Original Article

Cephalic Measurements of Different Tribal Groups of Udaipur District of Southern Rajasthan, India

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ABSTRACT

Introduction: Cephalometry is an important part of physical Anthropology and medicine which is used for the determination of the morphological characteristics of the head. Cephalometric results can also be of great assistance in evaluating patients while imaging, in the filed of paediatrics, craniofacial surgery and study growth patterns.

Aim: To determine cephalic measurements (head circumference and auricular head height) in tribes of Udaipur Rajasthan and also to find out gender-based differences, if any.

Materials and Methods: This anthropometric study was carried out in the Department of Anatomy, RNT Medical College, Udaipur, Rajasthan. The subjects were 500 tribal people (269 male and 231 female) aged between 21 to 50 years. Head circumference (cm) and auricular head height (cm) were measured using Todd's Head spanner and measuring tape to nearest 1 mm. Data were subjected to statistical analysis to find out Mean±SD and Independent group t-test was used for comparing two independent groups. The p-value <0.05 was considered to be statistically significant.

Results: Overall, there were 269 (53.8%) tribal males and 231 (46.2%) females with mean age 33.10±8.64 and 34.67±8.17, respectively. The mean values of head circumference (cm) in Bheel, Damor, Garasia, Kathodi and Meena were 56.17±0.85, 56.13±1.11, 55.99±0.90, 56.53±1.08 and 56.26±1.13, respectively. The mean auricular head height (cm) in Bheel, Damor, Garasia, Kathodi and Meena were 13.20±0.39, 13.17±0.43, 12.99±0.24, 13.51±0.45 and 13.17±0.41, respectively. The values for mean head circumference (cm) and auricular head height (cm) were 56.19±1.02 and 13.17±0.40, respectively, in all study participants. The mean head circumference (cm) and auricular head height (cm) of tribal males were significantly higher (56.45±1.03 and 13.32±0.40, respectively) than females (55.87±0.90 and 13.00±0.32, respectively).

Conclusion: Significant differences exist in mean values of head circumference and auricular head height between the tribal males and females, which indicates gender differences with significantly higher values for all anthropometric parameters in the male counterpart.

INTRODUCTION

As per census 2011, tribals have a total share of 8.6% of India's total population and are spread in over about 1/5th part of country's total geographical area with 500 different tribal groups having distinct cultural identity [1]. The criteria used for identifying any specified tribal community can be based on their geographical isolation, backwardness, distinctive culture, language, religion and shyness [2].

Rajasthan state has one of the highest population of the tribal communities [3]. The present study was conducted in Udaipur which is located in the southern most part of Rajasthan, near the Gujarat border. It is surrounded northwest by the Aravalli Range, which separates it from Thar Desert. Udaipur district lies between 23°46'and 25°05'north latitudes and 73°09' and 74°35'east longitude. It is bounded on the north by Rajsam and Pali District, on the south by Dungarpur District, on the east by Chittaurgarh and Pratapgarh District, northwest by Sirohi and Pali District and Sabarkantha district, Gujarat State [4].

With the help of anthropometric methods one can evaluate changes in cranial composition and other features with which it is possible to differentiate between different human phenotypes, individuals, and ethnic group [5]. Cephalometric results are of great importance in evaluation of patients in various fields like medical imaging, paediatrics, craniofacial surgery and also become important in order to study and compare growth trends in different castes/races within a particular geographic zone [6]. So, that the knowledge of normal values of cephalometric parameters is quite important in identification

of a missing person and helps in diagnosis and treatment of some developmental abnormalities (abnormal brain and skull growth such as hydrocephalus, microcephaly and macrocephaly) [7].

Cephalometric measurements play important role in the field of forensic medicine for determination of sex of an individual after pelvic measurements. Worldwide data provides information that a larger size and shape of skull belongs to a male whereas a smaller size and shape to a female; but for certain population like tribes there is paucity of standard data. Therefore, it will be of great use to provide such kind of standard data for tribal population.

So, the present study was an attempt to find out standard data for various cephalic measurements viz., head circumference and auricular head height on different tribal groups of Udaipur district, Rajasthan, India.

MATERIALS AND METHODS

This was an observational type of descriptive study carried out on 500 tribal subjects in Department of Anatomy, RNT Medical College and attached groups of hospitals, Udaipur, Rajasthan from January 2016 to June 2018. The study was conducted after getting approval from Institutional Ethical Committee (No.RNT/STAT/IEC/2015/443), Institutional Research Board and other concerned authorities (Departmental research committee and research board of Rajasthan Health University).

Sample size estimation: As per census of India-2011, total population of Udaipur district is 30,68,420 [4]. Out of total population of tribal population is 15,25,289 which covers about 50% of the

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total population. The following considerations were made: p=50%, q=50% at 95% confidence interval, 5% marginal error. The final sample size was 384. Taking non response rate to be 20%, 460 was the required sample size and it was rounded off to 500.

The study was carried out on various tribal communities such as Bheel, Damor, Garasia, Kathodi and Meena of Udaipur district of Southern Rajasthan. Before starting study initially some demographic areas or villages were selected according to the density of tribal population. First the need and requirement of the study was discussed with the community leader of respective tribe to smoothen the further work in that particular tribal community.After that all the tribal subjects were selected randomly, after explaining them about nature and purpose of the study.

Inclusion criteria: Both male and female study participants of Bheel, Damor, Garasia, Kathodi and Meena tribal communities aged between 21 to 50 years residing in this particular, specific native area of Udaipur region from last two generations were included.

Exclusion criteria: Subjects with crainofacial trauma, facial scars and facial asymmetry and congenital craniofacial anomalies such as cleft lip were excluded from the study.

Study Procedure

After getting the informed consents the subjects were made to sit on a stool or a table in such a way that head in anatomical position so that one could take measurements on all sides of the head. Then head circumference and auricular head height was measured by using Todd's Head spanner and measuring tape to nearest 1mm according to methods given by Martin and Saller (1957) [8].

(1) Head circumference (cm) (g-op-g): Head circumference was measured in such a way to hold the tape with the left hand on glabella (g) and take it with right hand over the left-side to opisthocranion (op), then over the right side back to glabella (g) tape is wound around the head at the same level by using measuring tape [Table/Fig-1a].

(2) Auricular head height (cm) (AM-V): Auricular head height was measured as vertical distance from the external acoustic meatus to the vertex by using Todd's spanner [Table/Fig-1b].
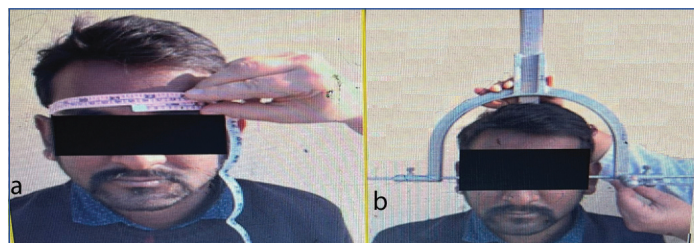
[Table/Fig-1]: a) Head circumference (g-op-g); b) Auricular head height (AM-V).

STATISTICAL ANALYSIS

Statistical Package for Social Sciences (SPSS), version 21.0 was used for statistical analysis. Data was subjected to statistical analysis to find out Mean±SD and Independent group t-test was used for comparing two independent groups. One-way ANOVA (Analysis of Variance) test was applied for comparing more than two independent groups. The p-value at <0.05 was considered to be statistically significant.

RESULTS

Out of total 500 subjects, maximum participants belonged to the Meena tribe and the least to Kathodi [Table/Fig-2]. Overall, there were 269 (53.8%) tribal males and 231 (46.2%) females. Females with mean age 33.10±8.64 and 34.67±8.17 years, respectively [Table/Fig-3,4]. The head circumference (cm) and mean auricular head height (cm) was largest in the Kathodi tribe whereas it was smallest in Garasia [Table/Fig-5].

The head circumference and auricular head height in tribal males were significantly higher than females [Table/Fig-6].

Tribe	Frequency (Percentage)
Bheel	126 (25.2%)
Damor	80 (16%)
Garasia	99 (19.8%)
Kathodi	46 (9.2%)
Meena	149 (29.8%)
Total	500 (100%)

[Table/Fig-2]: Distribution of the population according to the tribe.

Tribes	Age (Mean±SD) years
Bheel	35.88±8.36
Damor	34.05±8.62
Garasia	30.71±7.66
Kathodi	31.21±7.67
Meena	34.8±8.5

[Table/Fig-3]: Age of the population.

Gender	No. (%)	Age (Mean±SD) (years)
Male	269 (53.8%)	33.10±8.64
Female	231 (46.2%)	34.67±8.17
Total	500 (100%)	33.8±8.46

[Table/Fig-4]: Gender distribution.

Parameters	Tribes	Mean±SD
Head circumference (cm)	Bheel	56.17±0.85
	Damor	56.13±1.11
	Garasia	55.99±0.90
	Kathodi	56.53±1.08
	Meena	56.26±1.13
Auricular head height (cm)	Bheel	13.20±0.39
	Damor	13.17±0.43
	Garasia	12.99±0.24
	Kathodi	13.51±0.45
	Meena	13.17±0.41

[Table/Fig-5]: Cephalic parameters.

Parameters	Gender	Mean±SD	p-value
Head circumference (cm)	Male	56.45±1.03	<0.001
	Female	55.87±0.90	
	Total	56.19±1.02	
Auricular head height (cm)	Male	13.32±0.40	<0.001
	Female	13.00±0.32	
	Total	13.17±0.40	

[Table/Fig-6]: Cephalic parameters between tribal males and tribal females.

The head circumference (cm) and auricular head height (cm) were significantly higher in tribal males than tribal females [Table/Fig-7].

Parameters	Tribes	Male	Female	p-value
Head circumference (Mean±SD)	Bheel	56.41±0.88	55.90±0.73	<0.001
	Damor	56.88±1.00	55.42±0.60	<0.001
	Garasia	55.91±0.93	54.07±0.86	<0.001
	Kathodi	56.57±0.95	55.25±0.24	<0.001
	Meena	56.60±1.12	55.81±0.97	<0.001
Auricular head height (Mean±SD)	Bheel	13.33±0.39	13.05±0.30	<0.001
	Damor	13.41±0.44	12.93±0.26	<0.001
	Garasia	13.44±0.20	12.01±0.26	<0.001
	Kathodi	13.72±0.36	13.25±0.40	<0.001
	Meena	13.34±0.38	12.96±0.34	<0.001

[Table/Fig-7]: Gender based comparison of mean cephalic parameters (cm) within tribe. The p-value at <0.05 was considered to be statistically significant

Name and year of researcher	Location	Population	Sample size	Male (Mean±SD)	Female (Mean±SD)	Total (Mean±SD)
Present study (2023)	Udaipur (Rajasthan)	Tribals	500	56.45±1.03	55.87±0.90	56.19±1.02
Chatterjee M et al., (2015) [9]	Chhattisgarh	Gond	100	-	-	54.22±0.16
Krishan K (2008) [13]	North India	Gujjars	996	53.21±2.57	-	-
Ghosh S et al., (2007) [14]	West Bengal	Santhal	800	54.87±0.09	54.20±0.08	54.53±0.08
Pandey AK et al., (2006) [15]	Andaman Nicobar	Onges	53	52.24±1.30	50.01±1.26	51.12

[Table/Fig-8]: Comparison of mean head circumference (cm) of the present study with National studies [9,12-14].

Name and year of researcher	Location	Population	Sample size	Male (Mean±SD)	Female (Mean±SD)	Total (Mean±SD)
Present Study (2023)	Udaipur (Rajasthan)	Tribals	500	56.45±1.03	55.87±0.90	56.19±1.02
Oladipo GS et al., (2011) [10]	Nigeria	Omoku	800	55.72±2.79	54.89±2.82	55.30±2.74
Raji JM et al., (2010) [12]	Nigeria	Nigerian	343	57.25±4.38	57.22±2.61	57.23±2.02

[Table/Fig-9]: Comparison of mean head circumference (cm) of the present study with International studies [10,11].

Name and year of researcher	Location	Population	Sample size	Male (Mean±SD)	Female (Mean±SD)	Total (Mean±SD)
Present study (2023)	Udaipur (Rajasthan)	Tribals	500	13.32±0.40	13.00±0.32	13.17±0.40
Khan AM et al., (2015) [16]	Punjab (Multan)	Punjabi	672	14.4±0.98	13.9±0.79	14.1±0.84
Pandey AK et al., (2006) [15]	Andaman, Nicobar	Onges	53	12.30±0.64	12.21±0.76	12.25

[Table/Fig-10]: Comparison of mean auricular head height (cm) of the present study with National studies [14,15].

Name and year of researcher	Location	Population	Sample size	Male (Mean±SD)	Female (Mean±SD)	Total (Mean±SD)
Present study (2023)	Udaipur (Rajasthan)	Tribals	500	13.32±0.40	13.00±0.32	13.17±0.40
Timsina RP et al., (2014) [16]	Nepal	Medical students	940	-	-	15.01
Ilayperuma I (2011) [18]	Sri Lanka	Medical students	210	14.11±0.9	13.53±1.26	13.82
Ilayperuma I (2011) [19]	Sri Lanka	Medical students	400	14.02±1.03	13.88±1.29	13.95±1.13
Raji JM et al., (2010) [11]	Nigeria	Nigerian	343	16.6±9.60	14.10±0.87	15.35±0.92

[Table/Fig-11]: Comparison of mean auricular head height (cm) of the present study with International studies [11,16,18,19].

DISCUSSION

Available research studies based on anthropometric measurements in tribes of Udaipur region are few. Hence, there is a great scope and need to conduct such type of progressive study to determine craniofacial measurements along with frequency distribution of phenotypes of head, face and nose among different tribes residing in the same habitat geographical area and climatic environmental condition in Udaipur District of Southern Rajasthan.

Head circumference is an important parameter for forensic medicine for sex determination. Various authors have established normograms for head circumference in males and females, which can be used in forensic medicine. It is frequently used in orthodontics to measure the size and spatial relationships of the teeth, jaws and cranium.

[Table/Fig-8,9] show comparison of head circumference of the present study, which was conducted in Rajasthan, with previous studies. When present study was compared with a Nigerian population, it was observed that the anthropometric values were lesser in the present study. Difference could be because of the varied population-student Nigerians (non tribal). The head circumferences were smaller than in the present study, as compared to Gond (Chhattisgarh), Omoko indigenes (Nigeria), an endogamous group (North India), an endogamous Santhal group of tribal population (West Bengal) and Onges (Andaman Nicobar) [9-14].

[Table/Fig-10,11] show comparison of auricular head height of the present study which was conducted in Rajasthan with previous studies[11,14-19]. The mean value of auricular head height for the overall tribal population was 13.17 cm which was higher than the results obtained in Andaman Nicobar [14], but lower than those in Punjab [15], Nepal [16], Sri Lanka [17] and Nigeria [11].

These variations occurred due to difference in geographical location, racial variation, variation in sampled population, and difference in instrument used for studies, variations found in sample size of population.

CONCLUSION(S)

The study found statistically significant differences in mean values of head circumference and auricular head height between the selected tribal males and females. Significant difference exists among same sexes of all the selected five tribes, which indicated that all the studied tribes (Bheel, Damor, Garasia, Kathodi and Meena) were significantly different from each other based on craniofacial anthropometry. Further research on craniofacial anthropometry can be carried with the help of other modern advanced techniques like photogrammetry and 3-Dimensional surface scanner, which can reveal more detailed variables.

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