

## Original Research Article

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

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

**Method:** 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.

**Result:** 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.

**Keyword:** Anthropometric; Ear Shape; Earlobe; Hausa; Forensic

## **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 [1]. 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 [2]. 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 [3]. 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 [4]. 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 [5]. Asiwe et al., [6] verified that the unattached pattern of earlobe attachment is predominant in males and the attached is more dominant in females. Francis and Okoseimiema [7], stated that free (detached) earlobes were more common than the attached ones among the Kalabari people. Paul et al., [8] of the Idoma population revealed that attached earlobes are more observed than detached ones. Oyubu et al. [9] 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., [10] 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.

## **2.0 MATERIALS AND METHODS**

### **2.1 Study Design**

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

#### **Inclusion Criteria**

Subjects included in this study were 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.

#### **Exclusion Criteria**

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

### **2.3 Method of Data Collection**

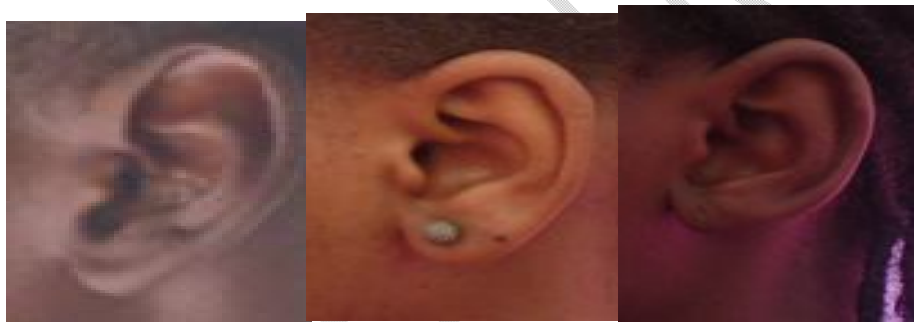
A written consent form was distributed among the respondents and followed by a personal interview. Data were collected using a closed observational approach where trained personnel took account of the earlobe pattern and ear shape. The data obtained were documented on a data spreadsheet (Microsoft Excel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

## 2.4 Method 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.

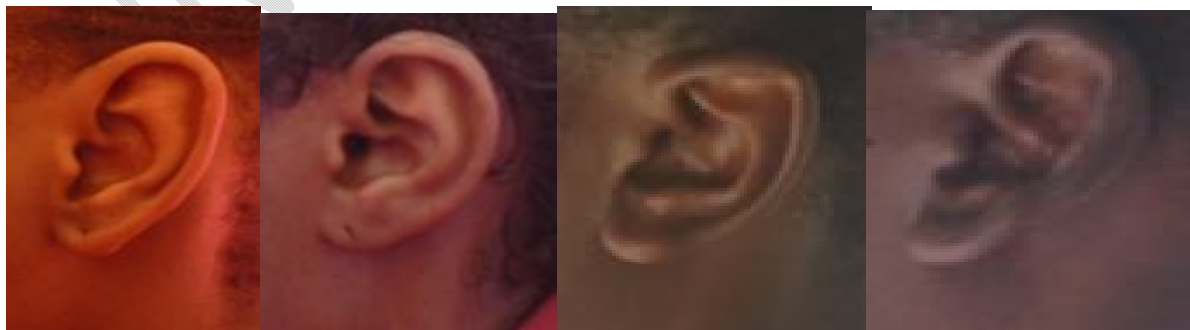


**Attached earlobe pattern**



**Detached earlobe pattern**

**Fig. 1; Pattern of Earlobe**



**Oval shape**

**Round shape**

**Triangular shape**

**Rectangularshape**

Fig. 2; Morphological Shapes of Ear

### 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  $22.63 \pm 4.06$  and an earlobe of  $1.42 \pm .49$ , ear shape of  $2.42 \pm 1.06$ . 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).

**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 <sup>2</sup>	df	p-value	Inference
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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% (Rectangular)

#### 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, [11] 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., [5] 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. [9], 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., [6] 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.

[12] 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, [11] reported that attached earlobe is more noted in Nigerian students of Bayero University Kano and Krishan et al., [13] observed that attached earlobe was common in the population of Indians. On the contrary, Fakorede et al., [14] and Kapile et al., [15] observed that detached (free) earlobes were more predominant and this disagreed with the present study.

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,  $p\text{-value} > 0.05$ . 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 [16]. Hormonal differences, particularly during puberty, can affect cartilage development and elasticity, leading to subtle variations in ear structure [17]. 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., [14] 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., [10], 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., [13] among Northern Indian where the most predominant ear shape was oval on both genders. According to Osunwoke et al., [18] 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., [19], 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 [20]. 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., [21]. Distribution of external ears in Sriganaganagar District, Rajasthan, India, oval shape ear was more observed by Kaur et al., [22]. Determination of external ear indices by digital photometry among the adult population by More et al., [23] 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.

## **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 CONSIDERATION**

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

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.

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