle cell anaemic patients as 77.9 [7].

Yagain et al [4] studied cephalic index in Indian students, dominant type of head shape in males was dolichocephalic (33%) and brachycephalic (33%), but the mean cephalic index was 77.92(mesocephalic). The mean cephalic index in females was 80.85, which showed that majority were brachycephalic (33%), with 29% each of dolichocephalic and hyperbrachycephalic and least common mesocephalic (9%). Nigerian crania are considered as dolichocephalic while European crania are mesocephalic. Heidari in the study on female population of south –east Iran, reported 21.3% crania as dolichocephalic, 41.3% crania as mesocephalic and 31.5% crania as brachycephalic [8]. Golalipour, in his study on Fars male population of Gargan-north of Iran, reported most of the crania as hyperbrachycephalic (52%) and only few were dolichocephalic(1.5%) [9].

In the present study, mean cranial index of males has been 81.20 and female has been 80.76. This finding was higher than that of North Indians as a whole[2], Haryanvi Baniyas,[10]Gujratis [11,12], Odiyas[13], Marathi and Telegu[14] population but less than that of Punjabis[15]. In addition, this CI was higher than that of Bhils (76.98) [5], Barelias (79.8) [6], central Rajasthan (79.72) [16], Iranians (80.41) [9], Igbo(79.04) and Ijaw (80.98) tribes[17] , Baysela state of Nigeria (73.68) [18], but lower than that of the population residing in south of Iran(82.4) [19].

Table – 4: The comparison of the present study with previous studies:

Region	Studied by	Sample size	Range of Cephalic index	Mean Cephalic index		Mean CI of the whole study
				Males	Females	
North India	Anitha et al[2]	100	64.00-93.55	79.14	80.74	
Indian Students	Yagain et al[3]	100	65.07-93.75	77.92	80.85	77.92±5.20
Haryanvi Baniyas	Kumar & Gopichand [10]	600	51.2-94.54	66.72	72.15	
Gujarat	Shah JV & Jadhav HR [11]	500	71.10-89.77	80.42	81.20	80.8
South Gujarat	Uttekar K et al[12]	800	69.06-89.55	80.88	82.48	81
Southern Odisha	Patro et al [13]			77.28	77.38	77.75±3.44
Maharashtra	Gujaria IJ [14]	440	69.57-87.53	77.08	79.02	78.14±2.97
Andhra Pradesh & Gujarat		420	69.11-84.52	76.28	78.16	77.32±2.87
		500	71.10-89.77	80.42	81.20	80.82± 3.77
Punjab	Mahajan A et al [15]	400	71.02-91.56	81.34	85.75	
West Bengal	Present study	200	67.06-94.03	81.20	80.76	81.09±5.39

The cephalic index of the female students of West Bengal in present study is 80.76. This finding was lower than that of Shah and Jadhav from India with mean CI 81.20[11],Golalipour (2006) study on native Fars group with mean CI 85[9], Turkman group with mean CI 82.8 in North of Iran [20], but higher than that of Ijaw (78.24) and Igbo (76.83) tribes [17],Baysela state, Nigeria with mean CI 72.24 [18] , Abolhasanzedeh and Farahani study from Iran with mean CI 75 [21]and the Buretic- Tomljanovic et al (2004) study in Croatia with mean CI 79.23[22].

In females the dominant head shape was brachycephalic (32.69%). It is similar to other study in Tehran- Iran (42.7%) [21], South of Iran (42.5%) [9]and Shah and Jadhav study in India (49%) [14]. But in a study among Fars female, North Iran, hyper brachycephalic (53.6%) [9]was dominant which in our present study is 25%.

In the present study the rarest head shape was dolichocephalic. This is similar to other studies such as Tehran – Iran (9.9%) [21] South Iran (4.85) [19], North of Iran (0.5%) [9], and the Shah and Jadhav study in India [14]. The present study shows that the mean cephalic index of males is significantly higher than that of females. The mean cephalic index of this study is 81.08 ± 5.39 which says that the dominant head shape among the students of West Bengal is brachycephalic. This shows that there is tendency towards brachycephalisation. Also in tropical zones head form is longer (dolichocephalic), but in temperate zones the head form is more rounded in shape (mesocephalic or brachycephalic) [23]. Since India is partly in temperate and tropical zones, the present classification shows tendency to brachycephalization from dolichocephalization.

The variations of head shape may be due to hereditary or environmental factors which may act as secondary effects [20]. The kind of diet taken could also play a role in influencing the dominant head shape. Head shapes can also change from one generation to the other. For instance, in the first generation of Japanese immigrants in Hawaii it was noticed that they had an increased head breadth, a decreased head length and a higher cephalic index than their parents [3].

With the help of above statistics, the sex as well as race of the deceased can be determined accurately. This knowledge is of immense importance to anthropologists as well as forensic science experts.

The data from the present study can be used in various branches of medicine like Forensic medicine, Plastic surgery, Oral surgery, Pediatrics, Dentistry for comparison between patient and normal population.

Conclusion

In the present study 200 students of West Bengal, in the age group of 17-20 years, were chosen to study the cephalic index (CI) in relation to sex and geographical factors.

The mean overall CI was 81.09 ± 3.42 which implies that the dominant head shape among students of West Bengal is brachycephalic. In both males and females the dominant head type is brachycephaly and the rarest type is dolichocephaly. Though on comparison with previous records of cephalic index with present work suggests a tendency towards “brachycephalisation, a larger study with more representative population is required to prove this trend.

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