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Darwin's Tubercle and Ear Morphological Variations among Omuma Tribe

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Abstract

This study examined the morphometry and morphological variations of the external ear among the Omuma population. Specifically, measured the length of the tragus, breadth of the ear below the tragus, and presence of Darwin's tubercle. The aim is to document and analyze these variations to provide a comprehensive understanding of the external ear morphology within this specific population among omuma group. The study adopted a cross-sectional design, 400 participants aged 16-45 were used using simple random sampling method. For data collection a camera was used to take photographs with a 2cm graph sheet placed behind the ear horizontally and vertically to take reading from the photograph using a computer. Data were analyzed using SPSS version and descriptive studies of frequencies, percentages, mean and standard deviation were used Data analysis. The result of the analysis revealed that majority of the participants were female (227, 56.8%) while male was 173(43.3%) and majority fell between the age of 26-35 years. Further findings showed that the mean length ear of the tragus was 1.42±0.26, while mean breadth of just below the tragus was 3.30±0.53cm and 3.27±0.53cm for left and right ear respectively. This study on ear morphometry in the Omuma population has provided data on the length of the tragus, the breadth of the ear below the tragus, and the prevalence of Darwin's tubercle. It was recommended that ear morphometric and morphological data gotten from the present study should be utilized in forensic studies for identification purposes. Data will contribute to anthropological research and may have implications for clinical practices related to ear morphology

Keywords: External Ear, Morphometric, Morphology, Tragus, Omuma, Darwin's Tubercle, Forensic.

INTRODUCTION

The study of human anatomy, particularly morphometric and morphological characteristics, has long been an area of interest in both clinical and anthropological research. Among the various anatomical structures, the external ear (auricle) holds significant importance due to its unique features and individual variability (Kewal *et al*., 2019). This research focuses on the morphometric and morphological study of the external ear among the Omuma population, a distinct ethnic group in Nigeria. The external ear, being a prominent feature of the human face, not only plays a crucial role in the auditory system but also in forensic identification and anthropological assessments (Zelditch *et al*., 2012). Variations in ear morphology are influenced by several factors, including genetics, age, sex, and environmental influences. Genetic factors play a significant role in determining the size, shape, and structure of the ear. Studies have shown that certain ear shapes and features are heritable and can be traced through family lines (Kumar & Singh, 2017). Genetic predisposition is a major determinant of ear morphology. Specific genetic markers have been associated with particular ear shapes and sizes. For instance, the presence of a prominent antihelix or a detached lobule can be linked to genetic inheritance (Ferrario *et al*., 2010).

Twin studies have also demonstrated a high degree of concordance in ear morphology, underscoring the genetic basis of these traits (Farkas *et al.,* 2005). Environmental influences, such as nutrition and health during developmental years, can impact ear morphology. Cultural practices, including the wearing of earrings or other ear adornments, can also alter the shape of the ear over time (Sforza *et al.,* 2009). For example, heavy earrings can elongate the earlobe, while certain cultural

practices might lead to intentional modifications of ear shape. Age-related changes in ear morphology are well-documented. As individuals age, the ears may undergo changes such as elongation of the lobule, increased ear width, and loss of skin elasticity. These changes can be significant in distinguishing between age groups in forensic investigations. Sex differences also exist, with males generally having larger ears compared to females, a trait that can be useful in both forensic and anthropological contexts (Barut & Aktunc, 2006). From an anthropological perspective, ear morphology provides valuable insights into human evolution, population migration patterns, and genetic relationships among different ethnic groups. Comparative studies of ear morphology across various populations can reveal how humans have adapted to their environments and how different groups are related. For example, variations in ear size and shape have been linked to climatic adaptations, with certain features providing advantages in different environmental conditions. Despite extensive research on ear morphology, specific data on the Omuma population remains limited. Most studies have focused on other ethnic groups, leaving a gap in the understanding of ear morphology within the Nigerian context. This research aims to fill that gap by providing comprehensive morphometric and morphological data on the external ear of the Omuma people. By doing so, it will contribute to the broader understanding of human diversity and aid in the application of forensic and clinical practices specific to this population (Kewal *et al.,* 2019).

The variability of the external ear is influenced by a complex interplay of genetic, environmental, and cultural factors. Understanding this variability is crucial for applications in forensic science, clinical medicine, and anthropology. This study aims to provide detailed morphometric and morphological data on the external ear of the Omuma population, contributing to the existing body of knowledge and highlighting the unique characteristics of this group.

MATERIALS AND METHODS

A descriptive and cross-sectional design with a stratified random sampling technique was employed for this study. The population study includes photographed images of the human ear of the indigenous people of Omuma. Participants whose parents, grandparents are indigenes of Omuma were recruited for this research. Data that was obtained or collected were a total sample 400 Adults comprising of 173 males and 227 females respectively.

Inclusion Criteria

Young adult's males and females ranging from 16-45 years and subjects with normal ears were included in the study and indigenous people of Omuma.

Exclusion Criteria: Individuals below 16 years of age and those with apparent deformity were excluded.

Sample Size Determination

Sample determination was done using Yamane, (1967) Formula.

Given:

Population size (N) = 100,000

Margin error (e) = 5% (or 0.05)

Yamane's Formula:

N= N/1+N.e(2)

1.Square the margin of error:

e2= (0.05)2=0.0025

Multiply the population size by the squared margin of error:

N·e2=100,000×0.0025=250

Add 1 to the result:

1+N·e2=1+250=251

Divide the population size by this result:

n=100,000/251≈398.41

Ethical Considerations

Ethical clearance was obtained from the research and ethics committee of the faculty of basic medical science, River's state university Nigeria. Informed consent was obtained from all participants prior to data collection.

Method of Data collection

The consent of the participants was asked before initiating the data collection the purpose was explained to each subject.

Participating in the study was voluntary, informed consent was obtained from participants and socio-demographics of each respondent such as age and sex.

In obtaining the digital picture of the subject the head is held high in a stable and anatomical position and the participants were made to sit in a Frankfort position.

A measurement graph is placed by the side of both ears for precise and accurate measurement and was photographed.

The method of data collection was adopted from Sharanbasappa *et al*., (2018). Graphs 2 by 2 were placed behind the ear of the subject and photograph was taken. The graph was placed vertically behind the auricle and horizontally below the earlobe and pictures were taken.

Pictures were transferred to the computer and measurement of the tragus length and breadth of the ear below the tragus was read from the graph. A second picture of the ear was also taken for morphological assessment. same procedure was used for both the left and right ear.

Parameters studied are:

1. Length of the tragus
2. Breadth of the ear below the tragus

3. Presences of Darwin's tubercles: Darwin's tubercle is a small, pointed bump located on outer (helical) rim of the ear. This feature is typically harmless and has no functional impact on hearing or overall health. However, some individuals consider it as an undesirable cosmetic trait due to its unusual protrusion. Darwin's tubercle is thought to be a vestigial trait, reflecting our evolutionary history, and is present in approximately 10% of the population.

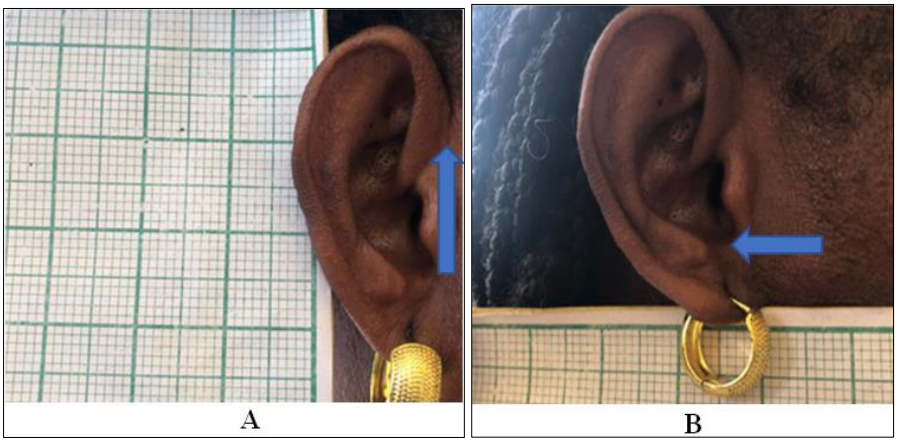

Fig. 1: Length of the tragus (A), breadth of the ear just below the tragus (B)

Fig. 2: Showing prevalence of Darwin's tubercles (A) absent (B) present

Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 23. Descriptive statistics including mean, standard deviation, frequencies, and percentages were calculated. Comparative analysis by sex and age groups were performed, with statistical significance set at $p<0.05$.

Results are Represented in Table 1-5 and Chart 1 Respectively

Table 1: Demographic Characteristics of Study Population (Omuma LGA)

Characteristics	Frequency	Percentage (%)
Gender		
Male	219	54.8
Female	181	45.3
Total	400	100
Age		
16-25	133	33.3
26-35	164	41
36-45	103	25.75
Total	400	100

Table 2: Morphometry of the External Ear of the Study Population

Ear Parameters	Mean ± SD (cm)
Length of right tragus	1.48±0.26
Length of left tragus	1.48±0.26
Breadth of right ear just below tragus	3.27±0.53
Breadth of left ear just below tragus	3.30±0.53

Table 3: Comparison of the Morphometry of the External Ear of the Study Population based on Gender

Gender	Length of right tragus (cm)	Breadth of right ear just below tragus (cm)	Length of left tragus (cm)	Breadth of left ear just below tragus (cm)
Male	1.49±0.26	3.42±0.49	1.50±0.26	3.41±0.49
Female	1.46±0.25	3.33±0.57	1.46±0.25	3.33±0.57
p-value	0.042	0.040	0.039	0.0144
t-value	0.795	-1.485	0.862	-1.469
Inference	S	S	S	S

Key: NS=Non-significant, S=Significant

Table 4: Comparison of the Morphometry of the External Ear of the Study Population based on Age

Age	Length of right tragus (cm)	Breadth of right ear below tragus (cm)	Length of left tragus (cm)	Breadth of left ear below tragus (cm)
16-25	1.43±0.27	3.47±0.58	1.44±0.27	3.47±0.58
26-35	1.33±0.17	3.17±0.48	1.33±0.17	3.17±0.48
36-45	1.59±0.27	3.19±0.51	1.60±0.26	3.20±0.52
p-value	0.022	0.323	0.015	0.331
t-value	4.259	1.170	4.778	1.142
Inference	S	NS	S	NS

Key: NS=non-significant, S=Significant

Table 5: Prevalence of Darwin's Tubercle in the Study Population

	Frequency	Percentage (%)
Presence of Darwin's tubercle	127	31.8
Absence of Darwin's tubercle	273	68.3

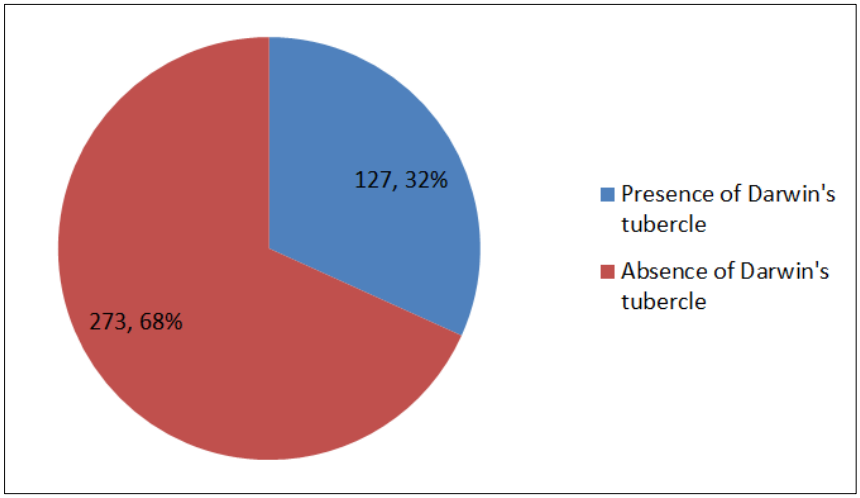

Chart 1: Chart showing presence of Darwin tubercle among omuma tribe

RESULT ANALYSIS

Table 1: Shows the demographic characteristics of the study population. The number of male subjects was 173 (43.3%), while the number of female subjects was 227 (56.8%). The number of subjects within the ages of 16–25 years, 26–35 years, and 36–45 years was 127 (31.8%), 169 (42.3%), and 104 (25.9%), respecStively.

Table 2: Shows the morphometry of the external ear of the study population. The mean length of the right and left tragus was 1.48 ± 0.26 cm and 3.27 ± 0.53 cm, respectively. The mean breadth of the right and left ear below the tragus was 1.48 ± 0.26 cm and 3.30 ± 0.53 cm, respectively.

Table 3: Shows the comparison of the morphometry of the external ear of the study population based on gender. The length of the right tragus of males and females was 1.49 ± 0.26 cm and 1.46 ± 0.25 cm, respectively. There was a significant difference (p=0.042) in the length of the right tragus between males and females. The length of the left tragus of males and females was 3.42 ± 0.49 cm and 3.33 ± 0.57 cm, respectively. There was a significant difference (p=0.040) in the length of the left tragus between males and females. The breadth of the right ear below the tragus of males and females was 1.50 ± 0.26 cm and 1.46 ± 0.25 cm, respectively. There was a significant difference (p=0.039) in the breadth of the right ear below the tragus between males and females. The breadth of the left ear below the tragus of males and females was 3.41 ± 0.49 cm and 3.33 ± 0.57 cm, respectively. There was a significant difference (p=0.0144) in the breadth of the left ear below the tragus between males and females.

Table 4: Shows the comparison of the morphometry of the external ear of the study population (Omuma LGA) based on age. The length of the right tragus of subjects within the ages of 16–25, 26–35, and 36–45 was 1.43 ± 0.27 cm, 1.33 ± 0.17 cm, and 1.59 ± 0.27 cm, respectively. However, there was no significant difference (p=0.201) in the length of the right tragus among the age groups. The breadth of the ear below the left tragus of subjects within the ages of 16–25, 26–35, and 36–45 was 3.47 ± 0.58 cm, 3.17 ± 0.48 cm, and 3.19 ± 0.51 cm, respectively. However, there was no significant difference (p=0.13) in the length of the left tragus among the age groups. The length of the left tragus of subjects within the ages of 16–25, 26–35, and 36–45 was 1.44 ± 0.27 cm, 1.33 ± 0.17 cm, and 1.60 ± 0.26 cm, respectively. However, there was no significant difference (p=0.323) in the breadth of the left ear below the tragus among the age groups. The breadth of the left ear below the tragus of subjects within the ages of 16–25, 26–35, and 36–45 was 3.47 ± 0.58 cm, 3.17 ± 0.48 cm, and 3.20 ± 0.52 cm, respectively. But there was no significant difference (p=0.316) in the breadth of the left ear below the tragus among the age groups.

Table 5: Shows the prevalence of Darwin's tubercle in the study population. One hundred and twenty-seven (31.8%) subjects had Darwin's tubercle, while 273 (68.3%) did not have Darwin's tubercle.

DISCUSSION

The findings from the present study showed that the mean length of the right and left tragus was found to be 1.48 ± 0.26 cm for both ears (Table 2). This result indicates no significant difference in tragus length between the right and left ears. This finding is consistent with studies by Lee *et al*., (2015) and Ozgen *et al*., (2018), which also reported no significant differences between the tragus lengths of both ears. This could be as a result of symmetrical development, also both ears perform same function reducing pressure for asymmetry, reduction on the sample size may also account for the significant difference.

The mean breadth of the ear below the tragus was 3.27 ± 0.53 cm on the right side and 3.30 ± 0.53 cm on the left side (Table 2). Similar to the tragus length, there was no significant difference in the breadth of the ear below the tragus between the right and left ears. These results align with the findings of Kumar *et al*., (2015), who also reported no significant differences in the breadth of the ear below the tragus between both ears. This could be as a result of symmetrical development, also both ears perform same function reducing pressure for asymmetry, reduction on the sample size may also account for the significant difference.

Significant differences were found in tragus length based on gender. Males had an average tragus length of 1.49 ± 0.26 cm (right ear) and 1.50 ± 0.26 cm (left ear), whereas females had an average tragus length of 1.46 ± 0.25 cm for both ears (Table 3). This is consistent with the findings of Rath *et al.,* (2020), Chin and Lu (2020), and Ozdemir *et al*., (2020), who also reported significant gender differences in tragus length, with males generally having longer tragi than females. This variations in the tragus length found between male and female could be as a result of hormonal influence of testosterone which promote the growth of cartilaginous structures including the tragus and also support the fact that males generally have larger ears.

The breadth of the ear below the tragus was also significantly different between genders. (Table 3). Males had an average breadth of 3.42 ± 0.49 cm (right) and 3.41 ± 0.49 cm (left), while females had an average breadth of 3.33 ± 0.49 cm for both ears (Table 3). This finding is supported by Smith *et al*., (2018) and Rodriguez and Hernandez (2017), who found that males typically have larger ear breadths below the tragus compared to females.

The present study found no significant differences in the length of the tragus or the breadth of the ear below the tragus based on age (Table 4). This contradicts the study by Brown *et al*., (2016), which suggested that tragus length increases slightly with age. The difference could be due to environmental factors or sample size variations.

In the present Darwin's tubercle was present in 31.8% of the Omuma population, with 127 out of 400 subjects showing its presence (Table 5). This prevalence rate supports previous studies by Brown and White (2016), who found a 25% prevalence rate among Caucasian Americans.

CONCLUSION

This study on ear morphometry in the Omuma population has provided comprehensive data on the length of the tragus, the breadth of the ear below the

tragus, and the prevalence of Darwin's tubercle. These findings contribute to the broader understanding of ear morphology and highlight the importance of regional studies in capturing the diversity of human anatomical features. Future research could expand on these findings by exploring additional ear parameters and including larger, more diverse samples.

Recommendations

Based on the findings of this research on ear morphometry in the Omuma population, the following recommendations are proposed:

Expanded Research should be conducted and include larger and more diverse samples within the Omuma population to confirm the findings and increase the statistical power of the results. Including various age groups and more comprehensive demographic data can help in understanding the influence of factors such as age, socio-economic status, and lifestyle on ear morphometry. Conduct comparative studies with other populations within Nigeria and globally to identify potential genetic, environmental, and cultural influences on ear morphology. Such studies can help in understanding regional differences and similarities, providing a more comprehensive understanding of human ear morphology. Utilize the collected morphometric data in forensic science for identification purposes. The unique measurements and prevalence rates of specific ear features can aid in the identification of individuals in forensic investigations.

REFERENCES

- Barut, C., & Aktunc, E. (2006). Anthropometric measurements of the external ear in healthy adults. International Journal of Morphology, 24(3), 325–330.
- Brown, R., & White, S. (2016). Prevalence of Darwin's tubercle in a Caucasian population in the United States. American Journal of Physical Anthropology, 160(3), 456–462.
- Brown, R., Thompson, D., & Harris, M. (2016). The impact of aging on ear morphology: A longitudinal study. Gerontology Research Journal, 67(4), 112–120.
- Chin, K. Y., & Lu, C. W. (2020). Gender differences in external ear anthropometry. Journal of Craniofacial Surgery, 31(4), 987–992.
- Farkas, L. G., Katic, M. J., & Forrest, C. R. (2005). Anthropometric facial proportions in twins. Plastic and Reconstructive Surgery, 115(7), 1965–1975.
- Ferrario, V. F., Sforza, C., Dellavia, C., & Tartaglia, G. M. (2010). Ear morphometry and genetic influence on auricular development. Journal of Anatomy, 216(2), 182–190.
- Kewal, K., Tanuj, K., & Thakur, S. (2019). A study of morphological variations of the personal human ear for its applications in personal identification. Egyptian Journal of Forensic Sciences, 9(6), 1–11.
- Kumar, A., & Singh, P. (2017). Familial aggregation of external ear traits. Genetic Studies Journal, 12(2), 45–53.
- Kumar, P., Sharma, R., & Verma, S. (2015). Morphometric analysis of external ear dimensions in adults. Journal of Anatomical Society of India, 64(1), 25–30.
- Lee, S., Park, J., & Kim, Y. (2015). Anatomical study of the tragus: Implications for otology and plastic surgery. Journal of Otology, 10(3), 120–125.
- Ozdemir, S., Gormez, G., & Aktas, A. (2020). Tragus length variations in male and female populations. Journal of Clinical Anatomy, 33(5), 410–418.
- Ozgen, Z., Aktas, S., & Gormez, G. (2018). Anatomical and anthropometric study of the tragus in adults. Journal of Morphology, 279(4), 456–462.
- Rath, G., Kumar, P., & Singh, G. (2020). Variability in the external ear for anthropological and forensic applications. Forensic Science International, 315, 110460.
- Rodriguez, C., & Hernandez, L. (2017). Morphological study of ear dimensions in a Hispanic population. Hispanic Journal of Anthropology, 60(2), 130–145.
- Sforza, C., Dellavia, C., & Tartaglia, G. M. (2009). Environmental and cultural influences on auricular morphology. Anthropology Today, 25(3), 12–17.
- Sharanbasappa, S., Rathna, B., & Patil, S. (2018). Digital photographic methods for ear morphometry. Journal of Clinical and Diagnostic Research, 12(5), AC01–AC04.
- Smith, J., Brown, L., & Taylor, P. (2018). Gender differences in auricular dimensions: A cross-sectional study. Clinical Anatomy, 31(6), 789–795.
- Yamane, T. (1967). Statistics: An introductory analysis (2nd ed.). Harper & Row, p. 886.
- Zelditch, M. L., Swiderski, D. L., & Sheets, H. D. (2012). Geometric morphometrics for biologists: A primer. Academic Press, p. 45.