RESEARCH PAPER

A COMPARATIVE STUDY OF ORBITAL DIMENSIONS BETWEEN THE RESIDENTS OF TRIPURA, INDIA: AN ANTHROPOMETRIC ANALYSIS

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Abstract:

Background: Human craniofacial morphology reveals variability influenced by genetics, environment, nutrition and socioeconomic factors. Orbital dimensions comprising the length and width of orbit with in the human's skull. The people of Tripura have diverse dimensions, encompassing their demography (a mix of tribals and nontribals including 19 tribal communities), rich cultural heritage reflected in the field of art, dance, and music, and a high literacy rate with a flourishing economy and remarkable Gross State Domestic Product. Whether, there is any association between the orbital dimensions and structures among the scheduled tribe and other caste individuals residing in Tripura. Aim of the study to determine the orbital dimensions and structures among the scheduled tribe and other caste individuals residing in Tripura.

Methods: A total of 150 subjects participated in this study and based on cross sectional study. Subject's orbital dimension measured by height and width of both the right and left orbits, in addition, included the demographic data, height, weight, BMI.

Result: A total of n=150 patients were assessed and screened to evaluate for the study. Among them, 43% participants are Schedule tribes (ST) and 57% participants are from others castes. 40% subjects are male and 60% subjects are female. For individuals from ST category, average right eye orbital length is 26.62mm and width is 35.83mm and length is 27.16mm and width is 35.89mm. For other caste group's individuals average right eye orbital length is 26.14mm and width is 33.64mm and left eye's length is 25.85mm and width is 33.16mm. Here, the typical measurements of orbital length and width are recorded in millimeters by caste.

Conclusion: Individuals from scheduled tribes (ST) exhibits larger orbital dimensions compare to the other caste of Tripura people. These morphological differences suggest population specific craniofacial traits, mostly influenced by genetic and environmental factors. This research results could assist in, studies in ophthalmology, the design of optical aids, forensic identification and anthropological investigations.

Keywords: Orbital dimensions, Caste comparison, Anthropometry, Scheduled Tribe, Craniofacial variation Tripura, Vernier caliper measurement, Orbital index Forensic anthropology.

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Introduction:

Human craniofacial morphology exhibits variability influenced by genetics, environment, and socio-economic factors. Orbital dimensions, comprising the orbital length and width of the eye socket(orbit) in the human skull, are critical in anthropological, forensic, ophthalmology and clinical research. In multi-ethnic societies like India, caste-based variations remain a significant, yet under explored, axis of biometric differentiation. Evaluation of orbital dimensions is essential for knowing the anatomical structure of orbit and surgical management of orbital pathologies. The two larger orbital cavities are placed on either side of the sagittal plane of skull in between the cranium and the skeleton of the face. They encroach about equally on these two regions. Anthropometric studies of orbital dimensions have shown population-specific traits influenced by factors such as casts. The orbits are two bony sockets in craniofacial skeleton protecting eyeballs, good mobility in all directions facilitating binocular vision, roughly the shape of elongated four-sided pyramids [5,6]. Base is directed forwards, laterally and slightly downwards opening in the face [5]. Apex is probably at or between optic foramen and superior orbital fissure and directed backwards communicating with middle cranial fossa [5]. Previous study shown the facial structural differences between the various tribes and nontribes of the north-eastern region of India. The distances between of various facial feature points are

measured using the face images of the newly created database, named as, the Department of Electronics and Information Technology-Tripura University (DeitY-TU) face database [7]. So, previously there is nothing such information regarding the study of eye structure of variety residents of Tripura. Aim of the study to determine the orbital dimensions and structures among the scheduled tribe and other caste individuals residing in Tripura.

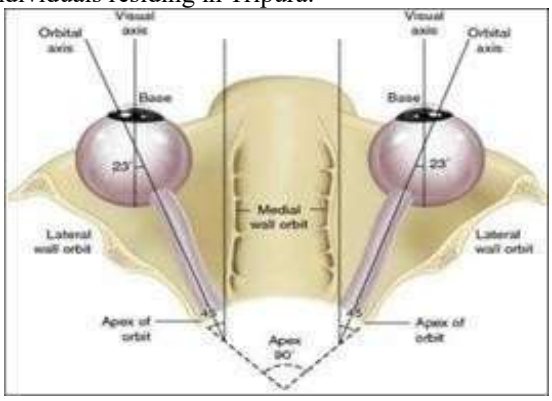


Fig-1: Bones and Walls of Orbit

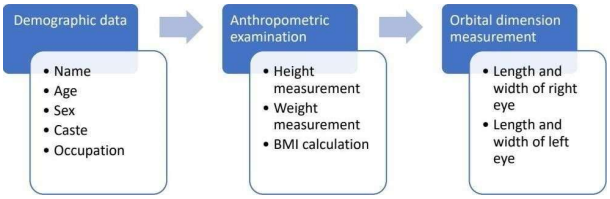
Materials and Methods:

A total of 150 subjects participated in this study and based on cross sectional study carried out among the residents of Tripura. Subject's orbital dimension measured by height and width of both right and left orbits, in addition, included the demographic data, height, weight, BMI. For the orbital measurements using vernier calipers, weighing scale for weight measurement, calculator for BMI calculation and the standardized anthropometric data sheet for recording the value. This research aims to determine the relationship between the orbital dimensions of the scheduled tribes (ST) and the other castes of Tripura people.

Materials used in research purpose:

1. Anthropometric Rod for height measurement
2. Weighting scale for weight measurement
3. Vernier caliper for orbital dimension measurements(mm)
4. Calculating for BMI calculation
5. Standardized anthropometric data sheet for recording

Flowchart of the data collection method



Key steps:

1. **Calibration:** Before measuring, ensuring the jaws are closed and the zero mark on the vernier scale aligns with a mark on the main scale to check for zero error.
2. **Read the main scale:** note the last whole number on the main scale that is visible past the zero mark on the vernier scale
3. **Read the vernier scale:** find the single vernier scale division that aligns precisely with a main scale division.
4. **Calculate the final measurement:** Add the main scale reading to the corresponding vernier scale value to get the total length or width.
5. **Measurement technique:** Measurements were taken on both right and left orbits separately by the maximum distance of orbital width which was measured from the media to the lateral orbital rim including skin and soft tissues (wet skull) and the orbital length margin lying perpendicular to the orbital width including skin and soft tissues around orbit.
6. **Data collection procedure:** Participants were seated in an upright position or stand in straight position. Each measurement was taken thrice, and the average value was recorded. Caste identity was documented based on self-declaration.

Results:

A total of n=150 patients were assessed and screened to evaluate for the study. Among them, 43% participants are Schedule tribes (ST) and 57% participants are from others castes. And 40% subjects are male and 60% subjects are female. For individuals from ST category, average right eye orbital length is 26.62mm and width is 35.83mm and length is 27.16mm and width is 35.89mm. For other caste group's individuals average right eye orbital length is 26.14mm and width is 33.64mm and left eye's length is 25.85mm and width is 33.16mm. Here, the typical measurements of orbital length and width are recorded in millimeters by caste.

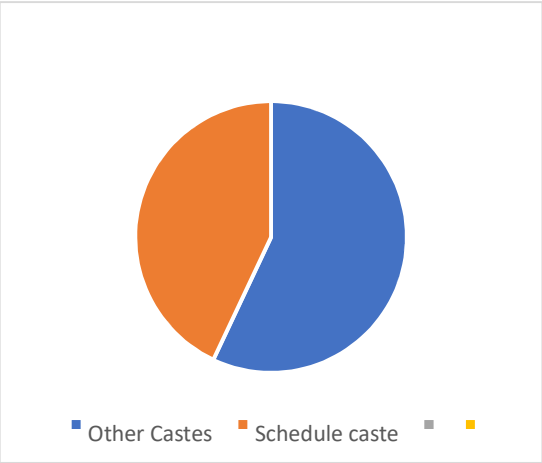


Figure-2: Probability density of Caste

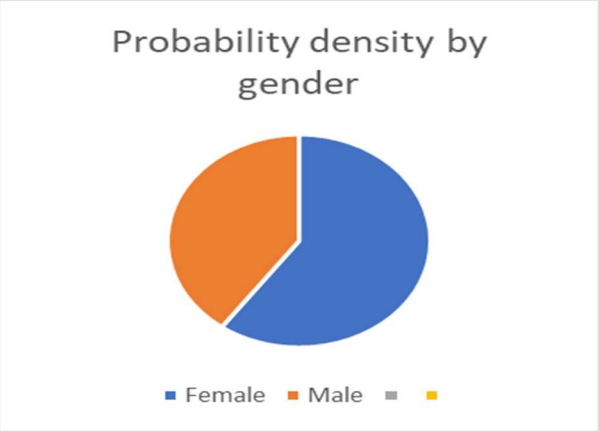


Figure-3: Probability density by Gender

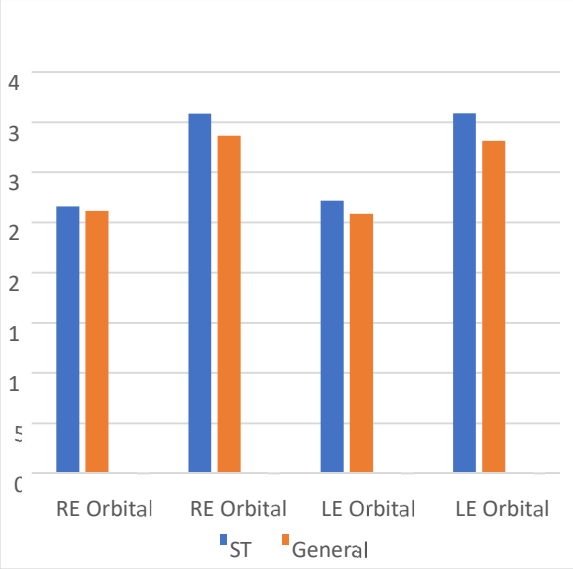


Fig-4: Average Orbital Dimension among Schedule Caste (ST) and Other Caste

Discussion:

The average orbital length and width measurements (in millimeters) by caste. For individuals from the scheduled tribes (ST) category, the average right eye (RE) orbital length is 26.62mm and the RE width is 35.83mm. The left eye (LE) orbital length is 27.16mm, and the LE width is 35.89mm. In contrast, for individuals from other caste groups (General, OBC, and SC), the average RE orbital length is 26.14mm and the RE width is 33.64mm. The LE orbital length is 25.85mm, and the LE width is 33.16mm. Here, we have combined the data of others castes groups like GEN, OBC & SC in a single category caste group differentiating with scheduled tribes (ST). The observed differences in orbital dimensions between the ST and others caste groups suggest potential anthropometric variation influenced by genetic, environmental, or evolutionary factors. The greater orbital length and width in the ST group may reflect broader craniofacial characteristics commonly found in certain ethnic populations. These variations can be significant in fields such as forensic science, where identification relies on skeletal features, and in clinical practices, especially in ophthalmology, refractive surgery, where normative data is crucial for planning interventions. The near-symmetry in orbital dimensions between left and right eyes within each group supports the reliability of the measurements and the bilateral uniformity of orbital anatomy. It is also noteworthy that while the differences are consistent, they are not extreme, indicating inter-group variability within a relatively narrow range.

Conclusion:

The comparative analysis of average orbital dimensions by caste reveals that Individuals from scheduled tribes (ST) exhibits consistently greater orbital dimensions compare to the other caste of Tripura people. These morphological differences suggest population specific craniofacial traits, mostly influenced by genetic and environmental factors. This research results could assist in, studies in ophthalmology, the design of optical aids, forensic identification and anthropological investigations. These findings may reflect population-specific craniofacial variations and could have implications for clinical field. No significant difference was reported in the right and left orbits.

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