European Journal of Molecular & Clinical Medicine (EJMCM)
ISSN: 2515-8260 Volume 07, Issue 11, 2020

Original research article

Craniometry in Central India – An anthropometric study

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Abstract

Context: Craniometry helps to assess the growth in peadiatrics and also used in various other fields like forensic medicine, plastic surgery, oral surgery and dentistry and for diagnostic purpose

Aims: to investigate the cranial index values anthropometrically and to contributing to the existing data.

Settings and Design: cross sectional study done in Department of Anatomy, People's College of Medical Sciences, Bhopal

Methods and Material: Craniometry of thirty skulls (normal, fully mature, devoid of any fractures or damages) were done using caliper, scale, and marker

Statistical analysis used: mean, standard deviation and frequency were found using Microsoft excel and graph pad prism software.

Results: In present study, prominent categories based on various indices were mesocranial, cryptozygy, metriocrane, orthocrane, mesene, and sthenometopia.

Conclusions: the finding of the present study varied from previous studies from other countries. It is recommended that various studies across various regions using various techniques with larger sample size.

Keywords: Craniometry, Anthropometry, Caliper, cranial index

Introduction

Since ancient times, the human body has been measured for several reasons. Eventually, the practice was adopted by the anthropologists to identify human basic morphological characteristics. In history, the anthropologists' prior object of investigation was "the skull," which they believed represented the most important part of the body. The anthropometrical method became more popular in several fields due to the research of Adolphe Quetelet in the 19th century.(1)

Human skulls have been studied both metrically and nonmetrically earlier and these studies have thrown light on the functional and morphological aspect of skull. Craniometrics is an important tool for anthropologists and forensic experts for identification of the racial differences, sexual differences, offsprings, and siblings toward their genetic transmission of inherited characteristics and also to a great extent for the facial reconstruction of disputed identity.(2)

The craniometric results can also be of great assistance while evaluating patients in various fields of medicine such as medical imaging, pediatrics, and craniofacial surgery and also for studying growth trends in various castes/races within a defined geographic zone. Anthropometric study of the head is useful in designing various equipment of head and face such as helmets, headphones, and goggles by formulating standard sizes.(3)

The skull forms the cranial end of the axial skeleton. It is composed of 22 bones and 6 ear ossicles. Some are paired and others are single. It consists of two parts, neurocranium (8 bones- paired temporal and parietal and unpaired frontal, sphenoid, ethmoid and occipital) and splanchnocranium (14 bones- paired nasal, maxilla, lacrimal, palatine, zygomatic and inferior nasal concha and unpaired vomer and mandible).

In this study, craniometric measurements were made with the previously defined parametric values; and various index values were calculated with these measurements. These indices provide information about the morphology of the head and face of the societies as well as the effects of various factors on the development of head and face. The aim of this study was to investigate the cranial index values anthropometrically and to contribute to the literature data.

Subjects and Methods:

This was the cross sectional study done in Department of Anatomy, People's College of Medical Sciences, Bhopal.

In our study, 30 cranium whose age and sex were not known belonging to Department of Anatomy, People's College of Medical Sciences, Bhopal were used. All the skulls were normal, fully mature, devoid of any fractures or damages.

Instruments used for the measurement were spreading caliper, scale, and marker. All parameters were measured independently by two different observers, with a predetermined methodology to prevent interobserver and intra-observer error. Various anatomical landmarks were marked. All measurements were taken in centimetres and to an accuracy of 0.10.

Measured parameters were as follows (4–6)

1. Maximum cranial width: Also called "the maximum transverse width". It is the linear distance measured between the eurion points located on both parietal bones.
2. Maximum cranial length: In the sagittal plane, it is the largest distance measured between the glabella and the opisthocranion, which is the most protruding point on the occipital bone.
3. Bizygomatic width: It is the linear distance measured between zygion points, which are the most lateral points on zygomatic arch.
4. Cranial height: The linear distance measured between basion and bregma points.
5. Upper face height: The distance between nasion and prosthion points.
6. Minimum frontal width: It is the smallest distance between the frontotemporale points on the temporal crest on the frontal bone.

Calculated index values are shown in table 1.

Table1: Index values

Sr. no	Parameter	Formula	Classification
1.	Cranial Index	Maximum Cranial Width / Maximum Cranial Length × 100	7 categories (5,7)
2.	Transverse Cranio - Facial Index	Facial Index = Bizygomatic Width/ Maximum Cranial Width × 100	2 categories (4,7)
3.	Cranial Height- - Width Index	Cranial Height / Maximum Cranial Width × 100	3 categories (7,8)
4.	Cranial Height - Length Index	Cranial Height /Maximum Head Length × 100	3 categories (7,9)
5.	Upper Facial Index	Upper Face Height / Bizygomatic Width × 100	5 categories (7,9)
6.	Transverse Fronto-Parietal Index	Minimum Frontal Width /Maximum Cranial Width × 100	3 categories (7,10)

Statistical Analysis

The data were analysed by Microsoft Excel, and all the statistical tests and calculations were performed using the software GraphPad Prism Version 5.

Results:

In the present study, various measured parameters were calculated as shown in table1 and table 2 shows various index values. Based on index values, head were classified into various types. Figure 1 shows the prominent categories based on various indexes.

Table 2: Mean and standard deviation values of parameters

Parameters	Mean ± S.D. (mm)
Maximum Cranial Width	135.57 ± 9.89
Maximum Cranial Length	180.25 ± 6.0
Bizygomatic Width	119.75 ± 9.05
Cranial Height	130.06 ± 6.23
Upper Face Height	62.58 ± 5.40
Minimum Frontal Width	83.87 ± 5.09

Table 3: Mean results and classification of index values

Index Values	Mean ± S.D.	Classification
Cranial Index	75.17 ± 5.40	Mesocranial
Transverse Cranio - Facial Index	88.33 ± 7.10	Criptozygy
Cranial Height - Width Index	95.98 ± 8.32	Metriocrane
Cranial Height - Length Index	72.15 ± 6.69	Orthocrane
Upper Facial Index	52.28 ± 5.19	Mesene
Transverse Fronto - Parietal Index	61.89 ± 5.89	Sthenometopia

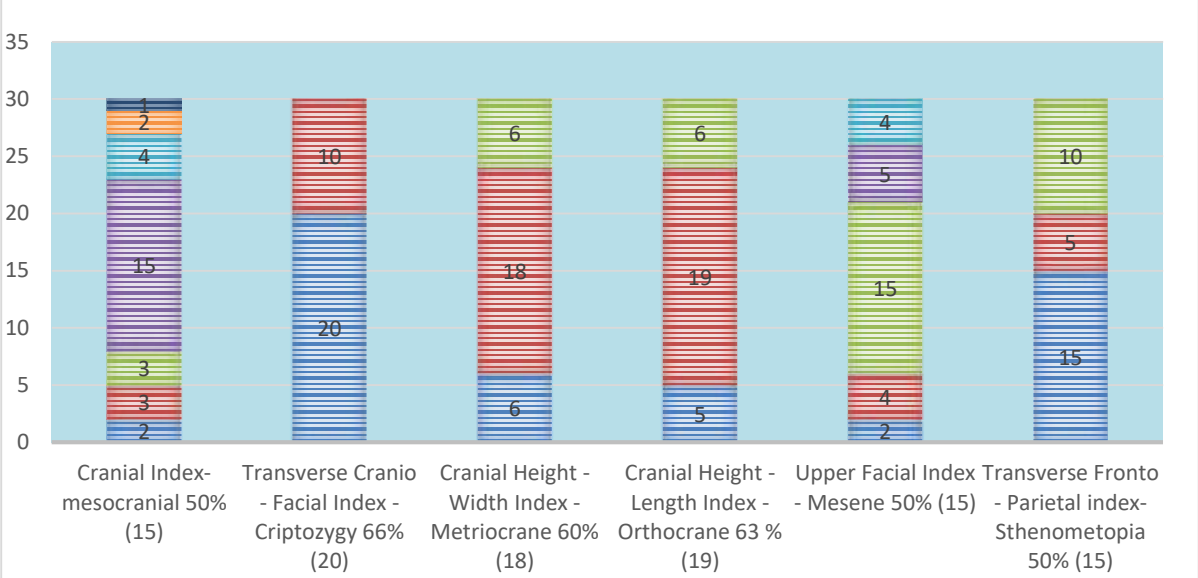

Figure 1: Percentage distribution based on various index values

Discussion:

Craniometry is the scientific measurement of various dimensions of bones of the skull useful in anthropometry and forensic practice. In most of the previous studies, parameters of head and face in living individuals were measured to calculate the values of various indices. Dry skull bones were used in the present study. In present study, prominent categories based on various indexes were mesocranial, cryptozygy, metriocrane, orthocrane, mesene, and sthenometopia.

Knowledge Craniofacial morphometry and morphology is used not only in medicine but also used in anthropology and forensic science.

It was observed in various studies done in Indian population where maximum cranial width and maximum cranial length was similar to present study. (11) Senol et al had studied various parameters as studied by us from the population in Turky. (7) Further, some parameters were also studied in Arabian, Albanian Kosova and Nigerian population. (8,9,12) Our finding differ from these studies. This could be because of regional and ethnic variation.

We came across various studies about cranial index in Indian population and Population in Nigeria and Turkey. Our findings were matching with that of the studies in Indian population,(3,13) however variation was seen when compared with foreign population.(5,7)

As per values of various cranial index, frequency of mesocranial, cryptozygy, metriocane, orthocrane, mesene and sthenometopia was 50, 66, 60, 63,50 and 50 % respectively. We had come across a similar study in population in Turkey, where we could not get frequency of distribution of various types, but minor variation amongst various cranial values were seen. (7)

We came across various studies where Transverse Cranio - Facial Index, Cranial Height - Width Index, Cranial Height - Length Index, Upper Facial Index and Transverse Fronto - Parietal Index were studied in Indian as well as foreign population. When compared

with Indian population,(2,4,10,11,14) variation was minor while variation was more when compared with the studies in foreign population.(5,7,9,12)

Thus, to summarise regional variation is seen amongst various craniometry parameters which could be due racial and ethnic variation. Genetic factors may also play role.(6,7) In the various studies, morphometric estimation of various population is done where variation was also found. In present study, craniometry of dry skull was done. For anthropometric assessment, various techniques have been used like computerized tomography, Magnetic resonance Imaging technique and three dimensional imaging. (15) Craniofacial morphometry and morphology has been widely used in medical sciences and there is large evidence for regional variation, hence we recommend various studies across various regions using various techniques with larger sample size.

Limitation of the study-

Sample size was small and we had used only one technique for measurement. Also, we had not done gender differentiation.

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