e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(11); 195-197

Original Research Article

Assessment of the Skull's Sexual Dimorphism Indicators: An Accelerated Research

Harsh Kumar Chawre[1], Vishal Bhadkaria[2], Rajeev Vijay Joshi[3], Ashok Najan[4]

[1]Associate Professor, Dept. of Anatomy Government Medical College, Datia.
[2]Associate Professor, Dept. of Anatomy, Bundelkhand Medical College, Sagar
[3]Assistant Professor, Dept. of Anatomy, NSCGMC, Khandwa
[4]Associate Professor, Dept. of Forensic Medicine and Toxicology, NSCGMC, Khandwa

Received: 16-08-2023 / Revised: 28-09-2023 / Accepted: 29-10-2023
Corresponding Author: Dr. Ashok Najan
Conflict of interest: Nil

Abstract

Introduction and Objective: Since the skull is resistant to fire, mutilation, and decay, it is the ideal bone for determining the gender of the deceased. In order to determine the reliability of these indices for sexual dimorphism of the skull, the study will examine the usage of the Cranial Index, Nasal Index, and Orbital Index.

Materials and Method: The study material consisted of 100 adult skulls of known sex available in the Anatomy department, GMC, Datia (M.P.) from August 2022 to January 2023 (6 months) which includes 60 males and 40 females. After positioning the skull on Frankfurt's horizontal plane, measurements were collected. A scale, marker, spreading calliper, and Vernier calliper were the tools utilized for the measurement. Two measurements were made at separate sittings, and the average was calculated.

Results: Male and female participants' skulls had mean CIs of 74.22 and 76.12, respectively, and NIs of 48.64 and 55.42. The average OI for male and female skulls was 85.66 and 85.58, respectively. This method only allowed the nasal index to identify 32.16% of male and 5.12% of female skulls, while the cranial index could only identify 5% of male and 20.38% of female skulls. It was discovered that the nose index and the cranial index were both statistically significant ($p<0.05$). For males and women, respectively, the CI's demarking points were 62.34 and 86.14. The DP for NI for men was 36.18, and the DP for women was 67.38. Because the skulls of the male and female share a large percentage of overlap, DP for OI could not be determined.

Conclusion: Because so few skulls could be recognized, none of the three indices—CI, NI, or OI—promised in isolation for sex identification. The study comes to the conclusion that, in cases of sexual dimorphism of the skull, the validity of these three cranial indices is questionable.

Keywords: Cranial Index, Nasal Index, Orbital Index, Sexual dimorphism.

Introduction

The morphology of the skeletal remains is highly valued by anthropologists, forensic experts, and anatomists for sex identification. The skull is one of the most popular bones for identification and sexual dimorphism because of its resilience to fire, explosions, mutilations, and decomposition. Ninety percent of the time, one can tell someone's sex just by glancing at their head. [1] Anthropometry is needed in a few inevitable and inadvertent circumstances in order to ascertain an individual's sex. These include deliberate disfigurement, beatings, gauging, and intentional body mutilation. They also involve car and train accidents, as well as combat. [2] The sexual dimorphism of skulls has been measured in the past using a variety of metrical factors and indices. Claims have been made that the cranial index (CI), nasal index (NI), and orbital index (OI), which are commonly used to identify sexual dimorphism of the skull, may determine the sex of a significant portion of skulls. [3, 5, 6], Previous studies have revealed notable differences in these indices due to ethnic and cultural differences, genetic and environmental effects, different evaluation methods, and sample sizes. A thorough understanding of these indices is essential for their appropriate implementation. The purpose of this study was to assess how well these indices identified sex differences in skulls.

Material and Methods

The study material consisted of 100 adult skulls of known sex available in the Anatomy department, GMC, Datia (M.P.) from August 2022 to January 2023 (6 months) which includes 60 males and 40 females. After positioning the skull on Frankfurt's horizontal plane, measurements were collected. A scale, marker, spreading caliper, and Vernier caliper were the tools utilized for the measurement. Two

measurements were made at separate sittings, and the average was calculated.

Methodology

Following parameters were measured in all the skulls:

1. Maximum cranial length- from glabella to the most posterior point in the mid-sagittal plane on
1. occipital bone (opisthocranium).
2. Maximum cranial breadth- the greatest horizontal diameter of the cranium taken at the point above.
3. supramastoid crest perpendicular to median sagittal plane.
4. Cranial Index- Calculated as Maximum cranial breadth X 100/Maximum cranial length.[4,5]
5. Nasal height- from nasion to the lowest tip of the nasal spine on the lower border of nasal aperture.
6. Nasal breadth- maximum breadth of nasal aperture.
7. Nasal Index- Calculated as Nasal breadth X100/Nasal height[6].
8. Orbital Breadth (OB)-from the dacryon (d) to the ectoconchionec (ec)
9. Orbital Height (OH)- the maximum vertical distance between the superior and inferior orbital margins
10. Orbital Index (OI)- Calculated as Orbital Height X 100/Orbital Breadth.[7]

Statistical Analysis

The measurements were reported in millimetres and tallied. The mean, standard deviation, and range of each skull's three indices—CI, NI, and OI—as well as their descriptive statistics were determined for each sex. The Student t-test was used to determine the significance of the mean differences between the male and female indices. A 95% confidence interval was employed and the differences were considered significant at $P< 0.05$. The percentage of crania accurately categorized as male or female was calculated by taking the mean ±3S.D. for each of the three markers. This allowed for the calculation of five demarketing points.

Results

Table 1: Identification of various indices in male and female skulls using descriptive statistics

	Variables	Cranial Index (CI)	Nasal Index (NI)	Orbital Index (OI)
Males	Range	65.44-78.38	41.18-62.30	71.50-102.98
	Mean	74.22	48.64	85.66
	SD	4.87	5.14	8.10
	Identification Point	<66.41	<48.79	<71.56
	% identified	5.00	32.16	1.24
Females	Range	66.26-88.24	48.22-78.24	72.19-113.56
	Mean	76.12	55.42	85.58
	SD	4.19	6.38	5.25
	Identification Point	>78.75	>60.88	>102.18
	% identified	20.58	5.34	2.21
p-value		0.01*	0.01*	0.04

According to Table 1, in the current investigation, the mean CI in the skulls of male and female subjects was respectively 74.22 and 76.12, while their NI was 48.64 and 55.42. The mean OI in male skulls was 85.66, whereas in female skulls it was 85.58. The nasal index could only identify 32.16% male and 5.34% female skulls using this method, whereas the cranial index could only identify 5% male and 20.58% female skulls. Both cranial index and nasal index were found to be statistically significant. ($p<0.05$)

Table 2: Various Indices' calculated range and demarking points in male and female skulls

Sno.	Index	Gender	Mean ±3SD	Demarking points	% Identified
1	Cranial Index	Male	60.20-86.14	<62.34	0.00
		Female	60.20-88.46	>86.14	0.00
2	Nasal Index	Male	33.58-66.78	<36.48	0.00
		Female	36.90-75.80	>67.38	0.00
3	Orbital Index	Male	62.20-110.18	<71.30	5.24
		Female	70.14-105.14	-	0.00

According to table 2, the demarking point for the CI was 62.34 for men and 86.14 for women. Males' DP for NI was 36.48, while females' DP was 67.38. Due to a significant amount of skull overlap between male and female, DP for OI could not be determined. The percentage of skulls found by DP was then

determined and it was 5.24 percent of male skulls which could be recognized using DP of OI. From DPs of other indices, it was impossible to determine the gender of the skull.

Discussion

The human cranium is thought to be the best sex indication, second only to the pelvic bones. [4] Craniometry, which measures the skull scientifically, is helpful in forensics and anthropometry. [5] A variety of cephalic indices provide a framework for metric recording of cranial feature sizes and proportions and are widely used to measure race and gender differences. Six The cranial vault breadth divided by the glabellomaximal length and multiplied by 100 is the formula for the skull index. The CI, a critical property that determines how close or far apart the orbits appear to be as they are examined by various studies, is influenced by the shape of the skull. [7,8] The mean CI in the current study was 74.32 for male skulls and 76.56 for female skulls, with a statistically significant difference between the two. These findings confirm earlier findings that the CI was considerably higher in the female crania compared to the male crania. [4]

The largest nasal aperture width divided by the height of the nasal skeleton, multiplied by 100. [9], is the nasal index. Due to its sexual dimorphism, it has proven a useful tool in forensic science. [10,11] Various studies have been conducted in the past on nasal aperture measurements and nasal index to determine sex and in distinguishing racial and ethnic differences.[12] Few similar studies done in comparison of means of cranial index of males and females skulls, A study done by Vidya et al [3] among 80 skulls showed higher means of CI as compared to our study and it was not significant ($p>0.05$). As compared to the means of Nasal Index the results of the present study differs from the conclusion made by Vidya et [3] and Kotian et al [10].

Conclusion

In the present study the mean CI in male and female skulls was 74.32±4.20 and 76.56±4.12 respectively placing the Indian study population in Mesocephalic group. Though the OI was less in male skulls than the female skulls, the differences were statistically insignificant excluding their role in the sexual dimorphism of the skull. Thus, though the sex differences of CI and NI are significant by 't' test, none of the three cranial indices i.e. CI, NI and OI are reliable for sexual dimorphism of skull in general population as proven by demarking point analysis.

References

1. Krogman WM, Iscan YM. The Human Skeleton in Forensic Medicine (2 Edition) Springfield, Illinois, U.S.A. Charles C. Thomas Pub Ltd. 1986.
2. Marinescu M, Panaitescu V, Rosu M, Maru N, Punga A. Sexual dimorphism of crania in a Romanian population: Discriminant function analysis approach for sex estimation. Romanian Journal of Legal Medicine. 2018; XXII(1):21-26.
3. Vidya CS, Prashantha B, Gangadhar MR. Anthropometric Predictors for Sexual Dimorphism of Skulls of South Indian Origin. International Journal of Scientific and Research Publications, 2017;2(10):1-4.
4. Kumar A, Nagar M. Morphometric Estimation of Cephalic Index in north Indian population: Craniometric Study. International Journal of Science and Research. 2018;4(4):1976-82.
5. Pires LAS, Teixeira AR, Leite TFO, Babinski MA, Chagas CAA. Morphometric aspects of the foramen magnum and the orbit in Brazilian dry skulls. International Journal of Medical Research &Health Sciences, 2016; 5(4):34-42.
6. Mahajan SA, Gandhi D. Cephalometric study of adult human skulls of north Indian origin. International Journal of Basic and Applied Medical Sciences. 2016;1(1):81-83.
7. Jeremiah M, Pamela M and Fawzia B. Sex differences in the cranial and orbital indices for a black Kenyan population. International Journal of Medicine and Medical Sciences. 2013; 5(2):81-84.
8. Adejuwon SA, Salawu OT, Eke CC, Akinlosotu WF, Odaibo AB. A Craniometric Study of Adult Humans Skulls from Southwestern Nigeria. Asian Journal of Medical Sciences. 2011; 3(1):23-25.
9. Sangvichien S, Boonkaew K, Chuncharunee A, Komoltri C, Piyawinitwong S, Wongsawut A, Namwongsa S. Sex determination in Thai skulls by using craniometry: Multiple logistic regression analysis. Siriraj Med J. 2017; 59:216-221.
10. Kotian R, Bakkannavar SM, Shekhar H, Pradhan P, Nayak VC. Sex Determination Based on Nasal Index and Nasal Parameters using (Big Bore 16 Slice) Multidetector Computed Tomography 2D Scans. Indian Journal of Forensic and Community Medicine. 2015;2(3): 167-171.
11. Orish CN, Ibeachu PC. Craniometric Indices of Nigeria Skulls. Int J Anat Appl Physiol. 2016;2(1):6-13.
12. Mahakkanukrauh P, Sinthubua A, Prasitwattanaseree S, Ruengdit S, Singsuwan P, Praneatpolgrang S, Duangto P. Craniometric study for sex determination in a Thai population. Anat Cell Biol. 2015; 48:275-283.