# A Study to Correlate Cephalic Index Of Various Caste/Races Of Gujarat State

**Dr. H. R. Jadav*, Dr. V.B.Kariya**, Dr. B. B. Kodiyatar***, Dr. C.A.Pensi******

* Professor and Head, Department of Anatomy, GMERS Medical College, Gandhinagar, ** Assistant Professor, *** Tutor, **** Professor and Head, Department of Anatomy, B. J. Medical college, Ahmedabad.

**Abstract :** The study was carried out in various communities of Gujarat state which are still occupying particular locations of various districts in different regions. Total six communities were selected randomly. These were: Sindhi, Patel, Rabari, Kharwa (fisherman), Bhil and Siddi( negro ). Only male subjects who belonged to 21 - 50 years of age and who were not having any history of inter-caste, inter-religion marriage of their parents uptill at least 3 generations were included. The study subjects were divided into 3 age related groups: Group A: 21 to 30 years, Group B : 31 to 40 years and Group C : 41 to 50 years. 30 subjects, 10 per aforesaid age-groups (A, B and C) were studied from each community. This was followed by head measurements i.e. head length and width were obtained from each study subject ( total being 180) and by cephalic index of each study subject was determined by Hrdlicka's method. The data were then analyzed by statistical software and to determine statistical significance chi-square and Kruskal Wallis tests were applied. The features observed were co-related with the data of cephalic indices of respective communities.

**Key-words**: Cephalic index, Caste, Races

**Corresponding Author:** Dr. H. R. Jadav, 18/Shivkunj Society, Radhaswami Satsang Road, Ranip, Ahmedabad, Gujarat, India-382480. E-mail: drhrishihrishihrishi@gmail.com

**INTRODUCTION:** Human physical variability has been a subject of great interest for the scientists for a very long time and ANTHROPOMETRY evolved as a standard scientific technique for measuring human body dimensions.[1] Ethnologists classified Indian population on the basis of anthropometric data collected from various population of Indian subcontinent[1]. So far, many studies have been conducted in various parts of India applying the techniques of anthropometry[2]. This is a humble beginning towards undertaking an anthropometric study on head of various populations of Gujarat state.

Study of intra and inter-population variations in different morphological characters have long been an interest of anthropologists. The dimensions of the human body are affected by ecological, biological, geographical, racial, gender and age factors. On the basis of the above factors, anthropological studies have been conducted on the age, gender and racial groups in certain geographical zones[3].

Cephalometry is a branch of anthropometry in which the anatomical dimensions of head and face are measured. Cephalometric studies can be carried out by various methods like Photogrametry, Ultrasound, Computed tomographic scanning, Magnetic imaging, Optical surface scanning and Cephalometry. Out of all, Cephalometry continues to be the most versatile technique in the investigation of the craniofacial skeleton because of its validity and practicality[4].

This study was conducted in State of Gujarat in view of its importance in anthropometric indices in diagnostic knowledge between the patient and normal populations and in the medico-legal cases of Forensic Medicine. The Cephalometric results can also be of great assistance while evaluating patients in various fields of medicine like Medical Imaging, Pediatrics, Craniofacial Surgery [5] and also for studying growth trends in various castes/races within a defined geographic zone[6]. Anthropometric study of head is useful in designing various equipments of head and face like helmets, head phones, goggles etc by formulating standard sizes[7]. The observations and findings of this study will provide platform for similar extended Cephalometric studies based on various communities/castes/races of particular geographic zones.

**MATERIAL AND METHODS:** The study was carried out in various communities of Gujarat state which are still occupying particular locations of various

districts in different regions. Total six communities were selected randomly. These were: Sindhi, Patel, Rabari, Kharwa (fisherman), Bhil and Siddi( negro).

The demographic areas having denser population of above mentioned communities were selected for study purpose i.e. Jantanagar; City: Ahmedabad for Sindhi, Ramdevnagar; City : Ahmedabad for Patel, Ta: Mangrole; Dist: Junagadh for Rabari, Ta:Veraval; Dist: Junagadh for Kharva(fisherman), Panchmahal, Dist: Godhra for Bhil and Sirvan village, Ta: Sasan Gir, Dist: Junagadh for Siddi(negro).

Male subjects who belonged to 21 - 50 years of age and who were not having any history of inter-caste, inter-religion marriage of their parents' uptill at least 3 generations were included in the study.
The study subjects were divided into 3 age related groups:
Group A : 21 to 30 years
Group B : 31 to 40 years
Group C : 41 to 50 years

Before starting study, a community leader of respective community was made understand the aims and objectives of the study in order to smoothen the further work in that community. A written consent of the subjects was taken after explanation about aims and objectives of the study in locally palatable language. Those who did not wanted to participate in the study after explanation were opted out of the study.

A pre-set pre-tested structured questionnaire comprising the demographic profile and other necessary information was used to match the pre-requisites of the subjects for their inclusion and to obtain necessary information for the purpose of keeping record and data analysis. This helped to obtain a "pure" subject of a respective community fulfilling all pre-requisites. 30 subjects, 10 per aforesaid age-groups ( A, B and C) were studied from each community.

The method used for assessing Cephalic Index was Hrdlicka's method[8]. The head length was measured with spreading callipers from glabella to inion. The head breadth was measured as the maximum transverse diameter between the two fixed points over the parietal bones. All measurements were taken in centimetres and to an accuracy of 0.10. All measurements were taken with the subject sitting on a chair, in a relaxed mood and the head in the anatomical position.

Cephalic index was calculated as bi-parietal diameter/length of cranium X 100. The data was subjected to statistical analysis.

The data of each subject was recorded and then analysed by Microsoft Excel and by a statistical software-SPSS (Statistical Package for Social Sciences). To determine statistical significance of respective communities' data, chi-square test and Kruskal -Wallis test were applied.

**RESULTS AND DISCUSSION:** As described in the methodology, the measurements were taken in to account for 180 subjects of six different communities in the state of Gujarat (30 subjects per community).

TABLE 1: Bi-parietal diameter (head breadth) break-up according to communities and mean values:

| Parameter | Population type | N | Mean (cm) |
|---|---|---|---|
| Bi-parietal diameter (Head Breadth) | Rabari | 30 | 14.64 |
| | Bhil | 30 | 13.67 |
| | Siddi | 30 | 14.72 |
| | Sindhi | 30 | 15.34 |
| | Patel | 30 | 15.01 |
| | Kharwa | 30 | 14.59 |
| | Total | 180 | 14.67 |
| **P < 0.001** | | | |

Out of all the communities studied the mean Bi-parietal diameter was observed to be highest among Sindhi (15.34 cm) and lowest among Bhil (13.67 cm). The mean Bi-parietal diameter of total population was found to be 14.67 cm.

In a study of cephalic index in students of Gujarat by Shah G V et al[9], the commonest Bi-parietal diameter range was observed to be 14.01 to 15 cm. The difference in present and cited study might be due

to the variation in age of study population which is up to 23 years in the study by shah et al and 20 to 50 years in the present study. Moreover in the former, the study population comprises of medical students which would be having a little representation of the tribal communities while the current study is predominantly having tribal population as the study population. The mean bi-parietal diameter in males above 20 years of age was found to be 13.3 cm in tribal communities like Dangis and Ahirwar in the study by Priyanka Singh et al[7] which is lower than our findings. In the present study loosely relevant communities to Ahirwar and Dangis were Rabari and Bhil respectively. In Rabaris the mean value of Bi-parietal diameter was 14.69 cm while in Bhil it was 13.67 cm. The values in present study were higher than those reported by Priyanka et al[7] for the relevant communities. Thus a difference was observed between two geographically different tribal communities of two different studies.

In a similar study on 400 males of Ogoni ethnic group with age group between 25 to 45 years of age by Oladipo et al[10] the mean Bi-parietal diameter was found to be 20.39 cm, which is 5.72 cm higher than our mean result. It differs from the results of our study and the possible reason might be the difference in the ethnicity. The mean head breadth was found to be 15.8 cm in a study carried out on 561 males of 18 to 35 years of age of Albanian Kosova population by Agron Rexhepi et al[4] which is slightly higher than the mean values of Bi-parietal diameter. Intercommunity variation of bi-parietal diameter (head width).The statistical association was found using Kruskal-Wallis test of significance as the gathered data was non-parametric.

Out of all the communities studied the mean Antero-posterior diameter was observed to be highest among Siddi (18.69 cm) and lowest among Bhil (17.96 cm). The mean Antero-posterior diameter of total population was found to be 18.39 cm.

In a study of cephalic index in students of Gujarat by Shah G V et al[9], the commonest Antero-posterior diameter range was observed to be 18.01 to 19.0 cm. The difference observed between present and above cited study can be age related factor, the maximum age observed was 50 and 23 respectively, in both the studies. Again, in cited study the medical students belong to the study population who have a little representation of tribal community whereas the current study contains predominantly tribal population.

TABLE 2: Antero-posterior diameter (head length) break-up according to communities and mean values:

| Parameter | Population type | N | Mean rank (cm) |
|---|---|---|---|
| Antero-posterior diameter ( head length ) | Rabari | 30 | 18.22 |
| | Bhil | 30 | 17.96 |
| | Siddi | 30 | 18.69 |
| | Sindhi | 30 | 18.56 |
| | Patel | 30 | 18.56 |
| | Kharwa | 30 | 18.35 |
| | **Total** | **180** | **18.39** |
| **P < 0.001** | | | |

The mean Antero-posterior diameter in males above 20 years of age was found to be 18.7 cm & 18.2 cm respectively, in tribal communities like Dangis and Ahirwar in the study by Priyanka Singh et al[7] which almost corroborates with our findings. In the present study, loosely relevant communities to Ahirwar and Dangis were Rabari and Bhil respectively. In Rabaris the mean value of Antero-posterior diameter was 18.23 cm while in Bhil it was 17.96 cm. Thus a very slight difference was observed between two geographically different tribal communities of two different studies.

In a similar study on 400 males of Ogoni ethnic group with age group between 25 to 45 years of age by Oladipo et al[10], the mean Antero-posterior diameter was found to be 18.55 cm, which is slightly higher than our results. The possible reason for the difference might be due to the difference in the ethnicity.

The mean head length (antero-posterior diameter) was found to be 18.87 cm in a study carried out on

561 males of 18 to 35 years of age of Albanian Kosova population by Agron Rexhepi et al[4] which is higher than the mean values of Antero-posterior diameter.Inter-community variation of Antero-posterior diameter (head length) in the study population was statistically highly significant with chi-square value of 22.612 at df 6, p value being < 0.001.

TABLE 3*:* Cephalic index breakup according to communities and mean values:

| **Parameter** | **Population type** | **N** | **Mean rank (cm)** |
|---|---|---|---|
| Cephalic index | Rabari | 30 | 80.83 |
| | Bhil | 30 | 77.85 |
| | Siddi | 30 | 78.79 |
| | Sindhi | 30 | 82.82 |
| | Patel | 30 | 81.03 |
| | Kharwa | 30 | 79.85 |
| | **Total** | **180** | **80.20** |
| **P < 0.01** | | | |

Out of all the communities studied the Cephalic Index was observed to be highest among Sindhi (82.82 cm) and lowest among Bhil (77.85 cm). The mean Cephalic index of total population was found to be 80.20 cm.

In the present study, Intercommunity variation of cephalic index in the study population was statistically significant with chi-square value of 21.238 at df 6, p value being < 0.01. (The statistical association was found using Kurskal-Wallis test of significance as the gathered data was non-parametric.)

Comparison of mean cephalic index observed in various studies in different races across the world is as follows:

| Country/people | Research Workers | Cephalic Index (cm) |
|---|---|---|
| Kvangaja race | Basu ( 1963)[11] | 79.50 |
| Bhils race | Bhargav and Kher ( 1960)[12] | 76.98 |
| Barelias | Bhargav and Kher ( 1961)[13] | 80.81 |
| Gujarat | Shah et al ( 2004 )[9] | 80.98 |
| Ijaw males | Oladipo and Olotu ( 2006)[14] | 79.04 |
| Igbo males | Oladipo and Olotu ( 2006)[14] | 86.50 |
| Urhobo males | Oladipo and Paul ( 2009)[15] | 94.41 |
| Itsekiri males | Oladipo and Paul ( 2009 )[15] | 111.18 |
| Ogoni males | Oladipo, Olotu & Suleiman ( 2009)[10] | 80.20 |
| Present study | (2009-2010) | |

The value of mean cephalic index in the present study is close to the observations made by Shah et al in 2004 in Gujarat, by Bhargav and Kher in 1961 in Barelias and by Oladipo and Olotu in 2006 in Ijaw males. Farthest of the values of mean cephalic index in comparison to the present study are observed in Ogoni males and Itsekiri males (higher values) as well as in Bhils race (lowest value).

**STUDY LIMITATION:** As certain castes of study population belonged to tribal community and were reluctant in allowing female subjects, only male subjects were included.

**CONCLUSION:** The value of mean cephalic index in the present study (80.20) is close to the observations made by Shah et al in 2004 in Gujarat, by Bhargav and Kher in 1961 in Barelias and by Oladipo and Olotu in 2006 in Ijaw males. Particularly, the data observed of Siddi community (which is inhabitant for last several generations at Sirvan village, Gir-forest, Dist. Junagadh , State: Gujarat is considered to be descendant of African Negros brought in India as slaves ) can be correlated with the data of at present African Negros and the difference if any, can be of value in understanding geographical influence in altering head dimensions.

**REFERENCES:**

1. Eickstedt, E.V. The races and types of the western Himalayas. Man in India, 1926; 6: 237.

2. Rakshit, H. K: A perspective for anthropometric work in India. In: Proceeding volume of summer school in Anthropology, Dalhausie,1964.
3. Imami-Mibodi MA, Mastri-Farahani R. study of normal range of anatomical dimensions of one day old newborn by cephalometry. J Med council Islam Republic Iran, 1996, 14:1-8.
4. Agron Rexhepi and Vjollca Meka. Cephalofacial morphological characteristics of Albanian Kosova population. International journal of morphology, 2008, 26(4):935-940
5. Rogers, B. O. The role of physical anthropology in plastic surgery today. Clinical plastic surgery, 1974, 1 : 439.
6. Muzj, E. Oro-facial Anthropometrics Index publishers Co-operation Hempstead, New York,1970.
7. Priyanka singh, rama purkit. A cephalometric study among sub caste groups Dangi and Ahirwar of Khurai block of Madhya Pradesh. Anthropologist,2006, 8(3): 215-217.
8. Hrdlika Practical Anthropometry. 4th edition, Philadelphia. The Wistar institute of Anatomy and Biology, 1952: 87-89.
9. Shah GV, Jadav HR. The study of cephalic index in students of Gujarat. Journal of anatomical society of India,2004, 53(1): 25-26.
10. G.S.Oladipo, J.E.Olotu and Y.Suleiman. Anthropometric studies of Cephalic Indices of the Ogonis in Nigeria. Asian journal of medical sciences, 2009 1 (2): 15-17.
11. Basu A. Anthropometry of the kayasthas of Bengal. Journal of anatomical society of India, 1963, 3:20-25.
12. Bhargav T. and G.A.Kher. An Anthropometry study of central India, Bhil of Dhar district of Madhya Pradesh. Journal of anatomical society of India, 1960, 9:14-19.
13. Bhargav T. and G.A.Kher. A comparative anthropometric study of Bhils and Barelas of central India. Journal of anatomical society of India, 1961, 10:23-26.
14. Oladipo, G.S. and E.J.Olotu. Anthropometric comparison of cephalic indices between the ijaw and igbo tribes. Global J. Pure appl. Sci.,2006, 12(1):137-138.
15. Oladipo, G.S. and C.W. Paul. Anthropometric comparison of cephalic indices between the urhobo and itsekiri ethnic group of Nigeria. Global J. Pure appl. Sci.,2009, 15(1):65-67.