Assessment of Earlobe Patterns and Ear Shapes in Hausa Ethnic Group of Nigeria: Implications for Forensic and Clinical Applications

Faustina Chiamaka Irozulike [a*],
Collins Gospel Uchechukwu [a],
Priscilla Nkechinyere Nwofor [a],
Patrick Leo Filima [a]
and Tobi Boma Selekekeme [b]

[a] *Department of Anatomy, Faculty of Basic Medical Sciences, College of Health Sciences, University of Port Harcourt, PMB 5323 Choba, Rivers State, Nigeria.*
[b] *Department of Human Anatomy, Faculty of Basic Medical Science, Bayelsa Medical University, Yenagoa Bayelsa State, Nigeria.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Background: The external ear consists of the pinna and external auditory meatus, which vary in shape, size, and structure among individuals. The earlobe is a soft tissue region near the base of the external ear. Both men and women have attached and detachable earlobes. The study sought

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Corresponding author: E-mail: faustinachiamaka64@gmail.com;

to evaluate the external ear morphology and earlobe attachment pattern of the Hausa ethnic group in Nigeria.

Methods: The study included 300 individuals (150 males and 150 females) aged 18 to 37 years. Multi-stage random sampling was employed. The data was analyzed using version 23 of the statistical package for social sciences. Chi-square was used as an inferential statistic and a probability less than 0.05 ($p<0.05$) was considered statistically significant.

Results: The study shows that 61.3% of males and 54% of females were observed to have attached lobes. There was no significant relationship between the sexes. The most prominent ear shape among the population was triangular in females while in males was oval.

Conclusion: This study shows that the most dominant pattern of earlobes was attached earlobes. It also indicated that the most common morphological shapes among the population were oval and triangular shapes in males and females respectively. The study will be useful in the implications of sectors like plastic surgery, hearing aid design, and forensic science, where a precise understanding of ear morphology aids identification processes.

1. INTRODUCTION

Anthropometry is the scientific study of measurement and proportion of the human body dimension. It is crucial in understanding human diversity, genetics, and evolution (Umar, 2024). The external ear consists of the pinna and external auditory meatus, a unique part of human anatomy that varies greatly in shape (oval, round, triangular, and rectangular), size, and structure across individuals and populations (Jan et al.,2023). This structure contributes to the unique appearance of the ear, especially in the concha and lobe areas. It has been observed that there is a significant variation in the geometry and shape of the ear among individuals. The earlobe is the soft tissue area at the bottom of the outer ear. Despite lacking cartilage, the earlobe has nerve endings and blood vessels (Deep et al., 2016). Earlobe attachment differs in every individual; it is either directly attached to the lateral side of the head or detached, hanging freely to the lateral side of the face. However, ear shape and earlobe attachment patterns are particularly intriguing as they are influenced by environmental and genetic factors (Purkait, 2015). Variations in these qualities can serve as distinguishing features in population-specific research. This study has practical implications in sectors like plastic surgery, hearing aid design, and, most significantly, forensic science, where a precise understanding of ear morphology aids in identification processes.

Studies on earlobe patterns across diverse populations in Nigeria have reported that the attached earlobe is more common than the free or unattached earlobe among the Ika ethnic group in Delta State (Ese et al., 2021,

Asiwe et al.,2021) verified that the unattached pattern of earlobe attachment is predominant in males and the attached is more dominant in females. Francis and Okoseimiema,2022, stated that free (detached) earlobes were more common than attached ones among the Kalabari people. Paul et al.,2022 of the Idoma population revealed that attached earlobes are more observed than detached ones. Oyubu et al.,2019 also reported the most predominant earlobe among the Nigerians in southern regions was the attached earlobe. Among the Adult Malaysian Population at Shah Alam, Attalla et al.,2020 reported in terms of the shape of ear distribution, the shapes oval, round, rectangular and triangular are nearly equally distributed among young adults in Shah Alam.

The Hausa ethnic group, one of the largest in Nigeria and West Africa, is an important population for studying anthropometric features such as ear morphology. The Hausa people, known for their rich cultural legacy and distinct genetic background, provide an unparalleled chance to study the variation and distribution of external ear features. However, while several anthropometric studies have been conducted on various global populations, precise data on ear morphology within the Hausa ethnic group is limited. Therefore, this study sought to evaluate the external ear morphology and earlobe attachment pattern of the Hausa ethnic group in Nigeria.

2. MATERIALS AND METHODS

2.1 Study Design

The study used a cross-sectional descriptive observational study design. Only respondents

Attached earlobe pattern

Detached earlobe pattern

Fig. 1. Pattern of Earlobe

| Oval shape | Round shape | Triangular shape | Rectangular shape |

Fig. 2. Morphological Shapes of Ear

within the age interval of 18-37 years made up the study population (150 males and 150 females) were allowed to participate in this study. The respondents were drawn from Kano, Kaduna, Kebbi, and Kastina States. Kano City was used as the study area and a multi-stage random sampling technique was adopted to ensure that all respondents had an equal chance of being selected.

2.2 Study Criteria

2.2.1 Inclusion criteria

This study included exclusively individuals whose parents and grandparents belonged to the Hausa ethnic group of Nigeria. Additionally, only those

aged between 18 and 37 years, with no history of ear surgery, were selected.

2.2.2 Exclusion criteria

Those who did not meet the inclusion criteria were all omitted from the study.

2.3 Methods of Data Collection

A written consent form was distributed among the respondents and followed by a personal interview. Data were collected using a closed observational approach where trained personnel took account of the earlobe pattern and ear shape. The data obtained were documented on a data spreadsheet (Microsoft Excel Document).

2.4 Methods of Data Analysis

The data obtained from the study were subjected to statistical analysis using the International Business Machine of Statistical Package for Social Sciences (IBM SPSS version 23) and Chi-square was used as an inferential statistic. A probability less than 0.05 (p<0.05) was considered statistically significant.

3. RESULTS

The present study comprised three hundred subjects (150 males and 150 females) of the Hausa ethnic group of Nigeria, aged 18-37 years old. Table 1 shows the descriptive statistics of the Hausa ethnic group of Nigeria with an average age of 22.63±4.06 and an earlobe of 1.42±.49, ear shape of 2.42±1.06. Table 2 shows the association of earlobe attachment among the sexes where (61.3%) of males and (54%) of females have an attached earlobe respectively and no gender difference was observed. The distribution of ear shape among the genders shows oval (31.3%), round (16%), triangular (30%) and rectangular (22.7%) all observed in males. In females, oval (20.7%), round (30.7%), triangular (35.3%) and rectangular (13.3%) were observed, it also shows there was a significant difference between the two genders about the ear shape (p-value=0.002). This indicates that ears are not the same in shape in both genders of the Hausa population (Table 3).

4. DISCUSSION

The present study evaluates the association of earlobe patterns among genders in the Hausa ethnic group of Nigeria and results presented that most males (61.2%) and females (54%) had attached earlobe patterns. This association also showed no gender difference. The findings of this study were in line with Gaya and Yahaya,2019 who reported that attached earlobe is more predominant in both genders among Nigerian students of Bayero University Kano. However, the findings of this study were inconsistent with Ese et al.,2021 whose study was among the Ika ethnic group in Delta State, Nigeria, which showed that females have a free earlobe and males have more attached earlobe. The findings of Oyubu et al.,2019, show that attached earlobe patterns were predominant in males, among Adult Nigerians residing in the Southern region which aligned with the present study that attached earlobe are more noted in males. However, they also reported that earlobe patterns showed no gender differences which concurs with the present study. Moreover, the present study differs from Asiwe et al.,2023 a study among the Igbo ethnic group of Nigeria where the males had unattached patterns of the earlobe and the females had attached earlobe patterns and Munir et al.,2015 study among the Quetta, Pakistan population that the most common earlobe attachment pattern found in males was free, their females have attached earlobe and this research agreed with the present study in terms of females having attached earlobe.

The study further revealed that the attached earlobe was the most common among the Hausa ethnic group of Nigeria. Our result concurs with Gaya and Yahaya,2019 reported that attached earlobe is more noted in Nigerian students of Bayero University Kano and Krishan et al.,2019 observed that attached earlobe was common in the population of Indians. On the contrary, Fakorede et al.,2021 and Kapile et al.,2014 observed that detached (free) earlobes were more predominant and this disagreed with the present study.

Table 1. Descriptive statistics of the hausa ethnic group of Nigeria

Parameter	N	Minimum	Maximum	Mean	Std. Deviation
age	300	17.00	36.00	22.6300	4.06302
ear lobe	300	1.00	2.00	1.4233	.49491
ear shape	300	1.00	4.00	2.4267	1.06225

Table 2. Association of earlobe attachment among the sex of hausa ethnic group of Nigeria

Sex	Attached lobe	Detached lobe	X^2	df	p-value	Inference
Male	92 (61.2%)	58 (38.7%)	1.652	1	0.24	NS
Female	81 (54%)	69 (46%)				

X^2= Chi-square, df =degree of freedom, NS= Not significant, 61.2%, 54% (Attached), 38.7%, 46% (Detached)

Table 3. Distribution of ear shape among the genders

Ear Shape	Male	Female	X^2	df	p-value	Inference
Oval	47 (31.3%)	31 (20.7%)	14.479	3	0.002	S
Round	24 (16%)	46 (30.7%)				
Triangular	45 (30%)	53 (35.3%)				
Rectangular	34 (22.7%)	20 (13.3%)				

X^2= Chi-square, df =degree of freedom, NS= Not Significant, 31.3%, 20.7% (Oval), 16%, 30.7% (Round), 30%, 35.3% (Triangular), 22.7%, 13.3% (Rectaangular)

In the present study, the most common ear shape observed was oval among the males (31%) and triangular among the females (35.3%) and it also shows there was a significant difference between males and females on the ear shapes, p-value>0.05. Genetically, ear shape and size are influenced by hereditary traits, which may differ slightly between males and females due to evolutionary adaptations or genetic variations (Ghosh et al., 2021). Hormonal differences, particularly during puberty, can affect cartilage development and elasticity, leading to subtle variations in ear structure (Soames,2023). For example, testosterone has been linked to thicker and more prominent cartilage, which might explain slightly larger or more angular ears in males. Environmental factors such as lifestyle, ageing, and exposure to elements like sun or wind can also shape ear morphology over time The sexual alteration shown in this study was in line with other research across many populations, which found that Fakorede et al.,2021 whose study was on ear morphology and morphometry as potential forensic tools for identification of the Hausa, Igbo and Yoruba populations of Nigeria, indicated that triangular shape is more frequent in Hausa females. In contrast, round ear shape is more common in males, which opposes the present study regarding male ear shape. However, the Malay females and males were found round shape and triangular respectively by Attalla et al.,2021, which differs from the present study.

Although, in this present study, the most predominant ear shape among the Hausa ethnic group in Nigeria was triangular, followed by an oval and, round and the least common is rectangular and this contradicts the study by Krishan et al.,2019 among Northern Indian where the most predominant ear shape was oval on both genders. According to Osunwoke et al.,2018 in an anthropometric study on the anatomical variation of the external ear amongst Port Harcourt students, Nigeria, it was observed that an oval shape is the most predominant ear shape among the students and this differs from the present study. Morphological variation and biometrics of the ear, an aid to personal identification carried out in north-west and north-east of India by Verna et al.,2016, discovered that an oval shape was commonly noted among the population and this research also disagreed with the present study. The round-shaped ear was more predominant in the morphological features of the ear in sex classification by Sezgin and Ersoy,2023. The oval and round-shaped ears were reported in 37.3%; 35.92% of males and 23.92%; 38.41% of females, respectively reported by Rani et al.,2020. Distribution of external ears in Sriganaganagar District, Rajasthan, India, oval shape ear was more observed by Kaur et al.,2020. Determination of external ear indices by digital photometry among the adult population by More et al.,2021 observed that oval-shaped ears were common in both sexes. The present study has shown some similarities and differences in external ear shape and earlobe attachment patterns among the Hausa ethnic group of Nigeria. The differences could be attributed to genetic, race, and environmental factors.

5. CONCLUSION

In conclusion, this study shows that both genders have attached earlobes and that the sexes have no significant relationship. It also indicated that the most common ear shapes among the population were oval and triangular in males and females respectively. However, this study will be useful in the implications of sectors like plastic surgery, hearing aid design, and forensic science, where a precise understanding of ear morphology aids identification processes.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

CONSENT

Written consent was distributed to all the subjects explaining the nature of the research only those who consented were allowed to participate in the study. The authors retrieved and preserved the consent.

ETHICAL APPROVAL

The study was approved by the research and ethics committee of the University of Port Harcourt, Port Harcourt Nigeria (UPHCEREMAD/REC/MM/91/046).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Umar, M. (2024, October 17). An introduction to anthropometry. In *Garment sizing and pattern making* (pp. 1-19). Springer Nature Singapore. https://doi.org/10.1007/978-981- 99-2476-1_1

Jan, S. S., Shah, B. A., & Saleem, S. M. (2023, April 1). Morphological variations and biometrics of ear: First documented evidence from ethnic Kashmiri population (Northern India). *Current Medical Issues*, *21*(2), 88-92. https://doi.org/10.4103/cmi.cmi_21_23

Deep, A., Mortazavi, M. M., & Adeeb, N. (2016, July 5). Ear. In *Bergman's comprehensive encyclopedia of human anatomic variation* (pp. 1167-1181). https://doi.org/10.1007/ 978-3-319-40350-8_156

Purkait, R. (2015). Application of external ear in personal identification: A somatoscopic study in families. *Annals of Forensic Research & Analysis*, *2*(1), 1015. https://doi.org/10.36648/2476-191X.2.1 .1015

Ese, A., Emmanuel, O. N., Charity, I., & Enoh, O. (2021). Pattern of earlobe attachment among the Ika ethnic group in Delta State, Nigeria. *GSC Advanced Research and Reviews*, *7*(3), 54-57.

Asiwe, N., Irozulike, F. C., Filima, P. L., Wedeh, M. S., & Yirate, B. N. (2023, November 4). Pattern of earlobe attachment among the Igbo ethnic group of Nigeria. *Asian Journal of Advanced Research and Reports*, *17*(11), 344-349.

https://doi.org/10.9734 /ajarr/2023/v17i113761

Francis, G. I., & Okoseimiema, S. C. (2022, November). Distribution of earlobe attachment among Kalabari people of Southern Nigeria. *Scholars Journal of Applied Medical Sciences*, *11*, 1884-1886.

Paul, J. N., Ochai, J., Dimkpa, G. C., Ogba, A. A., & Ohanenye, C. A. (2022, December). Pattern of earlobes attachment among the Idoma people of Benue State, Nigeria. *Scholars Journal of Applied Medical Sciences*, *12*, 2419-2423. https://doi.org/ 10.21276/sjams.2022.12.12.2456

Oyubu, E. A., Oyakhire, M. O., & Amasiatu, V. C. (2019). Morphometric evaluation of the external ear in relation to attachment pattern: A study of adult Nigerians resident in the Southern region. *European Journal of Biomedical*, *6*(6), 65-72.

Attalla, S. M., Kumar, K. A., & Hussain, N. (2020). Study of the ear shape and the lobule attachment among the adult Malaysian population at Shah Alam. *European Journal of Molecular & Clinical Medicine*, *7*(3), 5417-5425.

Gaya, A. A., & Yahaya, A. I. (2019). Sub-Saharan human morphological variations in the external ear (pinna): A potential tool for human identification. *EC Clinical and Experimental Anatomy*, *2*, 175-184.

Munir, S., Sadeeqa, A., Nergis, B., Tariq, N., & Sajjad, N. (2015). Assessment of morphogenetic inherited traits; earlobe attachment, bent little finger and hitchhiker's thumb in Quetta, Pakistan. *World Journal of Zoology*, *10*(4), 252-255.

Krishan, K., Kanchan, T., & Thakur, S. (2019, December). A study of morphological variations of the human ear for its applications in personal identification. *Egyptian Journal of Forensic Sciences*, *9*(1), 1-5. https://doi.org/10.1016/j.ejfs. 2019. 11.001

Fakorede, S. T., Adekoya, K. O., Fasakin, T. P., Odufisan, J. O., & Oboh, B. (2021, December). Ear morphology and morphometry as potential forensic tools for identification of the Hausa, Igbo, and Yoruba populations of Nigeria. *Bulletin of the National Research Centre*, *45*, 1-9. https://doi.org/10.1186/s42269-021-00510-2

Kapil, V., Bhawana, J., & Vikas, K. (2014, January). Morphological variation of the ear for individual identification in forensic cases: A study of an Indian population.

Research Journal of Forensic Sciences, *2*(1), 1-8.

Ghosh, S., Kasher, M., Malkina, I., & Livshits, G. (2021, October). Is craniofacial morphology and body composition related by common genes: Comparative analysis of two ethnically diverse populations. *American Journal of Physical Anthropology*, *176*(2), 249-261. https://doi.org/10.1002/ajpa.24255

Soames, R. W. (2023, December 15). *Anatomy and human movement-e-book: Structure and function*. Elsevier Health Sciences. ISBN 978-0-7020-7765-3.

Osunwoke, E. A., Vidona, W. B., & Atulegwu, G. C. (2018, December). Anthropometric study on the anatomical variation of the external ear amongst Port Harcourt students, Nigeria. *International Journal of Anatomical Variations*, *11*(4), 143-146.

Verma, P., Sandhu, H. K., Verma, K. G., Goyal, S., Sudan, M., & Ladgotra, A. (2016, May). Morphological variations and biometrics of ear: An aid to personal identification. *Journal of Clinical and Diagnostic Research*, *10*(5), ZC138.

Sezgin, N., & Ersoy, G. (2023, October 4). Metric and morphological features of the ear in sex classification. *Egyptian Journal of Forensic Sciences*, *13*(1), 44 -50. https://doi.org/10.1016/j.ejfs.2023.07.004

Rani, D., Krishan, K., Sahani, R., Baryah, N., & Kanchan, T. (2020, September 1). Evaluation of morphological characteristics of the human ear in young adults. *Journal of Craniofacial Surgery*, *31*(6), 1692 -1698. https://doi.org/10.1097/SCS. 0000000000006657

Kaur, M., Kaur, N., Sharma, P., Saini, R. G., & Ohri, M. (2023). A preliminary study on anthropometric measurements and shape distribution of external ear in Sriganaganagar district, Rajasthan, India.

More, S. S., Mane, V., & Yadav, A. (2021, August 2). Determination of external ear indices by digital photometry among adult population. *New Frontiers in Medicine and Medical Research*, *1*, 77-83.

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