Section: Anatomy

Original Research Article

# CRANIAL INDEX AND ANATOMICAL VARIATIONS OF PARANASAL AIR SINUSES IN CHRONIC SINUSITIS PATIENTS OF RAICHUR DISTRICT KARNATAKA: AN ANTHROPOMETRIC STUDY

***Ravivarma Vadegar[1], Sandhya Papabathini[2], Ravi Shankar G[3], Naveen N S[4]***

*[1]Assistant Professor, Department of Anatomy, Raichur Institute of Medical Sciences, (RIMS), Hyderabad road, Raichur, Karnataka, India*
*[2]Assistant Professor, Department of Microbiology, Navodaya Medical College, Raichur, Karnataka, India*
*[3]Associate Professor, Department of Anatomy, Raichur Institute of Medical Sciences, (RIMS), Hyderabad road, Raichur, Karnataka, India*
*[4]Professor and HOD, Department of Anatomy, Raichur Institute of Medical Sciences, (RIMS), Hyderabad road, Raichur, Karnataka, India*

***Received*** *: 05/01/2026*
***Received in revised form*** *: 22/02/2026*
***Accepted*** *: 11/03/2026*

**Corresponding Author:**
**Dr. Ravivarma Vadegar,**
Assistant Professor, Department of Anatomy, Raichur Institute of Medical Sciences, (RIMS), Hyderabad road, Raichur, Karnataka, India.
Email: ravivarma_uv@yahoo.com

**DOI:** 10.70034/ijmedph.2026.1.593

**Source of Support:** Nil,
**Conflict of Interest:** None declared

**Int J Med Pub Health**
2026; 16 (1); 3465-3469

ABSTRACT

**Background:** All human beings on the earth belongs to the same species i.e., Homo sapiens (Homo-human and sapiens-wise). No two individuals are exactly alike in their characteristics and body measurement, even in case of identical twins, they differ in some aspects. Anthropometric studies are scientific methods and techniques for displaying different measurement and observation on the human being as well as skeleton. These characteristics tend to undergo changes in various aspects. Hence anthropometry is the study of quantitatively measuring this kind of characteristics. Anthropometry is a Greek word which means a measurement of man: Anthropos-man and metron-refers to the measurement. Nowadays sinusitis is one of the major health problem, both incidence and prevalence of sinusitis is increasing. Moreover, chronic sinusitis is also defined as a group of disorders characterized by inflammation of the mucosa of nose and paranasal sinuses lasting for at least 12 weeks. With this background the present study is undertaken. The aim of the present study is to know is there any relation between cranial measurement and chronic sinusitis calculating the cranial index.

**Materials and Methods:** It is an observational descriptive type study done in Anatomy department, RIMS, Raichur which was performed on110 individuals above 18 years of chronic sinusitis patients. Patients are taken to the radio-diagnosis for Computerized tomography (CT) evaluation to measure the cranial, index and for anatomical variations. Cranial index is Head width is the distance between the two euryons and head length is the distance from glabella to opistho cranion.

**Results:** Cranial index were calculated according to the formula and the results obtained were analyzed statistically. In present study, out of 110 cases, males were 59 & females were 51 cases. maximum number of cases (27) were in age group of 21-30yrs. Mean cephalic index is 80.7 and 80.5 in males and females respectively. Mean cranial index in males is 92.5 and in females 91.9. The dominant type of cephalic shape shown in our study is Mesocephalic.

**Conclusion:** The present study conducted was concludes that facial index and cranial index are showing statistically significant value in chronic sinusitis patients. The study is confined in chronic sinusitis patients. Results and observations of our study can be useful for comparable cephalo-metrical studies in several geographic areas.

**Keywords:** Cranial index, Chronic sinusitis, Computerized tomography.

## INTRODUCTION

On the earth every human belonged to the identical species that are homo-sapiens (Homo=human and sapiens-wise). 2 persons were accurately not identical in characters and figure dimension, even though in homozygous twins, there were vary in few aspects.

These features may undergo various changes in many characteristics. Therefore, anthropometry is defined as study of measuring characteristics quantitatively. Anthropometry is a 'Greek word' means a measurement of human: "Anthropos-man and metron-refers to the measurement".[1]

Anthropologists scientifically investigate how people and communities are retaining their identification on the basis of socio- cultural on one hand and biologically on other hand, and how they are acquiring characters of others may be because interbreeding or change in cultures are main objectives for anthropologists.

Anthropologists differentiate people mainly on the basis of living, common origin, or lived in some defined areas and having unlike characteristic features. Everyone must remember there were no strong demarcations among the race.

Anthropometry was developed in 1654 by a German Anatomist, J Sigismund Elsho at the University of Padua.[3,4] Anthropometric measurements have direct association with gender, form and shape of an individual also these factors are closely related with each other.

There are variations in inter-geographical and inter-racial in measurements and it should be correlate with stature. In India only few references and studies are existing on cranial parameters. "What may be true for one race or one region may not be true for other".[5-9]

Studies related to anthropometric plays a vital role in differentiating a pure race from local races.[10] Studies related to the facial anthropometry have better implication in public health related areas.[11,12] Comparative racial anthropometrical science described consistent variations in proportions of body in different human races.[13] In each race various gene pools and genetical variations are exist in sub groups in the form of peculiarities, behaviour and characteristics.[14]

Present days sinusitis is one of the most important health problems, both incidence and prevalence of sinusitis is increasing.

Sinusitis is a clinical condition that is manifested by inflammation of the mucous membrane of nose and paranasal air sinuses. Furthermore, Chronic paranasal sinusitis is defined as a group of conditions characterized by the inflammation of the mucus membrane of nose and paranasal air sinuses at least for twelve weeks.

Compared to plain radiography, sinus CT is best to know about the anatomy of soft tissue, bony details, diagnosis and also provides the complete Sino-nasal anatomy.

With this back ground the present study is undertaken to know whether there is any relation between craniofacial measurement and chronic sinusitis.

The aim of the present study is Study of Anatomical variations of paranasal sinuses and correlation with cranial index in Chronic sinusitis patients of Raichur district, Karnataka.

**Aims and Objectives**

- Study of Cranial index in patients suffering with Chronic sinusitis.
- Study of Anatomical variations of paranasal sinuses in patients suffering with Chronic sinusitis.
- Correlation of Cranial index with Anatomical changes of paranasal sinuses in patients suffering with Chronic sinusitis.

## MATERIALS AND METHODS

**Study setting:** Raichur Institute of Medical Sciences, Raichur

**Study type:** Observational-descriptive type of study.

**Data Source:** For the present study, the patients suffering with chronic sinusitis patients attending the department of Otolaryngology, Government teaching hospital, Raichur.

**Criteria for inclusion in the study**

- Patients who are suffering with chronic sinusitis.
- Patients more than seventeen years age suffering with chronic sinusitis.

**Criteria for exclusion from the study**

- Acute sinusitis patients.
- Sinus- malignancies patients.
- Those who are not willing.
- Less than 17 years age.
- Pregnant ladies.
- Cranio-facial anomaly patients.
- Facial and head trauma Patients.

**Data Collection Procedure:** Before beginning of the study. the Ethical approval is obtained from Institutional ethical committee of RIMS (Raichur Institute of Medical Sciences), Raichur. Before beginning of the study, signed or thumb impression on informed-consent from was obtained from each patient.

**Sample collection**

- The present study of total 110 subject, with the indication, signs of the prolonged sinusitis and history had gathered.
- After the above procedure participants were taken over to CT for diagnosing and also to measure the cranial index.

## RESULTS

This study has conducted on a total of 110 patients clinically diagnosed with chronic sinusitis attended to the ENT department, Raichur Institute of medical sciences, Raichur

**Study groups:** The study group consist of chronic sinusitis patients attended to the ENT department, Raichur Institute of medical sciences, Raichur.

**Age distribution in the study group**

[Table 1] depicts age distribution in the study group maximum number of cases were in age group of 21-30yrs. Least number of cases was found in the age groups of >18 - 20 yrs.

**Sex distribution in the study group**

[Table 2] illustrates sex distribution in the study group. Out of 110 cases, males 59 & females 51

**Types of Head shape out of 110 cases (Martin and Saller classification of cephalic index)**

[Table 3] explains total types of head shapes among 110 cases with cranial index in chronic sinusitis patients. Majority of head shapes mesocephalic (average shape), observed in 41(37.3%) cases with cephalic index 75-79.9 and least type of head shapes is found in Hyperdolichocephalic (very long narrow head) with cephalic index 65-69.9 that are 03(2.7%). Also follows by brachycephalic (broad & short shape) with 30(27.2%) of cephalic index 80-84.9, Hyperbrachycephalic (very broad & short) by 22(20%) with cephalic index 85-89.9, Dolicephalic (long & narrow) 70-74.9 cephalic index of 10(9.1%) and Ultrabrachycephalic with 90.0>90 of 04(3.7%) cases.

**Correlation of Cranial Index between male and female**

[Table 4] describes Correlation of Cranial Index between male and female. Correlation Coefficient value is r=-0.002 and P value is P=0.991 which is statistically insignificant and no correlation of Cranial Index between male and female.

**Anatomical Variations out of 110 cases**

[Table 5] illustrates anatomical Variations out of 110 cases with cranial index in chronic sinusitis patients. Maximum cases observes in deviated nasal septum of 83 (75.4%) cases, S- shaped deviated nasal septum in 14(12.7%) cases, Deviated nasal septum with spur in 6(5.5%) cases, Hypoplasis of frontal sinus deviated nasal septum and Hypoplasia of Maxillary sinus with Deviated nasal septum distributes 3(2.7%) cases, only one observed with Enlarged Maxillary sinus.

**Multiple comparison of Types of head shape and Cranial Index**

[Table 6] depicts multiple comparison of types of head shape and cranial Index. When compared to the particular head shape with the cranial index of other head shapes it was found statistically significant.

**Table 1: Age distribution in the study group**

| Age group (Years) | No. of cases (%) |
|---|---|
| >18 – 20 | 05 (4.5%) |
| 21-30 | 44 (40%) |
| 31-40 | 27 (24.5%) |
| 41-50 | 18 (16.5%) |
| >50 | 16 (14.5%) |
| Total | 110 (100%) |

**Table 2: Sex distribution in the study group**

| Sex | Study group (%) |
|---|---|
| Male | 59 (53.6%) |
| Female | 51 (43.7%) |
| Total | 110 (100%) |

**Table 3: Types of Head shape out of 110 cases (Martin and Saller classification of cephalic index)**

| Types of Head Shape | Cephalic index | No. of cases (%) |
|---|---|---|
| Hyperdolichocephalic (very long narrow head) | 65.5-69.9 | 03(2.7%) |
| Dolicephalic (long & narrow) | 70-74.9 | 10(9.1%) |
| Mesocephalic (average shape) | 75-79.9 | 41(37.3%) |
| Brachycephalic (broad & short shape) | 80-84.9 | 30(27.2%) |
| Hyperbrachycephalic (very broad & short) | 85-89.9 | 22(20%) |
| Ultrabrachycephalic | 90.0>90 | 04(3.7%) |

**Table 4: Correlation of Cranial Index between male and female**

| Correlation of CI between Facial Index between male and female | Correlation Coefficient | Significant value | Remark |
|---|---|---|---|
| Male and Female | r=-0.002 | P=0.991 | No correlation and statistically insignificant |

**Table 5: Anatomical Variations out of 110 cases**

| Type of Anatomical variation | No. of cases (%) |
|---|---|
| Deviated nasal septum | 83(75.4%) |
| S- shaped deviated nasal septum | 14(12.7%) |
| Hypoplasis of frontal sinus deviated nasal septum | 3(2.7%) |
| Hypoplasia of Maxillary sinus with Deviated nasal septum | 3(2.7%) |
| Deviated nasal septum with spur | 6(5.5%) |
| Enlarged Maxillary sinus | 1(1%) |

**Table 6: Multiple comparison of Types of head shape and Cranial Index**

| Post hoc test | | Significant value | Remark |
|---|---|---|---|
| Hyperdolichocephalic | Brachycephalic | 0.0001 | SIGNIFICANT |
| | Dolicephalic | 0.155 | NS |
| | Hyperbrachycephalic | 0.0001 | SIGNIFICANT |
| | Mesocephalic | 0.0001 | SIGNIFICANT |
| | Ultrabrachycephalic | 0.0001 | SIGNIFICANT |
| Brachycephalic | Hyperdolichocephalic | 0.0001 | SIGNIFICANT |
| | Dolicephalic | 0.0001 | SIGNIFICANT |
| | Hyperbrachycephalic | 0.0001 | SIGNIFICANT |
| | Mesocephalic | 0.0001 | SIGNIFICANT |
| | Ultrabrachycephalic | 0.0001 | SIGNIFICANT |
| Dolicephalic | Hyperdolichocephalic | 0.155 | NS |
| | Brachycephalic | 0.0001 | SIGNIFICANT |
| | Hyperbrachycephalic | 0.0001 | SIGNIFICANT |
| | Mesocephalic | 0.0001 | SIGNIFICANT |
| | Ultrabrachycephalic | 0.0001 | SIGNIFICANT |
| Hyperbrachycephalic | Hyperdolichocephalic | 0.0001 | SIGNIFICANT |
| | Brachycephalic | 0.0001 | SIGNIFICANT |
| | Dolicephalic | 0.0001 | SIGNIFICANT |
| | Mesocephalic | 0.0001 | SIGNIFICANT |
| | Ultrabrachycephalic | 0.0001 | SIGNIFICANT |
| Mesocephalic | Hyperdolichocephalic | 0.0001 | SIGNIFICANT |
| | Brachycephalic | 0.0001 | SIGNIFICANT |
| | Dolicephalic | 0.0001 | SIGNIFICANT |
| | Hyperbrachycephalic | 0.0001 | SIGNIFICANT |
| Ultrabrachycephalic | Hyperdolichocephalic | 0.0001 | SIGNIFICANT |
| | Brachycephalic | 0.0001 | SIGNIFICANT |
| | Dolicephalic | 0.0001 | SIGNIFICANT |
| | Hyperbrachycephalic | 0.0001 | SIGNIFICANT |
| | Mesocephalic | 0.0001 | SIGNIFICANT |
| NS:Not significant | | | |

**Table 7: Comparison of Mean Cephalic Index**

| Study population | Authors | Mean Cephalic index (Male/Female) |
|---|---|---|
| Gujarati and Non-Gujarati | Twisha Shah11 | Gujarati 77.14/77.38<br>Non-Gujarati 70.61/81.17 |
| Central Indian people Indore region | Nandini Bansod Kamble and Dinesh Kamble12 | 70.63/68.72 |
| South Kerala | Ranga and Mallika13 | 77.1/78.4 |
| Present Study | Ravivarma V | 80.7/80.5 |

## DISCUSSION

Anthropometric parameters have always been of major interest to anatomists, anthropologists, and biologists because they provide standards and make the distinction between two ethnic groups

The present study employed anthropometric/ craniofacial measures which are widely used to describe and classify the face and head form according to Martin and Saller.

Cephalic index of 110 adult patients were evaluated.

In the present study the individual of head form groups were studied to find possible association of the chronic sinusitis with the craniofacial pattern.

In the present study it is found that cranial index is showing significant value in chronic sinusitis.

Comparison of Mean Cephalic Index

In our study Mean Cephalic Index was 80.7 & 80.5 in males and females respectively. Twisha Shah11 observed 77.14 in males & 77.38 in females of Gujarati's similarly 70.61 & 81.17 respectively in males and females of Non-Gujarati's. Nandini Bansod Kamble and Dinesh Kamble12 found 70.63 & 68.72 respectively in males and females in Central Indian people Indore region. Mean Cephalic Index in South Kerala region was 77.1 & 78.4 respectively in males and females study done by Ranga and Mallika [Table 7].[13]

**Various types of head shapes**

The dominant type of cephalic shape shown in our study population is Mesocephalic (average shape) of 37.3%, whereas cranial index shown by Twisha Shah,[11] in Gujarat was Mesocephalic type i.e. 40.7% among Gujarati's and non-Gujarati's of same study was dolicephalic type (62.3%).

In another study 87% of dolicephalic type was observed by Nandini Bansod Kamble and Dinesh Kamble,[12] in Central Indian people, Indore region. In our study dolicephalic type is 9.1% shown.

In our study, brachycephalic type is 27.2%, in another conducted by Ranga and Mallika,[13] in South kerala observed 43.6% brachycephalic type.

**Different types of cephalic type in Males and Females**

Amongst males and Females in our study depicts the percentages of 16.3 & 23 of mesocephalic type was dominant, in other study of non-Gujaratis observed 80% of dolecephalic type amongst males & 30% of brachycephalic type found in females, in same study among male Gujaratis was mesocephalic type with

40.2%, and in females dolecephalic type with 42.2%, another study conducted in central India, Indore region revealed dominant cephalic type is 87% of dolicephalic type in both males and females.

**Various Anatomical Variations**

The prevalence of nasal septum deviation varies from 18 to 80 % according to various studies. Deviation of nasal septum was found 65 % by Bharathi et al,[17] 55.7 % by Bolger et al,[18] 44 % by Dua et al.[19] In our study we found the prevalence of nasal septum deviation is 88% and it was found 88.2% study conduceted by Rashi Tiwari and Rashmi Goyal.[20]

3% of study population showed maxillary sinus hypoplasia. Study conducted by Devareddy, et al,[21] showed maxillary sinus hypoplasia 3% and 5% by Vettrivizhi Sampath Arutperumselvi et al.[22]

**Limitations of the study**

- The study is confined in chronic sinusitis patients with limited sample size.
- Future studies are recommended for better exploration of this field in different population groups
- Studies with larger sample size could throw better light on the exact prevalence.

**Future prospective**

- It clearly indicates that there is research vacuum, so it demands more studies.
- The observations and results of this study may provide platform for similar extended cephalometric studies based on various geographical zones.
- It is hoped that this study will be a steppingstone for further cranial analysis on the population using other classical formulas & standards.
- This knowledge of the anthropological data of the population may be helpful for further studies.

## CONCLUSION

In the present study the dominant cephalic shape is Mesocephalic and it is dominant shape in both males and females.

In the present study, cranial index is showing significant value in chronic sinusitis patients.

The data obtained in our study may be useful in anthropological research, forensics, genetic research, as well as in clinical and dental practice (reconstructive surgery).

## REFERENCES


1. Jahanshahi M, Golalipour M J and Heidari K. "The effect of ethnicity on facial anthropometry in Northern Iran," Singapore Med J 2008; 49 (11): 940-43.
2. Ngeow W, Aljunid S. Craniofacial anthropometric norms of Malaysian Indians. Indian J. Dent. Res. 2009;20(3):313.
3. Hassanzadeh G, Sadr M, Alaghbandha N, Dehbashipour A, Abbas MA , Heydar Zeidi O. Anthropometric characteristics of craniums in residents of Qazvin, Iran and Dera Ghazi Khan, Pakistan: A comparative study. Anat. Sci. J. 2013;10(1):43-49.
4. Azizi M, Hassanzadeh G, Barbarestani M, et al. Comparative Anthropometric Analysis of Facial Dimensions and Types in Qazvin, Iran and DeraGhazi Khan, Pakistan. Anat. Sci. J. 2014;11(3):119- 126.
5. Abu A, Ngo CG, Abu-Hassan NIA , Othman SA. Automated craniofacial landmarks detection on 3D image using geometry characteristics information. BMC Bioinformatics. 2019;19(13):548.
6. Remya KJ, Mathangi K, Mathangi DC, et al. Predictive value of craniofacial and anthropometric measures in obstructive sleep apnea (OSA). Cranio. 2017;35(3):162-167.
7. Perri RA, Kairaitis K, Wheatley JR , Amis TC. Anthropometric and craniofacial sexual dimorphism in obstructive sleep apnea patients: is there male-female phenotypical convergence? J. Sleep Res. 2015;24(1):82-91.
8. Osunwoke EA, Amah-Tariah FS, Obia O, Ekere IM, Ede O. Sexual dimorphism in facial dimensions of the Bini's of South-Southern Nigeria. Asian J Med Sci 2011;3(2):71-3.
9. Navaei F, Ghaffari N, Mojaverrostami S, Dodongeh M, Nemati M , Hassanzadeh G. Stature estimation from facial measurements in medical students of Tehran university of Medical Sciences: an Iranian population. Iraq. Med. J. 2018;2(3):68-71.
10. Otolaryngologic Clinics of North America : chronic sinusitis ; vol.38 December 2005 issue. page no.: 1144-1145.
11. Twisha Shah, Manish B Thaker, Shobhana K Menon (2015) Assessment of Cephalic and Facial Indices: A proof for Ethnic and Sexual Dimorphism. J Forensic Sci Criminol 3(1): 101. doi: 10.15744/2348- 9804.2.401.
12. Nandini Bansod Kamble and Dinesh Kamble. Anthropometric Study of Cephalic and Facial Indices among Central Indian Population. Indian Internet Journal of Forensic Medicine & Toxicology. 2020;18(1):12-18.
13. Ranga MKS, Mallika MCV. Cephalic index and facial index of adults in rural South Kerala, India. Int J Sci Stud 2020;8(9):41-45.
14. SHETTI, R. V.; PAI, S. R.; SNEHA, G. K.; GUPTA, C.; CHETHAN, P. & SOUMYA. Study of prosopic (facial) index of Indian and Malaysian students. Int. J. Morphol., 29(3):1018-1021, 2011.
15. Palagiri Lakshmi Prasanna, Peddengatagiri Suresh, K Srinivasan, Anthropometric Study of The Facial (Prosopic) Indices: A Proof for Gender Dimorphism. J Dent Educ. 2020;13(2):53–59.
16. Kumar M, Muzzafar Lone M. The study of facial index among Haryanvi adults. International Journal of Science Research. 2013;2(9): 51–3.
17. Bharathi MB, Mamtha H, Prasanna LC (2010) Variations of ostiomeatal complex and its applied anatomy: a CT scan study. Indian J Sci Technol 3(8):904–907
18. Bolger WE, Butzin CA, Parson DS (1991) Paranasal sinus bony anatomic variations and mucosal abnormalities; CT analysis for endoscopic sinus surgery. Laryngoscope 101:56–64
19. Dua K, Chopra H, Khurana A, Munjal M (2005) CT scan variations in chronic sinusitis. Indian J Radiol Imaging 15(3):315–320
20. Rashi Tiwari, Rashmi Goyal. Study of Anatomical Variations on CT in Chronic Sinusitis. Indian J Otolaryngol Head Neck Surg (Jan–Mar 2015) 67(1):18–20; DOI 10.1007/s12070-014-0734-2
21. Devareddy, Mallikarjun, Devakar, Shilpa. Evaluation of Anatomical Variations in Nose and Paranasal Sinuses by using Multidetector Computed Tomography. International Journal of Contemporary Medicine, Surgery and Radiology, 2019; 4. 10.21276/ijcmsr.2019.4.3.32.
22. Vettrivizhi Sampath Arutperumselvi, Anbalagan Malaisamy, Karthik Krishna Ramakrishnan, Sneha Yarlagadda, Praveen K. Sharma, Arunthathy Thangarajah, Seena Cheppala Rajan. A review of common anatomical variants of paranasal sinuses and nasal cavity and its frequency of occurrence as evidenced on multi-detector computed tomography. IAIM, 2022; 9(1): 8-21.