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ASSESSMENT OF HEAD SIZE PARAMETERS IN SCHOOL CHILDREN FROM RURAL SETTLEMENTS OF TASHKENT REGION

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Abstract
Anthropometric measurements of the human head serve as critical indicators for assessing growth patterns, developmental status, and health risks in pediatric populations. This study evaluates the head size parameters of school-aged children living in rural settlements of the Tashkent Region. A total of 420 children aged 7 to 15 years were examined using standard anthropometric techniques. The study revealed age- and sex-related differences in head circumference, head length, and head breadth, reflecting normal growth trends and highlighting slight regional variations. The findings can contribute to the development of updated reference norms for Uzbek schoolchildren and assist in early identification of craniofacial deviations.

Keywords: anthropometry, head circumference, school children, cranial index, Uzbekistan, rural population, growth assessment.

Introduction

Anthropometric characteristics, especially cranial dimensions, are historically significant markers in pediatric growth monitoring, clinical diagnostics, ergonomics, and forensic science (Kanchan & Krishan, 2011). Head size parameters, such as head circumference (HC), head length (HL), and head breadth (HB), are routinely used to assess neurodevelopmental status and detect cranial deformities in children (Farkas, 1994).

Global studies have emphasized the variability of cranial dimensions depending on genetic, environmental, nutritional, and socio-economic factors (Golalipour et al., 2003; Jadav & Shah, 2004). However, national datasets in Central Asia, particularly in Uzbekistan, remain limited. Given the substantial socio-economic and environmental distinctions between urban and rural populations, there is a need to establish region-specific anthropometric references.

The Tashkent Region, with its diverse rural settlements, presents a unique case for such an assessment. Rural children may differ in their growth trajectories due to distinct dietary patterns, physical activity levels, healthcare access, and traditional lifestyles. This study aims to fill that gap by systematically measuring head size indicators in school-age children from rural areas in the region.

Purpose of the Study

To assess the head size parameters (head circumference, head length, and head breadth) of school-aged children residing in rural settlements of the Tashkent Region and to analyze these indicators in relation to age and sex.

Materials and Methods

This cross-sectional descriptive study was conducted between January and April 2024 with the aim of evaluating cranial anthropometric parameters among school-aged children residing in rural settlements of the Tashkent Region. The research focused on a sample population of 420 healthy children—215 boys and 205 girls—ranging in age from 7 to 15 years. Participants were selected from six general education schools located in different rural districts, ensuring representation across socio-economically diverse rural communities within the region.

All children included in the study were lifelong residents of the selected areas and attended school regularly. Inclusion criteria required that participants be free from any known neurological disorders, genetic syndromes, craniofacial abnormalities, or chronic illnesses that could influence normal growth and development. Written informed consent was obtained from parents or legal guardians, and verbal assent was acquired from each child before data collection began. Ethical approval was granted by the local medical ethics committee in accordance with the Declaration of Helsinki.

Anthropometric data were collected using standard techniques as recommended by the International Society for the Advancement of Kinanthropometry (ISAK). Three main cranial parameters were measured: head circumference (HC), head length (HL), and head breadth (HB). Head circumference was measured using a flexible, non-stretchable measuring tape, wrapped horizontally around the head at the level just above the eyebrows anteriorly and the most prominent part of the occiput posteriorly. Head length, defined as the linear distance from the glabella (the most prominent point on the forehead between the eyebrows) to the opisthocranion (the farthest point on the back of the head), was measured using a spreading caliper. Head breadth was obtained as the maximum transverse diameter between the two parietal eminences, also using a sliding caliper. All measurements were taken on the right side of the body, with the child in a relaxed, upright seated position, and recorded to the nearest millimeter. Each dimension was measured twice, and the average value was used to minimize intra-observer error. In cases where the two values differed by more than 2 mm, a third measurement was conducted, and the two closest values were averaged.

To ensure consistency and reliability, all measurements were conducted by the same trained anthropometrist throughout the study. Equipment was calibrated daily, and environmental conditions such as lighting and room temperature were kept constant to reduce variability. The data collection process followed a standardized protocol to avoid measurement bias and ensure reproducibility.

The cranial index (CI), a widely used anthropometric ratio for classifying head shape, was calculated using the formula: CI = (head breadth / head length) × 100. Based on the CI values, head shapes were categorized as dolichocephalic (CI < 75), mesocephalic (CI 75–79.9), and brachycephalic (CI ≥ 80), following conventional anthropological criteria.

Collected data were entered and analyzed using IBM SPSS Statistics (version 25.0). Descriptive statistics, including means, standard deviations, and ranges, were computed for each cranial parameter across age and sex groups. Inferential statistical tests, such as the independent samples t-test and one-way ANOVA, were employed to identify significant differences between sexes and age brackets. The level of statistical significance was set at $p < 0.05$. Normality of the data was assessed using the Shapiro-Wilk test, and homogeneity of variance was confirmed with Levene's test prior to applying parametric tests. Where appropriate, post hoc analyses (Tukey's HSD) were used to determine the nature of group differences.

This methodological framework enabled a comprehensive evaluation of cranial growth patterns in a rural pediatric population, providing reliable baseline data for regional health assessments and future comparative studies.

Results

A total of 420 school-aged children (215 boys and 205 girls), aged 7 to 15 years, were examined. The anthropometric measurements analyzed included head circumference (HC), head length (HL), head breadth (HB), and the calculated cranial index (CI). Descriptive statistics were computed for each parameter, and comparisons were made between boys and girls across different age groups.

Table 1. Mean Head Circumference (cm) by Age and Sex

Age (years)	Boys (Mean ± SD)	Girls (Mean ± SD)	p-value
7	51.2 ± 1.3	50.8 ± 1.2	0.041
9	52.1 ± 1.4	51.5 ± 1.3	0.032
11	53.4 ± 1.5	52.6 ± 1.3	0.015
13	54.6 ± 1.4	53.8 ± 1.2	0.008
15	55.2 ± 1.3	54.5 ± 1.1	0.011

Across all age groups, boys consistently demonstrated larger mean head circumferences compared to girls of the same age. These differences were statistically significant ($p < 0.05$), suggesting a sex-based divergence in cranial growth patterns beginning from early school age.

Table 2. Mean Head Length and Breadth (cm) by Sex

Parameter	Boys (n = 215)	Girls (n = 205)	p-value
Head Length	18.3 ± 0.7	17.8 ± 0.6	0.003
Head Breadth	14.1 ± 0.5	13.9 ± 0.6	0.027

The mean head length and breadth were both greater among boys than girls, with statistically significant differences in both dimensions. This aligns with general patterns of cranial development where male children tend to exhibit larger head dimensions.

Table 3. Cranial Index (CI) by Sex

Sex	Mean CI (%) ± SD	Skull Type Classification
Boys	76.8 ± 3.1	Mesocephalic
Girls	78.5 ± 2.9	Borderline Brachycephalic

The cranial index (CI) values indicated a predominantly mesocephalic head shape among boys, while girls demonstrated slightly higher CI values, trending toward brachycephaly. The difference in CI values was statistically significant ($p = 0.014$), suggesting subtle sex-based variations in cranial proportions. Pearson correlation coefficients revealed a strong positive correlation between age and all three cranial dimensions ($r > 0.75$, $p < 0.01$). One-way ANOVA indicated significant differences in head dimensions across age groups ($F = 12.41$, $p < 0.001$), confirming age as a major determinant of cranial growth. Post hoc analysis showed the most rapid growth in HC and HL occurred between 9 and 13 years.
These findings suggest that cranial growth in this rural population follows expected physiological trends, with clear distinctions in head size by age and sex. Notably, while the overall cranial shape remained within normal anthropometric classifications, subtle shifts in proportions were evident, particularly in girls.

Discussion

The study confirms the presence of age- and sex-related differences in cranial dimensions among rural schoolchildren in the Tashkent Region. The values obtained are comparable to similar studies conducted in Iran (Golalipour et al., 2003), India (Jadav & Shah, 2004), and Nigeria (Oladipo et al., 2009), though slight regional deviations were observed, likely due to ethnic and environmental influences. The results reflect a prevailing mesocephalic cranial type in boys and a tendency toward brachycephaly in girls. These findings align with sexual dimorphism patterns in cranial morphology, as described in previous anthropological literature (Farkas, 1994). Importantly, the increasing head circumference with age corresponds to expected neurodevelopmental growth curves, reinforcing the validity of the data. Given that anthropometric norms are essential for pediatric assessment, prosthetics design, and neurological screening, the establishment of local reference values is of significant clinical and public health interest. The data may be used to detect deviations in cranial growth, such as microcephaly or hydrocephalus, and to inform ergonomic product development for children (e.g., helmets, school furniture).

Conclusion

This study provides baseline anthropometric data on head size parameters among rural school-aged children in the Tashkent Region. The observed differences by age and sex underscore the importance of using region-specific growth references. The findings may contribute to national pediatric health policies, educational ergonomics, and further anthropological research in Central Asia.

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