ORIGINAL RESEARCH PAPER

Volume-8 | Issue-6 | June-2019 | PRINT ISSN No. 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A STUDY ON CEPHALIC INDICES AMONG STUDENTS FROM TAMILNADU OF INDIA

Forensic Medicine

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ABSTRACT

Introduction: Craniofacial anthropometry deals with the dimensions of head and face. Based on these measurements race and sex can be determined. To determine the predominant head type in males and females from Tamil Nadu in India and also compare this study with other similar studies done in different Indian populations.

Methods: A cross-sectional study was conducted among medical students in a Tertiary care teaching hospital. A total of 500 subjects (246 males and 254 females), above 18 years was studied. Cephalic indices of all the subjects were analyzed based on Martin & Saller method.

Results: Mesocephalic/medium head type was predominant in both males (45.53%) and females (47.24%).

Conclusion: This study might serve as the basis of comparison for future studies on the cephalic index using Martin& Saller classification on other regional Indian population.

KEYWORDS

cephalic index; craniometry; head breadth; head length; head types

INTRODUCTION

Researchers in the past have studied about the cephalic index and cephalic dimensions in different populations of India to understand sexual dimorphism and diversity. Craniometry is valuable in designing various head gadgets like helmets, headphones, goggles, etc. by formulating standard sizes.[1] The cranial index was defined by Swedish professor Anders Retzius (1796–1860) and first used in physical anthropology to classify ancient human remains found in Europe. Usually, when applied to live individuals are known as the cephalic index, and to dry skulls as the cranial index. Cephalic index (CI) is also known as a cranial index or Index of breadth.[2] Cephalic index is the ratio of the maximum breadth of the head to the maximum length of the head. On the basis of the cephalic index, head shapes are grouped into dolichocephalic, brachycephalic, mesocephalic, and hyperbrachycephalic. It is one of the important parameters for identification and also to differentiate between different human races.[3] It also gives an idea of how genetic characters are transmitted between offspring and siblings.[4]

Indian population can't be classified as a pure Caucasian, Mongoloid or Negroid because of racial mixing and hence it's basically Caucasian with a few Negroid characters.[5] Some authors state that North Indians and North West Indians are Caucasians, East Indians and North East Indians are more of Mongoloid while South Indians belong to Negroid race.[6,7]

The studies done in India mostly followed Williams classification or International Anatomical Descriptions for classifying head types based on the cephalic index, where the cephalic index range was not given individually for both males or females. In this study, we followed the Martin & Saller classification in which cephalic index range for both males and females were given separately. Taking all these into consideration, this study was undertaken to evaluate and report the association of sexual dimorphism and cephalic index pertaining to head shape from the Tamil Nadu population. Also, compare this study with other similar studies done in different Indian populations.

MATERIALS AND METHODS

A cross-sectional study was conducted from June 2017 – May 2018 in Tertiary care teaching hospital, the medical students after obtaining approval from the institutional ethical committee. A total of apparently healthy 500 subjects (246 males and 254 females) belonging to Tamil Nadu of above the age of 18 years, with valid consent are included for the study. Subject belonging to other parts of India, and those having a congenital craniofacial anomaly, trauma, reconstructive surgery, and deformities were excluded from the study.

The head of the subject was allowed to rest in the eye-ear plane or the Frankfurt plane. Subjects were made to sit on low raise stool and instructed not to change his/her position while taking measurements. To reduce the technical error of the measurements, each measurement was taken by the same person to eliminate the discrepancies.[4] All the physical measurements were taken using the spreading caliper with rounded ends. The anatomical landmarks are defined as follows:-

I. Glabella (g): A point above the nasal root between the eyebrows and intersected by a mid-saggital plane.
II. Opisthocranion (op): It is the most posterior point on the posterior protuberance of the head in the mid-sagittal plane.
III. Euryon (eu): It is the most laterally placed point on the sides of the head.

The maximum head length (glabella to opisthocranion) and maximum head width (maximum transverse diameter between euryon to euryon) will be measured with Spreading Caliper with rounded ends. The above-mentioned measurements will be used to derive the cephalic index (CI) according to Martin & Saller with following formulae: [8]

CI = (maximum head width / Maximum head length) x 100

Depending on these indices the types of head shapes will be classified according to Martin & Saller (1957) method (Table 1).[8]

Table 1: Classification of Head types

Head type	Range of Index	
	Male (M)	Female (F)
Dolicocephalic	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- above	91.0- above

The obtained data collected from the measurement of the cephalic indices for both male and female subjects were subjected to statistical analysis. The data were entered in MS Excel 2007 and was analyzed with statistical package SPSS version 16 for windows to calculate the mean, standard deviation (SD), and standard error (SE).

RESULTS

The prevalence of the mean cephalic index in different Indian population varies significantly, and it is shown in tables.

Table 2: Distribution of head types in males & females

Head types	Male		Female		Both	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Dolicocephalic	62	25.20%	65	25.59%	127	25.4%

Mesocephalic	112	45.53%	120	47.24%	232	46.4%
Brachycephalic	65	26.42%	54	21.26%	119	23.8%
Hyperbrachycephalic	07	2.85%	15	5.91%	22	4.4%
Total	246	100%	254	100%	500	100%

Table 3: Range, Mean, Standard Deviation (SD) and Standard Error (SE) of Cephalic Index (CI)

Cephalic Index (CI)	Parameter	Male	Female
	Minimum	71.1	72.0
	Maximum	90.9	91.7
	Mean	78.93	79.87
	Standard Deviation (SD)	3.97	3.97
	Standard Error (SE)	0.25	0.24
	Sample Size	246	254

DISCUSSION

In the present study (Table 2), the predominant cephalic phenotype for Tamil Nadu population was noted to be Mesocephalic (46.4%) and it is same as that observed in other Indian studies by Salve VM et al in Andhra region, Shah GV et al in Gujarathi population, Sunita P et al in Orissa population, Swapnali et al in Mumbai region, Shema KN et al in Central part of India, Vijanath et al in Eastern part of India, Shrikanthan G et al in Southern part of India and Anitha MR et al7 in Northern part of Indians. On the contrary, Hyperbrachycephalic phenotype was predominantly noted in Punjabi students by Mahajan A et al.

In the present study (Table 3), the mean Cephalic index of males was 78.93. This finding was higher than studies done by Shah GV et al, Mahajan A et al, Swapnali et al, Shema KN et al, Vijanath et al, and Anitha MR et al. But lower than Salve VM et al, Sunita P et al, and Shrikanthan G et al. In the present study (Table 3), the mean Cephalic index of females was 79.87. This finding was higher than studies done by Shah GV et al, Mahajan A et al, Shema KN et al, Vijanath et al, and Anitha MR et al. But lower than Salve VM et al, Sunita P et al, Swapnali et al, and Shrikanthan G et al.

Table 4: Cephalic Index of different populations studied in India.

S.No	Population Studied	Authors	Sample Size	Mean Cephalic Index			Head Type
				Male(M)	Female(F)	Both(B)	
1**	Gujarat	[4]Shah Gv et al (2004)	500	80.42	81.20	80.81	M: Mesocephalic F: Mesocephalic B: Mesocephalic
2*	Punjab	[9]Mahajan A et al (2009)	400	81.64	85.75	85.53	M: Brachycephalic F:Hyperbrachycephalic B:Hyperbrachycephalic
3*	Andhra Pradesh	[10]Salve VM et al (2011)	300	76.94	75.68	78.20	M: Mesocephalic F: Mesocephalic B: Mesocephalic
4*	Orissa	[11]Sunita P et al (2014)	1030	77.28	78.38	77.75	M: Mesocephalic F: Mesocephalic B: Mesocephalic
5*	Mumbai	[12]Swapnali et al (2013)	100	81.28	75.22	78.48	M: Brachycephalic F: Mesocephalic B: Mesocephalic
6**	Central part of India	[13]Shema KN et al (2014)	480	81.24	80.31	81.21	M: Mesocephalic F: Mesocephalic B: Mesocephalic
7*	Eastern part of India	[14]Vijanath V et al (2010)	100	80.20	81.72	80.74	M: Mesocephalic F: Mesocephalic B: Mesocephalic
8*	Southern part of India	[15]Shrikanthan G et al (2013)	305	78.20	79.68	79.20	M: Mesocephalic F: Mesocephalic B: Mesocephalic
9*	Northern part of India	[16]Anitha MR et al (2011)	100	79.14	80.74	79.72	M: Mesocephalic F: Mesocephalic B: Mesocephalic
10***	Tamil Nadu	Present	500	78.93	79.87	79.40	M: Mesocephalic F: Mesocephalic B: Mesocephalic

*International Anatomical Descriptions[17]
**Stewarts Classification[18]
***Martin & Saller Classification[8]

In our study (Table 2, 3&4), the dominant type of head shape in males was Mesococephalic (45.53%) followed by Brachycephalic (26.42%) but the mean cephalic index was 78.93±0.25 (mesocephalic). This finding of Mesocephalic was similar to study done on Indian males by Shah GV et al, Salve VM et al, Sunita P et al, Shema KN et al, Vijanath et al, Shrikanthan G et al and Anitha MR et al, but not similar with the study by Mahajan A et al, and Swapnali P et al which showed Brachycephalic head shape was common. In our study, the dominant type of head shape in females was Mesococephalic (47.24%) followed by Dolicocephalic (25.59%) but the mean cephalic index was 79.87±0.24 (mesocephalic). This finding of Mesocephalic was similar to study done on Indian females by Shah GV et al, Salve VM et al, Sunita P et al, Swapnali et al, Shema KN et al, Vijanath et al, Shrikanthan G et al and Anitha MR et al, but not similar with the study by Mahajan A et al which showed Hyperbrachycephalic head shape was common. The study shows that Tamil Nadu male predominantly has a medium head shape followed by the short head type. Whereas; Tamil Nadu female has a medium head type followed by the short head type.

This study showed that the indicate cephalic index of the female was significantly higher than those of male. The mean cephalic index of this study was 79.40 which say that the dominant head shape among Tamil Nadu region was mesocephaly. In the present study, it was observed that there was gender difference with females having a higher cephalic index compared to males seen in studies conducted by Shah GV et al, Mahajan A et al, Sunita P et al, Vijanath et al, Shrikanthan G et al, and Anitha MR et al. But differs in studies by Salve VM et al, Swapnali et al and Shema KN et al. This implies that the cephalic index can be higher in any sex depending on the peculiarity of the population under study. Although they have the same origin there is a significant difference between their cephalic indices. However, both genders were said to be mesocephalic. The results of this study are expected to be of significance to anthropologist and forensic scientist.

CONCLUSIONS

The present study provides new and valuable data pertaining to cephalic indices calculated using the Martin & Saller classification and the shapes of the head in individuals between 18-23 years of age, belonging to Tamil Nadu of India shows to be predominantly

mesocephalic which is consistent with the many other studies done using International Anatomical Description and with Stewarts classification which classified head shape based not based on gender. If this study is done further in other parts of India using Martin & Saller, we may arrive at an opinion as to whether the classification methods might have an impact on the outcome of the head types.

Acknowledgements: Nil

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