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Biometrics of the External Ear of the Ijaws in Bayelsa State, Nigeria

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ABSTRACT

Aim: Ear biometrics is key to evaluating various ear deformities, acquire syndromes and reconstructive surgery. This study was aimed at assessing the normative value of the external ear of the Ijaws in Bayelsa State.
Study Design: This is a cross sectional study of 570 subjects [290 male and 280 females] between the ages of 18-45yeras, were recruited for this study.
Method: The anatomical landmarks used for ear biometrics of both sides were
[1]. Total Ear Length [TEL]: Uppermost point of the pinna to the lowermost point of lobule
[2] Ear Breadth [EB]: Measured distance from root of the ear to maximum convexity of the helix. [3] Ear Index [EI] was calculated by dividing ear breadth /ear length multiply by 100.
RESULTS: The results showed that the mean male right total ear length and breadth are 60.27±0.90 and 34.57±0.77, the left total ear length and breadth are 60.59±1.24 and 34.91±1.13 with right and left ear indices as 57.68±1.42 and 57.76±1.00. The mean female right total ear length and breadth are 7.62±0.87 and 30.36±0.77, while the female left total ear length and breadth are 56.93±0.94 and 31.79±0.57 with right and left ear indices as 52.66±1.17 and 55.97±0.89 respectively. The findings showed no significant difference between the male right and left total ear length and breadth, female right and left total ear length and breadth. The Ijaw male right total ear length and breadth tend to be higher than the female counterparts ($p<0.05$). More so, the Ijaw males possess higher left total ear length and breadth than their females ($p<0.05$).
Conclusion: Ear biometrics are useful diagnostic tools for congenital malformations, acquired deformities, treatment planning and forensic studies because of the high level of sexual dimorphism.

Key words: Biometrics, Ear index, Sexual Dimorphism.

INTRODUCTION

The external ear is clinically and surgically important as it is related to the vital structures in the neck and that the human ear is the most defining feature of the face [1]. Study on anatomic and aesthetic showed differences between men and women, as well as changes in ear morphology with age. 123 volunteers were randomly selected for this study. The cohort consisted of 89 women with age range 19 to 65 (median 42) and 34 men age range 18 to 61 (median 35). The average total ear height across the entire cohort for both left and right ears was 6.30cm. The average lobular height was 1.88cm. The average lobular width was 1.96cm. As expected, based on head size, significant male/female differences were noted in the distance from the lateral palpebral commissure to both the helical root and insertion of the lobule [2].

All ears are different, and the degree of difference within the bounds of acceptability is remarkable [3]. To that end, the keys to construction, reconstruction, or modification must be observed in order to mold an ear that "looks right." Simply stated, these keys are as follows: The ear is a flap approximately 50 to 60% as wide as it is high, sitting back one ear length (6.5 to

7.5 cm) from the lateral orbital rim, with the top of the ear level with the brow inclined approximately 20 degrees and protruding 1.5 to 2.0 cm from the head. It is composed of five critical elements: concha, helix, antihelix, tragus, and lobule, and parts of lesser importance including antitragus, intertragic notch, and Darwin's tubercle [3]. The subtleties of form and proportion of its features will be revealed by careful observation and study. The use of ear as a tool for human identification started since late 19th century when Alphonse Bertillon utilized it as one of eleven anthropometric measurements for his manual system of identifying individuals [4]. The ear consists of a single piece of fibrocartilage with a complicated relief on the anterior, concave side and a fairly smooth configuration on the posterior, convex side. The fetal development of ear starts shortly after conception and by the 38th day some of its features are recognizable. The ear moves to its definitive position on 56th day and the shape of ear can be recognized on the 70th day. The shape is fixed from then on and never changes from birth until death [5]. The biometrics of ear is a very interesting issue as during crime scene investigation, ear marks and measurements are often used for identification in the absence of valid fingerprints. Ear biometrics can positively identify an individual using comparative analysis of the human ear and its morphology. The dimensions of the pinna have been found to vary among different ethnic groups [6]. [7] also stressed the possibility of using ear characteristics for assessing familial relationships, as the morphology of ears tends to be hereditary. The pattern of the free lobule was proposed by [8], to be a dominant trait with the attached lobule representing the recessive trait. [9] studied the external ear from an anthropological point of view and gathered data from the ears of 500 male and 500 female subjects. [10]worked on 10,000 human ear patterns and found that they all were different. The identity of Verrappan body, a famous sandal wood smuggler from Indian subcontinent was confirmed by his ear morphology and biometrics measurements in 2004 [11]. [12] conducted a survey and confirmed the age, gender and ethnic variations of ears among Koreans.

MATERIALS AND METHODS

Materials used includes camera, weighing balance, notebooks, Sliding vernier caliper.

STUDY TYPE

This is a cross sectional study of 570 subjects [290 male and 280 females] between the ages of 18-45yeras

STUDY LOCATION / DURATION

This research was conducted in specific areas and Ijaw speaking communities in Bayelsa State of Nigeria such as Ekowe, Otuan, Amasoma, Anyama, Ikibiri, Ikpetiama, Sabageria, Gbaraun. The study lasted from 15th January, 2022 to 10th of June, 2022.

This is a cross sectional study of 570 subjects [290 male and 280 females] between the ages of 18-45yeras, which were recruited for this study. All the measurements were taken twice for precision purpose and recorded in the nearest millimeter (mm) using standardized anthropometric measuring instruments; Sliding vernier caliper.

Methods Of Data Collection Technique

Convenient sampling technique done and data was collected randomly from the Ijaw speaking communities under study.

Height[m]: Measured from the vertex of the skull to the sole of the feet.

Total Ear length[mm]: Uppermost point of the pinna to the lowermost point of lobule.

Ear breadth[mm]: From root of the ear to maximum convexity of the helix

Ear Index was calculated by dividing ear breadth /ear length multiply by 100 according to [1].

Inclusion And Exclusion Criteria

Inclusion Criteria

1. All subjects were Ijaws of Bayelsa extraction.

2. All subjects were physically fit.
3. All subjects were free from ear deformity

Exclusion Criteria

1. Subject that didn't meet the above set inclusion criteria.
2. Also any subject that has some form of deformity in the body areas targeted for anthropological assessment that could hinder accurate measurement.

Ethical Measures

Permission to conduct this research was obtained from the authorities [Paramount Rules, Youth Leaders] these communities before the research commenced. The participants were enlightened on the purpose of the research. verbal informed consent was sought from the volunteered subjects before measurement procedures.

Statistical Analysis

The data collected was computed and analyzed using Statistical Package for Social Sciences [SPSS] version 16.0 software. The statistical tools such as Mean, Standard Deviation, Standard Error, Z- Test were used to analyze data. P- value less than (0.05) was considered as significant.

Fig 1: Ear measurement for volunteered subjects.

RESULTS

The data collected was analyzed and the results are presented in the tables below.

TABLE 1: MEAN VALUES OF MALE AND FEMALE EAR PARAMETERS[mm]

S/N	PARAMETERS	MALE	FEMALE
1	HEIGHT [m]	1.72±0.01	1.65±0.01
2	RIGHT TOTAL EAR LENGHT	60.27±0.90	57.62±0.87
3	RIGHT EAR BREADTH	34.57±0.77	30.36±0.77
4	LEFT TOATL EAR LENGHT	60.59±1.24	56.93±0.94
5	LEFT EAR BREADTH	34.91±1.13	31.79±0.57

Mean±SEM

The results from the analyzed data showed mean values of the males' right ear length and width as 60.27±0.90mm and 34.57±0.77mm. The mean value of the males' left ear length and width are 60.59±1.24mm and 34.91±1.13mm. The mean value of the females' right ear length and width are 57.62±0.87mm and 30.36±0.77mm. While the mean values of their left ear length and width are 56.93±0.94mm and 31.79±0.57mm respectively. Indices of both the right and left ears for males and females were calculated and the results indicates that, the mean value of the male right index 57.68±1.42 is and left ear index is 57.76±1.00 and the female right and left indices are 52.66±1.17 and 55.97±0.89 [table 2].

TABLE 2: MEAN EAR INDICES (%)

PARAMETER	MALE EAR INDEX	FEMAE EAR INDEX
RIGHT EAR	57.68±1.42	52.66±1.17
LEFT EAR	57.76±1.00	55.97±0.89

All values = Mean ±SEM

TABLE 3: Z-TEST FOR SIGNIFICANCE

S/N	PARAMETER	Right	Left	z- value	Z-CRIT	INFERENCE
1	Male right and left total ear length	60.27±0.90	60.59±1.24	-0.2061	1.96	P>0.05
2	Male right and left ear width	34.57±0.77	34.91±1.13	-0.2493	1.96	P>0.05
3	Female right and left total ear length	57.62±0.87	56.93±0.94	0.53224	1.96	P>0.05
4	Female right and left ear width	30.36±0.77	31.79±0.57	-1.4957	1.96	P>0.05
9	Male and female height	1.72±0.01	1.65±0.01	2.93790	1.96	P<0.05**

Keys: All values= Mean±SEM, **= Significance

TABLE 4: Z-TEST FOR SIGNIFICANCE BETWEEN MALE AND FEMALE

S/N	PARAMETER	Right	Left	z- value	Z-CRIT	INFERENCE
1	Male and female right total ear length	60.27±0.90	57.62±0.87	2.12	1.96	P<0.05**
2	Male and female right ear width	34.57±0.77	30.36±0.77	3.87	1.96	P<0.05**
3	Male and female left total ear length	60.59±1.24	56.93±0.94	2.35	1.96	P<0.05**
4	Male and female left ear width	34.91±1.13	31.79±0.57	2.47	1.96	P<0.05**

Keys: All values= Mean±SEM, **= Significance

TABLE 4: Z-TEST FOR SIGNIFICANCE FOR EAR INDICES WITHIN SEX

S/N	SEX	RIGHT EAR INDEX	LEFT EAR INDEX	Z- VALUE	Z-CRIT	INFERENCE
1	MALES	57.68±1.42	57.76±1.00	-0.04	1.96	P>0.05
2	FEMALES	52.66±1.17	55.97±0.89	-2.25	1.96	P<0.05**

Keys: All values= Mean±SEM, **= Significance

TABLE 5: Z-TEST FOR SIGNIFICANCE FOR EAR INDICES BETWEEN SEXES

S/N	PARAMETERS	MALE	FEMALE	Z- VALUE	Z-CRIT	INFERENCE
1	RIGHT EAR INDEX	57.68±1.42	52.66±1.17	2.73	1.96	P<0.05**
2	LEFT EAR INDEX	57.76±1.00	55.97±0.89	1.34S	1.96	P>0.05

Keys: All values= Mean±SEM, **= Significance

DISCUSSION

The ear constitutes facial esthetics of humans as such evaluating and differentiating the size has become imperative. The findings from this study have shown that there is no significant difference in the male right and left total ear length and breadth (p>0.05). Similarly, this result also indicates no statistical significant difference in the female right and left total ear length and breadth (p>0.05). In this present study, the male right and left ear indices showed no significant difference (p>0.05) of the Ijaw population. But contrary to this finding, the female right and left ear indices depicts statistically significant difference, where the female left ear index is more than the right ear index (P<0.05). Result of the comparison of the right and left total ear length between males and females of the Ijaws showed significant difference between the two sexes, of which the males tend to have higher value than the females (P<0.05). This result is in tandem with the findings of [14] study of the North West and North East Indians population, and also corroborates the results of [15,16. 17]. The results of the present study also show significantly higher male right and left ear breadth than the female ear breadth (P<0.05). The Ijaw male right ear index was statistically higher than their female counterparts (P<0.05). This finding is in consonant with the study of [18] were the ear indices of both sides in males were significantly higher than the females. Concurrently, the male left ear index and the female left ear index show no significant difference between the two sexes of the Ijaw population (p>0.05). It is ostensibly clear, that genetic characteristic and background played the difference in this result, which is in line with [19] study. Ear dimensions are key diagnostic tool for congenital malformations, acquired deformities and in treatment planning.

CONCLUSION

Knowing the normative dimensional values of the ear morphometric features will help in anthropological and forensic issues. From this study, it has shown that the males of the Ijaw population possess more lengthier and broader ear than their female counterparts. Gender variations must be considered in any ear biometrics measurement in facial and reconstructive surgery.

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REFERENCES

1. Natekar PE, De Souza FM. Demarking and identifying points-reliable criteria for determination of sex from external ear. Indian J Otol 2012;18: 24-7.
2. Jagruti Patel, Michael J. Brucker, Patrick K. Sullivan. A morphometric study of the external ear: age- and sex-related

differences (2010). Plast Reconstr Surg 2003 Aug;112(2):647-52
3. Tolleth, H. A hierarchy of values in the design and construction of the ear. Clin. Plast. Surg. 1990. 17(2): p. 193-207,.
4. Dhanda V, Badhan JS, Garg RK. Studies on the development of latent ear prints and their significance in personal identification. Problems of Forensic Sci. 2011;138:285–95.
5. Standring S, Barley NR, Collins P, et al. Gray's Anatomy. 40th edition. London: Churchill Livingstone; 2008. External ear; p. 618.
6. Kumar P and Singla A. Ear biometric: sex, bilateral and ethnic differences among brahmin and yadav communities of Bundelkhand region using PCA technique. Int J Scientific & Eng Res. 2013;4:799–805.
7. Imhofer R. Die Bedeutung der Ohrmuschel Fiir Feststellung der Identitat. Archivfiir die Kriminologie. 1906; 26:150–63.
8. Altmann F. Malformations of the auricle and external auditory meatus. Arch Otolaryngology. 1951;54:115–39.
9. Oepen I. Uberdie Haugigkeit einiger Morphologischer besonderheiten im kopfbereich. Antropologischer Anzeiger. 1970;32:141–56.
10. Iannarelli AF. Forensic identification series: ear identification. California: Paramont Publishing Company; 1989. p. 5.
11. Purkait R. Ear biometrics: an aid to personal identification. Anthropologist Spl. 2007;3:215–18.
12. Jung SH, Jung SH. Surveying the dimensions and characteristics of Korean ears for the ergonomic design of ear-related products. Int J Ind Ergon. 2003;31:361–73.
13. Bhasin MK. Ear lobe attachment among the Newars of Nepal. Hum Hered. 1969;19: 506–08.
14. Pradhuman Verma, Harpreet Kaur Sandhu, Kanika Gupta Verma, Sharry Goyal,4 Madhu Sudan, and Amit Ladgotra . Morphological Variations and Biometrics of Ear: An Aid to Personal Identification. J Clin Diagn Res. 2016. 10(5): ZC138–ZC142.
15. Ekanem A.U, Garba SH, Musa TS, Dare ND. Anthropometric study of the pinna (auricle) among adult Nigerians resident in Maiduguri metropolis. J Med Sci. 2010;10(6):176–80.
16. Eboh D. Morphological changes of the human pinna in relation to age and gender of Urhobo people in Southern Nigeria. J Cli Exp Anat. 2013;12:68–74.
17. Deopa D, Thakkar HK, Prakash C, Niranjan R, Barura MP. Anthropometric measurements of external ear of medical students in Uttarakhand. J Ana Soci India. 2013;62:79–83.
18. Ferrario VF, Sforza C, Ciusa V, Serrao G, Tartaglia GM, et al. Morphometry of the normal human ear: a cross-sectional study from adolescence to mid-adulthood. J Craniofac Genet Dev Biol. 1999;19:226–33.
19. Sharma A, Sidhu NK, Sharma MK, Kapoor K, Singh B. Morphometric study of ear lobule in northwest Indian male subjects. Ana Sci Int. 2007;82:98–104.

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