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Original Article

Cranial Anthropometric Indices in Population of Rajasthan, India

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Abstract

Background: Width and length of bones of both face and skull is increased by the post-natal craniofacial growth and development. By measuring these changes, classification system of cranial and facial parameters can be created which assesses both the head and face with the help of indices associated with growth patterns. Hence, we planned the present study to assess cranial anthropometric indices in a known population of Rajasthan, India.

Materials and Methods: The present study included assessment of a total of 200 participants, out of which 100 were male and 100 were female. Only participants with 18 years and above were included in the present study. Patients were made to sit on a chair in relaxed position. Head of the participants were placed in normal anatomic position, and a spreading caliper was used for taking the measurement using stretched anatomical landmarks. Cephalic index was measured by assessing various anatomic parameters. Categorization of the head shape, on the basis of cephalic index, was done. All the results were recorded and analyzed using SPSS software.

Results: Mean value of breadth of the head was found to be 187.52 mm and 176.87 mm in males and females, respectively. Cephalic index in males and females was found to be 74.72 and 76.85, respectively. Significant results were obtained while comparing the cephalic index among males and females. 53 males and 35 females showed dolichocephalic type of the head based on the cephalic index while mesocephalic head type was present in 34 and 48 males and females, respectively.

Conclusion: Comparatively, more head length and breadth occurs in males in comparison with females.

Key words: Cephalic index, Head breadth, Head length

INTRODUCTION

Width and length of bones of both face and skull is increased by the post-natal craniofacial growth and development. These development changes also result in significant alteration in the proportions of these bones which further result in the morphologic variation in the vertical, transverse, and anteroposterior plane of the space till the point of skeletal maturity.[1]

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By measuring these changes, classification system of cranial and facial parameters can be created which assesses both the head and face with the help of indices associated with growth patterns. This further helps in making more efficient and easier orthopedic and/or orthodontic diagnosis and treatment planning.[2]

Anthropometry of soft tissue is categorized under the heading of direct quantitative methods. It is non-invasive in nature and uses areas that are covered by hair or areas that would be observed distorted through indirect anthropometry.[2,3] Farkas *et al.* established the differences between direct and indirect measurement methods with clinical assessment.[3,4] Hence, we planned the present study to assess cranial anthropometric indices in a known population of Rajasthan, India.

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MATERIALS AND METHODS

The present study involved assessment of normal healthy appearing males and females of Rajasthan origin. A total of 200 participants were included in the present study, out of which 100 were male and 100 were female. Only participants with 18 years and above were included in the present study. All the parameters were measured four times and mean value was obtained which was used as standard value for assessment.

Patients were made to sit on a chair in relaxed position. Head of the participants was placed in normal anatomic position, and a spreading caliper was used for taking the measurement using stretched anatomical landmarks.

Parameters Measured

- Length of head: Measurement done from glabella to the inon
- Width of the head: Measurement done below the nasion to the gnathion
- Cephalic index: Head length × 100/Head breadth.

Method given by Williams *et al.*, which utilized the cephalic index, was used for the determination of head shape.[5]

Categorization of the head shape, on the basis of cephalic index, was done into following four categories:
1. Dolichocephalic
2. Mesocephalic
3. Brachycephalic
4. Hyperbrachycephalic.

All the results were recorded and analyzed using SPSS software.

RESULTS

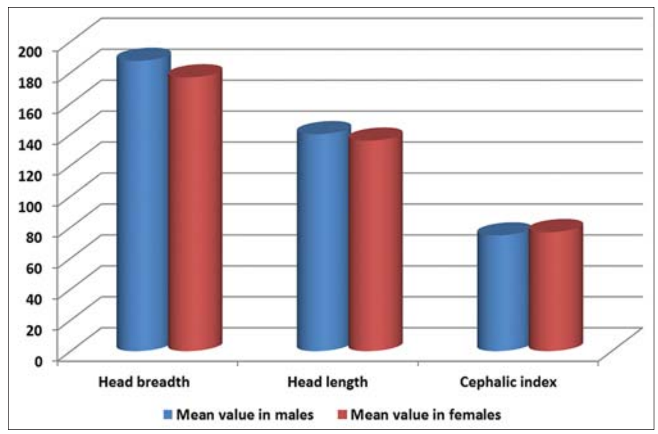
Head length in males and females was found to be 140.12 mm and 135.94 mm, respectively (Table 1 and Graph 1). Mean value of breadth of the head was found to be 187.52 mm and 176.87 mm in males and females, respectively. Cephalic index in males and females was found to be 74.72 and 76.85, respectively. Significant results were obtained while comparing the cephalic index among males and females (Table 1) ($P < 0.05$). 53 males and 35 females showed dolichocephalic type of the head based on the cephalic index while mesocephalic head type was present in 34 and 48 males and females, respectively (Table 2 and Graph 2). Only 1 participant in the males and 5 participants in females showed presence hyperbrachycephalic type of the head.

Table 1: Various parameters of all the participants

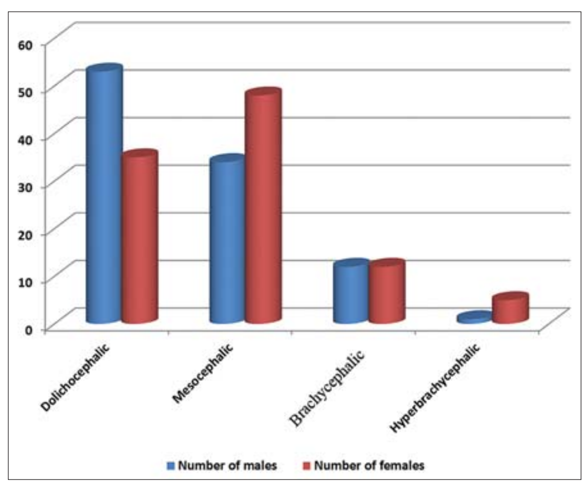
S. No.	Parameter	Mean value in males	Mean value in females	*P* value
1.	Head breadth	187.52	176.87	0.01
2.	Head length	140.12	135.94	0.01
3.	Cephalic index	74.72	76.85	0.01

Table 2: Types of heads on the basis of cephalic index

S. No.	Type of head	Number of males	Number of females
1.	Dolichocephalic	53	35
2.	Mesocephalic	34	48
3.	Brachycephalic	12	12
4.	Hyperbrachycephalic	1	5



Graph 1: Various parameters of all the participants



Graph 2: Types of heads on the basis of cephalic index

DICSUSSION

For the determination of racial traits, various methodologies have been used in the past which utilized various cranial capacities, cranial indices, and observations such as craniometry.[6] Craniometry refers to the technique of measurement of skull bones.[7] In the field of physical anthropology, cephalic index was first used for the classification of the ancient human remains which were found in Europe.[8] In the 19th and late 20th century, the theory became closely associated with the racial anthropological development.[9] Hence, we planned the present study to assess cranial anthropometric indices in a known population of Rajasthan, India.

In the present study, we observed that males were having comparatively higher cephalic index in comparison with females (Table 1 and Graph 1) ($P < 0.05$). Dolichocephalic was most common type of head type found in males (Table 2 and Graph 2). Gupta *et al*. conducted a study on 600 adults which included 300 males and 300 females. They evaluated the head length, head width, and assessed the relationship of these two parameters with each other. After evaluating these two parameters, they calculated the cephalic index. All the data obtained were assessed, compiled, and analyzed. The average head length and breadth in their study was found to be 139.51 mm and 186.88 mm in males and 136.19 mm and 177.74 mm in females, respectively. From the results, they concluded that dolichocephalic and mesocephalic types of the head are more common in males and females, respectively.[10]

Schaaf *et al*. compared the standard anthropometric cranial measurements with the measurement obtained from cranial photographs. They assessed a total of 122 children belonging to the age group of 3 months to 15 months of age. They obtained standardized digital images in the supracranial view and cranial anthropometric measurements. Quick Ceph® software was used for the assessment of the photographs. For indicating the degree of cranial deformity, the cephalic index and cranial vault asymmetry index were used. They classified the children into plagiocephaly, brachycephaly, and the combination of both. The photographic method satisfied the limits of agreement and showed slightly lower values represented by the respective bias. From the results, they concluded that for quantifying cranial deformities, digital photography is a reliable tool.[11]

Wilbrand *et al*. randomly analyzed 30 infants that were diagnosed with plagiocephaly, brachycephaly, or a combination of both conditions. Each group in their study consisted of 10 patients each. They analyzed the following parameters: Circumference, length, width, and oblique distance from the frontotemporal area (ft) to the lambdoid suture on each side of the head (ld). All the results were recorded and analyzed. They observed that mean inter-observer variability was lower than 0.182 mm (2), and mean intra-observer variability was lower than 1.131 mm (2). From the results, they concluded that for the quantification of early childhood head deformities, standardized measurements are highly reproducible.[12] Torres-Restrepo *et al*. assessed the agreement between cranial and facial classification obtained by clinical observation and anthropometric measurements among a known pediatric population. They analyzed 8-15-year-old children in their cross-sectional study. Initially, they determined the pattern of the skull using indirect clinical observation method and on visual equivalence of right eurion-left eurion and glabella-opisthocranion anthropometric points, as well as the facial type. They observed that out of 313 children included in the study, 172 were females. The agreement between the direct and indirect facial index measurements was 0.189, and the cranial index was 0.388, indicating poor concordance. From the results, they concluded that no direct agreement is observed between direct measurements conducted with an anthropometer and indirect measurements through visual evaluation.[13] Mendonca *et al*. conducted a comparative study to assess the craniofacial measurement by traditional calipers to computed tomography and three-dimensional photogrammetry. From the results, they concluded that underestimation of anterior-posterior and biparietal values occurs with caliper measurements in comparison with digital imaging.[14]

CONCLUSION

From the above results, the authors concluded that in males, comparatively, more head length and breadth occurs in males in comparison with females which exhibit sexual dimorphism. However, future studies are recommended for better exploration of this field.

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