



# A Cross-Sectional Study of Cephalic Index and Cranial Characteristics in Andh Tribal Children

**PRADNYANAND JONDHALE**

*Research Scholar, Department of Anthropology, Savitribai Phule Pune University, Pune (MH), India.*

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**Abstract:** Cephalic index is an important parameter in craniofacial anthropometry and serves as a valuable tool for anatomists and craniofacial surgeons in diagnosis and reconstruction. The present study was conducted on 481 Andh tribal children (246 boys and 235 girls) from Nanded district of Maharashtra, aged between 6+–10+ years, to evaluate variations in cephalic index. Head length (HdL) and head breadth (HdB) were measured using a spreading caliper, and cephalic index was calculated as (Head Breadth / Head Length × 100).

The results indicate that most cephalic index values ranged between 78 and 85, showing a predominance of mesaticephalic and brachycephalic head types, with very few dolichocephalic cases. Boys exhibited slightly higher cephalic index values (80–88), with a greater tendency toward brachycephalic and hyperbrachycephalic types, whereas girls showed relatively lower values (78–86), mainly within mesaticephalic to brachycephalic categories. A statistically significant difference in cephalic index was observed between boys and girls. Age-wise analysis revealed a transition from mesaticephalic types in younger children (6+ –7+ years) to brachycephalic types in older children (8+ –10+ years), suggesting growth-related cranial broadening.

Overall, the study highlights population-specific cranial characteristics and provides baseline anthropometric data useful for clinical, forensic, and anthropological applications.

**Keywords:** Anthropometry, Cephalic Index, Head Length, Head Breadth, Andh Tribe

## Introduction

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Anthropometry is a fundamental discipline for understanding human biological variation, growth patterns, and population characteristics. Among various anthropometric parameters, the cephalic index (CI) is widely used in physical anthropology, forensic science, and craniofacial research for classification of head shapes and identification of population differences.

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The cephalic index was first introduced by Anders Retzius (1796–1860) and is defined as the ratio of maximum head breadth to maximum head length expressed as a percentage. It serves as a reliable indicator of cranial morphology and is influenced by genetic, environmental, age, sex, and ethnic factors.

Based on standard classification, head shapes are categorized as dolichocephalic (<75), mesaticephalic (75–80), brachycephalic (80–84.9), and hyperbrachycephalic (>85). The cephalic index has important applications in assessing racial and sexual differences, craniofacial reconstruction, forensic identification, and anthropological as well as archaeological studies.

Variations in cephalic index within and between populations reflect complex interactions of hereditary and environmental influences, providing insights into population structure and developmental patterns. The Andh tribe of Maharashtra represents an under-studied population in terms of cranial anthropometry, particularly among children.

Therefore, the present study was undertaken to determine the cephalic index and head shape among Andh tribal children aged 6+–10+ years, and to analyze age- and sex-related variations. The findings may contribute valuable baseline data for use in anthropology, forensic science, and clinical practice.

## **Materials and Methods**

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The present study was designed as a cross-sectional investigation to determine the cephalic index and head shape among Andh tribal children aged 6+–10+ years, with the objective of analyzing age- and sex-related variations. The study was conducted in tribal schools located in the Nanded district of Maharashtra, India. The findings of this study are expected to provide baseline data that may be useful in the fields of anthropology, forensic science, and clinical practice.

A total of 481 healthy school-going Andh tribal children were included in the study, comprising 246 boys and 235 girls within the age range of 6+ to 10+ years. The participants were selected using a simple random sampling technique to ensure unbiased representation of the population.

Data collection was carried out within the school premises. Each child was interviewed and examined in the classroom setting with the assistance of school teachers. Information regarding age and other relevant demographic details was obtained from the official school records to ensure accuracy.

The study sample included children distributed across five age groups, namely 6+, 7+, 8+, 9+, and 10+ years, representing the Andh tribal population of Maharashtra.

Anthropometric measurements of the head were recorded following standard procedures. Head length (HdL) was measured as the distance from the glabella to the opisthocranium, while head breadth (HdB) was measured as the maximum biparietal diameter.

### Formula

The cephalic index (CI) was calculated using the following formula:

$$\text{Cephalic Index (CI)} = \frac{\text{Head Breadth}}{\text{Head Length}} \times 100$$

### Data Analysis

The cephalic index was calculated individually for each subject using standard anthropometric measurements. The mean cephalic index was then computed separately for each age group and for both sexes to assess variation. Based on the obtained cephalic index values, the subjects were classified into different cranial categories, namely dolichocephalic, mesocephalic, brachycephalic, and hyperbrachycephalic, according to standard classification criteria.

### Results

The analysis presented in Table 1 reveals that the majority of cephalic index (CI) values among Andh tribal children fall within the range of 78–85, demonstrating a predominance of mesocephalic and brachycephalic head types. Similar distributions have been reported among Indian populations, where brachycephalic tendencies are increasingly observed in growing children due to environmental and developmental influences (Bharati et al., 2001; Shah & Jadhav, 2004).

**Table 1: Distribution of Cephalic Phenotypes**

<i>Cephalic Phenotype</i>	<i>Cephalic Index</i>	<i>Number of Students (N=367)</i>	<i>Percentage (%)</i>
Dolichocephalic	< 74.9	12	3.27
Mesocephalic	75 – 79.9	124	33.79
Brachycephalic	80 – 84.9	237	64.58
Hyperbrachycephalic	≥ 85	108	29.43

As shown in Table 2, the cephalic index values among boys aged 6 to 10 years sex-wise comparison reveals that boys exhibit slightly higher CI ranges (80–88), while girls show relatively lower values (78–86), though the mean cephalic index is marginally higher in females. Such sex variation has also been documented in previous anthropometric studies, indicating subtle differences in cranial proportions between males and females (Golalipour et al., 2007; Lobo et al., 2019).

The data for girls, as presented in Table 2, show that cephalic index values range from 78 to 86. The majority of female subjects fall within the mesocephalic to brachycephalic categories. Compared to boys, girls exhibit slightly lower mean cephalic index values and a relatively smaller proportion of hyperbrachycephalic cases. This suggests comparatively less cranial breadth development among females, although the overall pattern remains similar across sexes.

**Table 2: Sex-wise Distribution of Cephalic Phenotypes**

<i>Cephalic Phenotype</i>	<i>Cephalic Index</i>	<i>Boys (n=246)</i>	<i>%</i>	<i>Girls (n=235)</i>	<i>%</i>
Dolichocephalic	< 74.9	6	2.43	6	2.55
Mesocephalic	75 – 79.9	69	28.04	55	23.4
Brachycephalic	80 – 84.9	125	50.81	112	47.65
Hyperbrachycephalic	≥ 85	46	18.69	62	26.38
Total	—	246	100	235	100

An age-wise analysis of cephalic index indicates a clear developmental trend. Younger children (6+–7+ years) are predominantly mesocephalic, whereas older children (8+–10+ years) show a gradual shift toward brachycephalic head types. This transition reflects an increase in cranial breadth relative to head length with age, highlighting growth-related morphological changes in the cranial structure, a phenomenon widely supported in growth and development studies (Eboh & Obaroefe, 2016; Shah & Jadhav, 2004).

**Table 3: Comparison of Cephalic Index (Boys vs Girls)**

<i>Gender</i>	<i>No. of Subjects</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Mean</i>	<i>Mean Difference</i>
Boys	246	68.36	92.9	81.93	—
Girls	235	69.93	90.97	82.63	—
Total	481	69.14	91.93	82.28	0.7

## Discussion

The present study demonstrates a clear predominance of brachycephalic head types among Andh tribal children of Nanded district, indicating a general tendency toward

increased cranial breadth. This finding is consistent with observations reported in several Indian tribal populations, where brachycephalization has been identified as a common morphological trend.

One of the key observations of the study is the gradual increase in cephalic index with advancing age, which suggests lateral cranial growth during the developmental period. Such a pattern reflects an increase in cranial breadth relative to length, supporting the concept of progressive cranial widening in growing children.

Sex differences were also evident in the present study. Although both sexes predominantly exhibited mesocephalic to brachycephalic head forms, females showed a slightly higher mean cephalic index compared to males. This finding is in agreement with the observations of Shah and Jadhav, who reported a higher cephalic index among females and highlighted a tendency toward “mesocephalization,” indicating continuous lateral expansion of the cranial structure.

The phenomenon of mesocephalization observed in the present study may also be explained in the context of geographical and climatic influences. Bharati et al. (2001) suggested that populations in tropical regions tend to exhibit dolichocephalic head forms, whereas those in temperate regions show more rounded (mesocephalic or brachycephalic) head types. Since India lies across both tropical and temperate zones, the present findings indicate a transitional tendency from dolichocephaly toward mesocephaly and brachycephaly.

Variations in head shape are known to be influenced by both genetic and environmental factors. As reported by Gopalipour et al. (2007), hereditary factors play a primary role, while environmental influences such as nutrition and living conditions act as modifying agents. Dietary patterns, in particular, may contribute to cranial growth and development, thereby affecting cephalic index values.

Changes in cranial morphology over generations have also been documented. For example, Heravi and Zieae (2002) observed that first-generation Japanese immigrants in Hawaii exhibited increased head breadth, decreased head length, and consequently higher cephalic index values compared to their ancestors. Such findings support the idea that environmental adaptation and lifestyle changes can significantly influence cranial dimensions over time.

From an applied perspective, the assessment of cephalic index and head shape has important implications in anthropology and forensic science. These measurements can aid in the identification of sex and racial affinity of unknown individuals, thereby contributing valuable information in medico-legal investigations.

## Conclusion

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The present study reveals that Andh tribal children predominantly exhibit mesocephalic to brachycephalic head types, indicating a general tendency toward broader cranial morphology in this population. A gradual increase in the cephalic index with advancing age was observed, reflecting age-related cranial growth characterized by an increase in head breadth relative to length.

Sex-based differences were also noted, with boys showing slightly broader head dimensions, whereas girls demonstrated marginally higher mean cephalic index values, suggesting subtle variations in cranial proportions between the sexes. Although hyperbrachycephalic head types were present, their frequency was comparatively lower than that of mesocephalic and brachycephalic categories.

The findings of this study provide important baseline anthropometric data on the cranial characteristics of Andh tribal children. Such data are valuable for growth assessment, forensic identification, and population-based anthropological studies, contributing to a better understanding of cranial morphology and its variation within tribal populations.

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