

Original research article

Cephalic index in South Indian medical students: A anthropometric study

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Abstract

Background: Cephalic index is a useful tool for identification and was first identified by Swedish Professor of Anatomy, Anders Retzius and he first used physical anthropology to classify ancient human remains found in Europe. Anthropometry is helpful in getting measurements of living subjects for identifying various dimensions like gender, age, stature, related to particular individual or a race. Cephalic index can be helpful while investigating for gender or racial difference.

Objective: The cephalic index is the ratio of the maximum breadth of head to its maximum length. To estimate cephalic index of healthy adult medical students of JJM Medical College.

Material & Methods: The present study was carried out with 320 (160 male & 160 female) medical students of JJM Medical College, Davangere, Karnataka, India.

Results: The mean cephalic index was 76.9 ± 2.53 . The mean cephalic index for male was 75.6 ± 2.05 and for female was 78.20 ± 2.33 . The difference between male and female cephalic index was significant ($p = 0.001$ & difference 2.52).

Conclusion: The result of present study shows that majority of male of Davangere are dolicocephalic or mesocephalic and female are mesocephalic. Cephalic index of the female is 2-3 point higher than the male in Davangere population. The data is of utmost importance in forensic medicine, anthropology and in genetics.

Keywords: Cephalic index, head length, head breadth

Introduction

Identification of an individual is the main objective of forensic investigations. Identification of an individual from dismembered, mutilated and fragmentary remains is a challenge to forensic experts, in such cases, complete identification becomes unlikely and partial identification assumes importance to proceed into further investigations. Ever since the human life came into existence constant changes are occurring in the morphological appearances. Human body has undergone this evolution and continues to do so. Evolution is simply defined as genetic change over time. The principles of modern evolutionary theory have withstood years of scrutiny and scientific challenges. Charles Darwin defined evolution as "Descent with modification"^[1].

Physical Anthropology is a science founded on evolutionary principles. It is important to realize that evolution is a documented fact. Four evolutionary processes or mechanisms are responsible for the relative frequencies of gene change over a period of time Natural selection is one of the evolutionary processes. The others include nutrition, genetic drifts and genetic flow^[2].

The human body dimensions are affected by ecological, biological, geographical, racial, sex, and age factors. Comparison of changes between parents, offspring and siblings can give a clue to genetic transmission of inherited character. 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. The most important of cephalometric dimension are length 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].

The cephalic index is the ratio of the maximum breadth of head to its maximum length. Cephalic index is very useful anthropologically to find out racial difference. It can also be utilized to find out sexual differences. Comparison of changes in cephalic index between parents, offspring and siblings can give a

clue to genetic transmission of inherited characters ^[4].

By means of cephalic index; person can be classified into the following three groups:

1. **Dolicocephalic:** Cephalic index below 76 for male & 77 for female.
2. **Mesocephalic:** Cephalic index between 76-81 for male & 77-82 for female.
3. **Brachycephalic:** Cephalic index above 81 for male & 82 for female ^[5].

Dolicocephalic person have otitis media less often than brachycephalic person. It has been reported that individual with Apert’s syndrome are hyperbrachycephalic. It has also been reported that cephalic index is less than 2-3 (difference of 2.7) in individual with sickle cell anemia than normal individual. Small head with varying cephalic index is found in Cohen syndrome. Pathological cephalic index may indicate chromosome anomaly. Standardized cephalometric records enable diagnostic comparison between patients and normal population. The cephalometric results can be of assistance when evaluating a patient before craniofacial surgery ^[6].

Material and Methods

The present study was carried out with 320 (160 male & 160 female) medical students of JJM Medical College, Davangere, Karnataka, India.

Medical students were selected because of the easy availability. They belong to age group of 20-25 years. This study got JJM Medical college ethical committee permission.

The anatomical landmarks, glabella (g), inion (I) and euryon (eu) were marked. The anatomical landmarks were defined as follows:

Glabella: A point above the nasal root between the eyebrows and intersected by mid-sagittal plane.

Inion: The distal most point placed on the external occipital protuberance in the mid-sagittal plane.

Euryon: The lateral most point on the side of the head ^[7].

All the measurements were taken with subjects sitting on the chair; head in anatomical position. The each measurement was taken to the nearest 1 mm. The head length was measured with spreading caliper with scale from glabella to Inion. Head breadth was measured as the maximum transverse diameter between the two euryons using spreading caliper with scale. The process of measurements was explained to each and every subject. The written consent obtained from each and every subject before taking measurements. Cephalic index was calculated as maximum breadth of head/head length X 100. The subjects were classified into dolicocephalic, mesocephalic and brachycephalic.

Data analysis: The data was entered into the computer and analyzed. The differences in means of cephalic index, head length and head breadth were tested for statistical significance by independent sample “t” test ^[8].

Observations and Results

From the collected data, statistics were analyzed and observations and results are presented in tabulated form (Table no: 1, 2 &3). The minimum cephalic index was found to be 69.11 and maximum cephalic index was found to be 84.52. The mean cephalic index was 76.9±2.53. The mean cephalic index for male was 75.6±2.05 and for female is78.20±2.33. The difference between male and female heads cephalic index was significant (p= 0.001 & difference 2.52). The mean head length was 177.75±7.32 mm. In the male the head length varies from 173 mm to 203 mm, the mean head length being 182.25±6.04 mm. In the female the head length varies from 163 mm to 191 mm, the mean head length being172.68±4.40 mm. The difference between male and female head length was significant (p= 0.001 & difference 10.15 mm).

Table 1: Comparison of classification of cephalic index in males and females

Sex	No	Dolico-cephalic	Meso-cephalic	Brachy-cephalic	Total
Male	160	78	79	03	160
Female	160	57	95	08	160
Total	320	135	174	11	320

Table 2: Comparison of head length in male and female

Range of cephalic index	Male	Female	Total
160-170 mm	01	29	30
170-180 mm	55	118	173
180-190 mm	73	11	84
190-200 mm	30	01	31
200-210 mm	01	01	02
Total	160	160	320

Table 3: Comparison of cephalic index in male and females

Variable	n	Min.	Max.	Mean	S.D.	S.E.	P Value
Cephalic index (male)	160	69.1	79.3	75.7	2.05	0.162	= 0.001
Cephalic index (female)	160	71.7	84.5	78.2	2.33	0.184	= 0.001
Cephalic index (male &female)	320	69.1	84.5	76.9	2.53	0.141	-----

Discussion

Table 4: Comparison of Cephalic index of various studies

Sl. No.	Studies	Place	Sex	CI
1.	Shah GV, JASI (2004)	500, Gujarat, India	M-302 F-198	80.42 81.2
2.	Lobo SW, KUMJ (2005)	267, Nepal	M-157 F-110	83.1 84.6
3.	Salve VM, AJMS (2011)	320, Andhra Pradesh	M-160 F-160	75.68 78.2
4.	Pandey, IJAR (2016)	292, Dharan, Nepal	M-158 F-134	75.82 78.36
5.	Present study	South India	M-160 F-160	75.7 78.2

Gender and racial variation in the cranium were recorded by Williams *et al.* (1995) Shah G.V. and Jadhav H.R, studied 500 (302 males & 198 females) medical students of Gujarat In their study the mean cephalic index is 80.81. The mean cephalic index for male was 80.42 and for female was 81.20. Most of their subject belongs to mesocephalic group. The mean head length for male is 18.26 cm and for female is 16.5 cm^[1].

Mahajan A *et al.* studied 400 medical students of Punjab aged 17-23 years. The mean cephalic index for male was 81.34 and for female was 85.75. The difference between the mean cephalic index of male and female of Punjab was statistically significant. Punjabi community can be categorized as brachycephalic^[9, 10].

Lobo S.W. *et al.* studied 267 (157 males & 110 females) subjects of Gurung village, Nepal. The mean cephalic index for male was 83.10±6.08 and for female was 84.60±5.14. Most of their subject belongs to brachycephalic group. Mean head length for male is 18.0±0.85 cm and for female is 17.4±0.78 cm^[11].

Studies in Iranian females of 17-20 yrs of age group showed brachycephaly and hyperbrachycephaly as predominant^[11].

Conclusion

The result of the present study shows that majority of male are dolicocephalic (80 out 160) or mesocephalic (80 out 160) and female are mesocephalic (93 out 160). There was a significant difference (p= 0.001 & difference 2.52) between cephalic index of male and female heads. Thus we can conclude that cephalic index of the female is 2-3 point higher than the male in South Indian population. The head length of male ranges between 170 mm - 200 mm and females 160-190 mm. Only 1 out of 160 female subjects has head length more than 190 mm. Thus we conclude that female of South Indian region hardly had head length more than 190 mm. Male of South Indian region hardly had head length less than 170 mm. This 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 basis of comparison for future studies on South Indian population.

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