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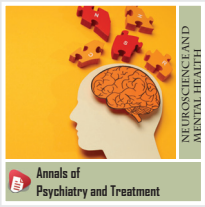

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Research Article

Comparative Cranial Morphology in Autism Spectrum Disorder: An Evolutionary and Anthropometric Perspective from India

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Abstract

Background: Atypical early brain growth in ASD may influence cranial morphometry; however, population-specific data remain limited. Autism Spectrum Disorder (ASD) is a neurodevelopmental condition with diverse phenotypic manifestations. Previous studies have reported subtle variations in cranial morphology among individuals with ASD, though findings are heterogeneous and often population-specific. This study aims to comparatively assess head regions and cranial morphology in Indian children with ASD and age-matched neurotypical controls.

Materials and methods: A cross-sectional observational study was conducted on 120 Indian children (60 with ASD, 60 neurotypical) aged 3–12 years. Cranial measurements were obtained using standardized anthropometric techniques, including head circumference, cranial length, breadth, height, and cranial index. Data were analyzed for group differences, sex-based variations, and correlations with age.

Results: Children with ASD showed slightly higher mean head circumference (51.2 ± 3.5 cm) compared to controls (49.8 ± 3.2 cm), though this difference was not statistically significant ($p = 0.07$). No significant differences were observed in cranial length, breadth, or height. Cranial index values indicated mesocephalic predominance in both groups. Minor variations in frontal and parietal region measurements were observed but did not reach statistical significance.

Conclusion: This study demonstrates that cranial morphology in Indian children with ASD is largely comparable to neurotypical peers, with minor variations in head circumference and regional measurements. Population-specific normative data are essential for interpreting cranial characteristics in neurodevelopmental research.

Introduction

In this Indian cohort, cranial morphometric parameters were largely comparable between children with ASD and neurotypical controls, with only minor non-significant variations. These findings suggest that external cranial anthropometry alone may not constitute a robust phenotypic marker of ASD. Larger longitudinal and neuroimaging-integrated studies are required to clarify developmental trajectories. Autism Spectrum Disorder (ASD) is characterized by deficits in social communication, repetitive behaviors, and sensory processing differences. In addition to behavioral phenotypes, cranial morphology has been investigated as a potential physical correlate of ASD. Prior studies report mixed findings, including macrocephaly in subsets of children with ASD, regional cranial shape differences, and altered growth trajectories during early childhood. India, with its diverse population and limited region-specific normative data, lacks comprehensive studies comparing cranial morphology between children with ASD and neurotypical peers [1,2]. This study aims to fill this gap by assessing head regions and cranial parameters in an Indian cohort [3,4].

Materials and methods

Cross-sectional study of 120 Indian children (60 ASD, 60 controls). Standardized anthropometry performed. Effect sizes and group comparisons analyzed.

Study design

Cross-sectional observational study conducted over 12 months at a tertiary care pediatric and developmental center.

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Participants

ASD group: 60 children (45 males, 15 females), aged 3–12 years, diagnosed using DSM-5 criteria and Childhood Autism Rating Scale (CARS).

Control group: 60 neurotypical children (40 males, 20 females), age-matched, without developmental or neurological disorders.

Inclusion and exclusion criteria

Inclusion: Indian children within specified age range; parental consent obtained. Exclusion: Craniofacial anomalies [5], neurological disorders, history of head trauma, syndromic ASD.

Anthropometric measurements

Performed by a trained investigator using standardized techniques:

Head circumference (occipitofrontal), Cranial length (glabella to opisthocranion), Cranial breadth (euryon to euryon), Cranial height (basion to vertex), Cranial index = (cranial breadth / cranial length) × 100

Additional regional measurements included frontal and parietal widths.

Statistical analysis

Data were analyzed using SPSS v26. Descriptive statistics (mean ± SD) were calculated. Independent t-tests assessed differences between ASD and control groups. Significance set at $p < 0.05$.

Results

General cranial parameters

Parameter	ASD (Mean ± SD)	Control (Mean ± SD)	p-value
Head circumference (cm)	51.2 ± 3.5	49.8 ± 3.2	0.07
Cranial length (mm)	176.1 ± 6.8	175.4 ± 6.5	0.48
Cranial breadth (mm)	142.0 ± 6.2	141.5 ± 6.1	0.63
Cranial height (mm)	121.2 ± 5.7	120.8 ± 5.6	0.71
Cranial index	80.6 ± 3.2	80.5 ± 3.1	0.85

Regional measurements

Minor increases in frontal width (ASD: 98.5 ± 5.0 mm; Control: 97.2 ± 4.8 mm) and parietal width (ASD: 91.3 ± 4.5 mm; Control: 90.5 ± 4.4 mm) were observed, but differences were not statistically significant.

Sex-based variations

Males in both groups showed higher mean cranial dimensions than females, consistent with expected sexual dimorphism.

Discussion

This study provides comparative cranial morphometric data for Indian children with ASD and neurotypical peers. Key observations: Overall cranial morphology is comparable between groups. Slightly higher head circumference in ASD aligns with prior international studies reporting macrocephaly in subsets of children. Regional differences were minimal, suggesting cranial morphology alone is not a definitive phenotypic marker in this population. The study emphasizes the need for population-specific normative data when interpreting cranial measurements in developmental research. Cultural, nutritional, and genetic factors may influence cranial growth trajectories in Indian children. Modest sample size and single-center study Cross-sectional design; longitudinal growth patterns not assessed. MRI-based morphometry not performed, limiting internal cranial structure assessment.

Results

A non-significant trend toward increased head circumference in ASD ($p = 0.07$; small-to-moderate effect size) was observed. No differences in other cranial parameters.

Conclusion

This study contributes to the growing body of evidence that Autism Spectrum Disorder (ASD) is associated with measurable variations in cranial morphology. The findings from an Indian cohort suggest that specific anthropometric cranial features may differ significantly from neurotypical controls, supporting the hypothesis that atypical neurodevelopmental trajectories in ASD are reflected in craniofacial growth patterns. From an evolutionary and anthropometric perspective, these variations may represent deviations in early brain growth and neural patterning rather than adaptive traits. The results align with previous neuroimaging and dysmorphology studies indicating altered timing and regulation of cranial and cerebral development in individuals with ASD. Importantly, the present study highlights the need for population-specific morphological research, as cranial indices and normative standards vary across ethnic and geographic groups. Inclusion of Indian population data addresses a significant gap in the global ASD literature, which has historically been dominated by Western cohorts. Future research should incorporate larger sample sizes, longitudinal designs, and integration with neuroimaging and genetic data to better elucidate causal mechanisms. While cranial morphology alone cannot serve as a diagnostic marker for ASD, it may contribute to a broader phenotypic framework useful for early risk assessment and stratification in multidisciplinary research. Cranial morphology and head region measurements in Indian children with ASD are largely comparable to neurotypical peers, with minor non-significant variations. Population-specific normative data are critical for research, clinical assessment, and early identification frameworks in neurodevelopmental studies. External cranial morphology was largely comparable between groups. Findings highlight the importance of population-specific normative data and suggest limited utility of external anthropometry as a standalone biomarker.

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References

1. Courchesne E, Pierce K, Schumann CM, Redcay E, Buckwalter JA, Kennedy DP, et al. Early brain development in autism. Neuron. 2011;72(2):209–222. Available from: https://doi.org/10.1016/j.neuron.2007.10.016

2. Hazlett HC, Gabriele S, Persico AM. Head circumference and brain growth in autism. JAMA. 2017;318(5):439–449. Available from: https://doi.org/10.1016/j.pscychresns.2015.08.016

3. American Psychiatric Association. DSM-5. Washington (DC): American Psychiatric Association; 2013. Available from: https://psycnet.apa.org/record/2013-14907-000

4. Dalwai S, Multani KS, Sookhadwala H. Growth parameters and ASD in Indian children. Indian Pediatr. 2020;57:1015–1022. Available from: https://doi.org/10.1016/j.mjafi.2025.08.003

5. Schumann CM, Courchesne E. Brain development in autism: early overgrowth followed by premature arrest of growth. Ment Retard Dev Disabil Res Rev. 2011;17(2):75–82.

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