

Cephalic index – A review

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ABSTRACT Index is a measuring scale on which the object under study is analysed. There is various index available in the field of medical science. The most common index known to the general population is the Body mass index (BMI). This index gives idea about the weight of person and its relationship to the height and helps us to categories the individual into normal weight, underweight or obese. Cephalic index (CI) is a measuring tool by which the size of the skull is classified. The details required to calculate CI is the length and breadth of the skull. The skull is classified into Dolichocephalic, Mesocephalic, Brachycephalic, Hyperbrachycephalic and Ultrabrachycephalic. The CI has various application in the field of anthropology, Forensic medicine. This article discusses the cephalic index briefly.

KEYWORDS Cephalic index, Measuring cephalic index

Introduction

The cephalic index was defined by Swedish professor of anatomy Andres Retzius (1796 -1860) and first used in physical anthropology to classify human remains found in Europe. The theory becomes closely associated with development of racial anthropology in the 19th and early 20th centuries. An index is a system by which changes in the value of something and the rate at which it changes can be recorded, measured, or interpreted[1]. There is various index to assess and evaluate the changes in the human body. The most common index known to general public is the body mass index (BMI). The BMI is defined as the body mass divided by the square of the body height and is universally expressed in units of kg/m², resulting from mass in kilograms and height in metres. The BMI is a convenient rule of thumb used to categorize a person as underweight broadly, normal weight, overweight, or obese based on tissue mass (muscle, fat, and bone) and height[2]. The most common other index are W/H index measure weight-for-height, W/A index measure weight for age, H/A index measure the height for the age, these are related to the BMI index. In human body the anthropometric measure-

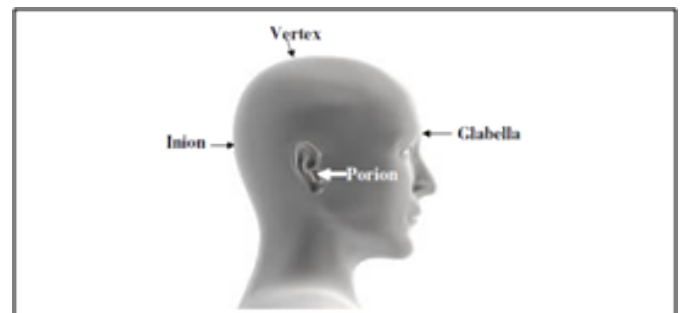


Figure 1: Position of Glabella and Inion.

ment provides some guidelines to the various proportions. The size of the skull is assessed and evaluated by cephalic index. The cephalic index has wide range of application in anthropology and forensic medicine. This article will briefly discuss the cephalic index.

Cephalic index

The formula for measuring the cephalic index is Maximum breadth X 100 / Maximum cranial length. The maximum Antero-posterior diameter is measured from glabella to Opisthocranium (or) Inion, and the maximum transverse diameter is measured from the parietal eminence (Euryon) from left side to right side³. The details about the anatomical landmark are discussed below: **Glabella:** A point above the nasal root between the eyebrows and intersected by mid-sagittal plane (Fig 1). **Opisthocranium:** It is the most posterior point on the poste-

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Table 1 Classification of head types according to Martin and Saller (1957).

Head type	Range index	
	Male	Female
Dolichocephalic	71.0 – 75.9	72.0 - 76.9
Mesocephalic	76.0 – 80.9	77.0 – 81.9
Brachycephalic	81.0 – 85.9	82.0 – 86.4
Hyperbrachycephalic	86.0 – 90.9	86.5 – 91.9
Ultrabrachycephalic	91.0 – X	92.0 - x

Table 2 Cephalic index in Indian population.

Author / Year	Region	Cephalic index		Type of Cephalic index	
		Male	Female	Male	Female
Anupam Mahajan/2009	Punjab	81.34	85.75	Brachycephalic	Hyperbrachycephalic
Dharam Singh Rathia/2018	Chhattisgarh Gond tribe Non gond tribe	Mesocephalic (26%) and Brachycephalic(31%) Mesocephalic (27%), Brachycephalic (27%) and hyper Brachycephalic (27%).			
Twisha Shah /2015	Gujarat	77.20	75.19	Mesocephalic	Dolichocephalic
Yagain V. K./2012	India	77.92	80.85	Mesocephalic	Brachycephalic
Shema K. Nair	Bhopal	75-79.9		Mesocephalic	

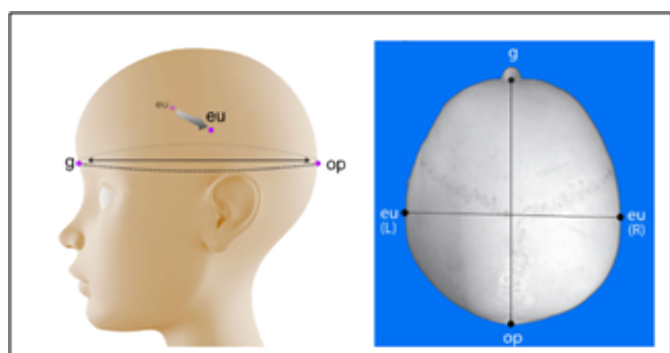


Figure 2: Position of Glabella (g), Opisthocranium(op), and Euryon(eu).



Figure 3: Spreading calliper.

rior protuberance of the head in the midsagittal planes (Fig2). **Inion:** The distal-most point placed on the external occipital protuberance in the midsagittal plane(Fig 1) **Euryon:** It is the most laterally placed point on the sides of the head (Fig 2). The posterior landmark for measuring the anteroposterior is either Opisthocranium or Inion. A spreading calliper (Fig 3) is used to measure the Anteroposterior and transverse distance, it has rounded end which is placed on the specified landmark, and the corresponding readings are noted on the scale attached to the device.

Types of cephalic index:

The head shape (Cephalic index) is classified into five types using Martin saller scale ultrabrachycephalic,hyperbrachycephalic, brachycephalic,mesocephalic,and dlichocephalic[4]. The values of the cephalic index are shown in table 1.

The cephalic index in Indian population:

The cephalic index is not common to all, it differs within the race and sex. The cephalic index in the Indian population is discussed here. A study was conducted in Punjab among 400 medical students. The mean CI was 81.34 for males and 85.75 for females, the values correspond to Brachycephalic /Hyperbrachycephalic[5]. The cephalic index was measured in Gond tribe (279) and Non-tribes (282) in Mungeli district of Chhattisgarh.The results were Most of the Gond Tribe boys were Mesocephalic (26%) and Brachycephalic (31%), while most of the Non-Tribe boys were Mesocephalic (27%), Brachycephalic (27%) and hyper Brachycephalic (27%).The study concludes that CI values do not have any significance to Gond tribe[6].The values of CI has proof for ethnicity and sex; a study was conducted in Gujarat to

Table 3 Comparison of studies on cephalic index among various population groups.

Name of the worker	Population	Mean cephalic index
Oladipo and Olotu, 2006	Ijaw males	80.98
	Ijaw females	78.24
Oladipo and Olotu, 2006	Igbo males	79.04
	Igbo females	76.83
Oladipo and Olotu, 2009	Ogonis males	111.18
	Ogonis females	75.09
Odokuma 2010	West African males	77.67
	West African females	78.1
Ilayperuma, 2011	Srilankan males	78.04
	Srilankan females	79.32
Anitha 2011	North Indian males	79.14
	North Indian females	80.74
Salve and Chandrashekhar, 2011	Andhra Pradesh males	75.68
	Andhra Pradesh females	78.20
Kumar and Gopichand, 2012	Haryanvi males	66.72
	Haryanvi females	72.25
Vidhya et al., 2012	South Indian Males	78.40
	South Indian females	79.13
Gujaria and Salve, 2012	Marathi males	77.08
	Marathi females	79.02
Gujaria and Salve, 2012	Andhra Males	76.28
	Andhra females	78.16
Gujaria and Salve, 2012	Gujarati males	80.42
	Gujarati females	81.20
Jeremiah et al., 2013	Kenyan males	71.04
	Kenyan females	72.3
Kumar and Nagar, 2015	North Indian males	73.75
	North Indian females	75.22
Mayura Setiya 2018	Mahakaushal males	77.65
	Mahakaushal females	78.13

verify the feature. Total 901 Gujarati (676 male, 255 female) were enrolled for the study and CI was measured. The mean cephalic index was 77.20 for males and 75.19 for females. According to the cephalic index 40.2% males were Mesocephalic, and 42.7% of females were Dolichocephalic[7].

A study on Cephalic index was done in Manipal University at Kasturba Medical College, Total of 100 students was enrolled of which 66 were male, and 34 were female. Indian males had mean cephalic index of 77.92, and they were Mesocephalic and females had mean cephalic index of 80.85, and they were Brachycephalic[8]. A study was conducted in central India (Bhopal) to find out the CI. Hardlika's method was used to measure cranial length and breadth. Maximum numbers of subjects were Mesocephalic (having cephalic index 75 – 79.9). 43.58% boys, as well as 42.93% girls, were Mesocephalic[9]. Cephalic index among the various population in the world and the comparison is shown in table III [11].

Application of cephalic index in medical science:

The cephalic index gives the idea about the length and breadth of the skull. Additional data like cranial volume and cephalometric measurements if available, the entire face and the skull can be constructed and will be very useful in forensic medicine to identify the individuals[10]. The bone harvesting and grafting is very important in the reconstructive surgery. The donor sites for bone harvesting can be from maxilla, mandible, iliac crest and ribs are mostly common site for bone harvesting. Skull is also one of the site for bone harvesting in which the parietal bone is most commonly preferred. A study was conducted to correlate the relationship for the thickness of the parietal bone and the cephalic index. The study establish a positive correlation between the CI and thickness of the parietal bone. The bone harvesting should be performed in the medial and posterior thirds of the parietal bone in dolichocephalic and Mesocephalic individuals[12].

Conclusion

Cephalic index an anthropometric measurement which is specific for particular race and sex. The findings and reading of cephalic index are widely applied in the field of forensic medicine. The cephalic index can be explored further, and the relationship with the size of the face, arch form and the bone availability for the placement of implant in the skull, further research can be taken to establish the interrelationship with the index and anthropometric measurements.

Conflict of Interest

There are no conflicts of interest to declare by any of the authors of this study.

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References

1. www.collinsdictionary.com/dictionary/English/index
2. www.wikipedia.org/wiki/Body_mass_index.
3. Twisha Shah, Manish B Thaker, Shobhana K Menon (2015) Assessment of Cephalic and Facial Indices: A proof for

Ethnic and Sexual Dimorphism. J Forensic Sci Criminol 3(1): 101. doi: 10.15744/2348-9804.2.401

4. Martin R, K Saller (1957) Lehrbuch der anthropologie. Gustav Fischer Verlag, Stuttgart.
5. Anupam Mahajan , The study of cephalic index in Punjabi students ,Journal of forensic medicine & Toxicology 9(2009).
6. Dharam Singh Rathia Anthropometric Study of Cephalic index of Gond tribe and Non-tribe boys of Mungeli district ,Chhattisgarh International Journal of Anatomy and Research, Int J Anat Res 2018, Vol 6(3.2):5558-63.
7. Twisha Shah, Manish B Thaker, Shobhana K Menon (2015) Assessment of Cephalic and Facial Indices: A proof for Ethnic and Sexual Dimorphism. J Forensic Sci Criminol 3(1): 101. doi: 10.15744/2348-9804.2.401.
8. Yagain V. K. Study of cephalic index in Indian students. Int J. Morphol., 30(1):125-129, 2012.
9. Shema K. Nair, The Study of Cephalic Index of Medical Students of Central India. Asian Journal of Biomedical and Pharmaceutical Sciences; 04 (28); 2014; 48-50.
10. V. Raveendranath , An study of Anthropometric correlation between cephalic index and cranial volume and cranial measurements in Indian cadavers.
11. Setiya, Morphometric Estimation of Cranial Index in Mahakaushal Region of Madhya Pradesh: Craniometrics Study International Journal of Scientific Study | April 2018 | Vol 6 | Issue 1.
12. Atson Carlos de Souza Fernandes, Dimensional analysis of the parietal bone in areas of the parietal bone in areas of surgical interest and relationship between parietal thickness and cephalic index J Oral Maxillofac Surg 2011.