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Full Length Research Paper

A study of the level of sexual dimorphism in ear length, width and index for both left and right sides

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External ear composed of three primary components: helix-antihelical complex, conchal complex, and lobe. The aim of the study was to determine the level of sexual dimorphism in ear length, width and index for both left and right sides. The correlation between the ear variables was also determined. The population consisted of 137 males and 82 females recruited among the students of Bayero University Kano, Nigeria. Direct method was employed in measurement of ear length and width. Independent sample t test and Pearson's correlation were used to analyse the data using SPSS version 16. The result shows that mean value of ear dimensions is higher on the right side. Significant differences were also observed on ear length and width of the right side (P < 0.05), and the width and index show significant difference (P < 0.05) in the left side. In the entire variables, male tend to have higher mean value. A negative correlation between the ear length and index was observed. In conclusion, the study has established the existence of sexual dimorphism on ear linear dimensions among Hausas of Nigerian population. Therefore, the use of ear dimensions on anthropometry for characterization of the differences in sex was highlighted.

Key words: External ear, Hausas, morphometry, Nigeria, sexual dimorphism.

INTRODUCTION

The external ear is composed of three primary components: the helix-antihelical complex, the conchal complex, and the lobe (Ito et al., 2001). The shape, size and orientation of each external ear is unique as fingerprint but it is plausible to make some conclusion; males have larger ears than their females counterpart (Healthcote, 1995). Ears increase in both length and width with increase in age (Meijerman et al., 2007), from birth to 99 years of age, the increment was continuous in females, but for males it stopped around age of 50 and 70 for ear width and length, respectively (Ito et al., 2001).

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The mean values of different age groups such as 4–5 (34.16 mm), 15–17 (35.74 mm), 18–30 (34.51 mm) and 31–40 (35.72 mm) for ear width and 4–5 (50.30 mm), 15–17 (60.26), 18–30 (56.11) and 31–40 (58.43) for ear length were documented (Sforza et al., 2009).

It was also shown that in comparison to Caucasian and Japanese populations, Indian population had lower measurements of ear morphometry (Sharma et al., 2008). There is always need for anthropometric data for a given population especially for the need of identification as well as designing products suitable for utility by the population. The ear dimension is one of such variables whose information is vital for ear reconstruction, ear related instruments among others.

The aim of the study was to determine the level of sexual dimorphism in ear length, width and index for both left and right sides. The correlation between the ear variables was also determined.

SUBJECTS AND METHODS

A total of 219 subjects consisted of 137 males and 82 females were randomly selected among Bayero University Kano students for the study. This followed written informed consent from the participants. Willing participants with physical deformity such as malformed external ear or any evidence of use of heavy ear ring (especially by the females) were excluded from the study. Most (95%) of the participants fall within the age range of 18 to 25 years.

The direct method using calibrated transparent ruler was employed in measurement of ear length and width. The ear length was measured as the distance from the caudal most projection of the lobule to the cephalic most projection of the helix. Ear width was measured as distance between the most anterior and posterior points of the external ear (Brucker et al., 2003). Repeated measurement was employed to ensure accuracy by single author with the subject in Frankfurt position. All the variables were measured in mm. Ear index was calculated as ear width/ ear length ×100 (Nathan et al., 2008) Figures 1 and 2.

The data were expressed as mean ± standard deviation. The independent t-test was used to analyze the sexual dimorphism in the ear variables. Pearson’s correlation was used to determine the correlation between the study variables. SPSS version 16 statistical software was used for analyses and $P < 0.05$ was considered as level of significance.

RESULTS

Table 1 shows descriptive statistics of the study population with mean age of 20.41 ± 2.94. The mean value of ear variable was higher in right sides. The standard deviation is also higher in the right side. The ear length of both sides shows the same minimum and maximum values. For the ear width and index, the right side shows higher maximum and minimum values

The sexual dimorphism on both sides in both sexes was analyzed. Significant differences were seen in ear length ($P = 0.013$) and width ($P = 0.003$) of the right side (Table 2), and the width ($P = 0.000$) and index ($P = 0.002$) show significant difference in the left side (Table 3). In the entire variables, males tend to have higher mean values compared to thier female counter part.

The correlation matrix between the variables in Table 4 shows positive correlation between the variables with the exception of ear length and index which show negative correlation. A higher correlation was observed between the left and right sides in all the variables, with ear length having stronger correlation and ear index with least. All variables show significantly high correlation ($P = 0.0000$).

DISCUSSION

As mentioned earlier, anthropometric studies had been carried out on the external ear of children with different conditions such as cleft lip/palate (Nathan et al., 2008), Down’s syndrome (Sforza et al., 2005) chromosomal abnormalities, like aneuploidy (Lettieri et al., 1993). The diagnostic values of abnormality of external ear to establish the existence of an abnormality of the urinary tract, as a result of coincidence in the period of embryogenesis has been reported (Perrin et al., 1999).

The present study shows existence of sexual dimorphism in the ear width on both sides. For ear length and index, significant differences were observed in only right and left sides respectively. Existence of sexual dimorphism in external ear dimensions were also documented (Bozkir et al., 2006; Meijerman et al., 2007; Niemitz et al., 2007). It was shown that sexual dimorphism exists in ear linear dimensions between males and females with higher values in males (Brucker et al., 2003). This is similar to the findings of Bozkir et al. (2006) who observed significant difference in ear height between Turkish and Japanese populations. In the same study, it was also shown that the total ear height and ear width were longer in males within the Turkish population. It was therefore concluded that all ear dimensions were significantly larger in males than in females (Sforza et al., 2009). The differences in males and females may be linked to the statement that auricle expansion starts earlier in males than females, which continues up to the older age (Meijerman et al., 2007). The variations in gender may also be influenced by genetic factors which vary with sex. Correlation between the variables was also studied. The result shows that there is significant correlation between the ear variables.

Various methods such as white light (Bhatia et al., 1994) and laser scanning (Moss et al., 1989) were used to measure the external ear linear dimensions, but an additional method used in the current study proved to be inexpensive and less cumbersome as well as being an alternative method of ear measurements when other sophisticated methods are not available. The other inexpensive methods such as two-dimensional photography were also proved to have some advantages like less cost, accessibility, portability, and easy to handle (Inoue et al., 1995; Nechala et al., 1999). Despite all these advantages, it may be time consuming compared to the current method, especially when a quick decision needs to be made. To summarize the issue, it was previously concluded that there are no significant differences in measurements of external ear linear dimensions (length and width) between direct anthropometry, scanning and photogrammetric measurements. Moreover, reproduction accuracy was not significantly

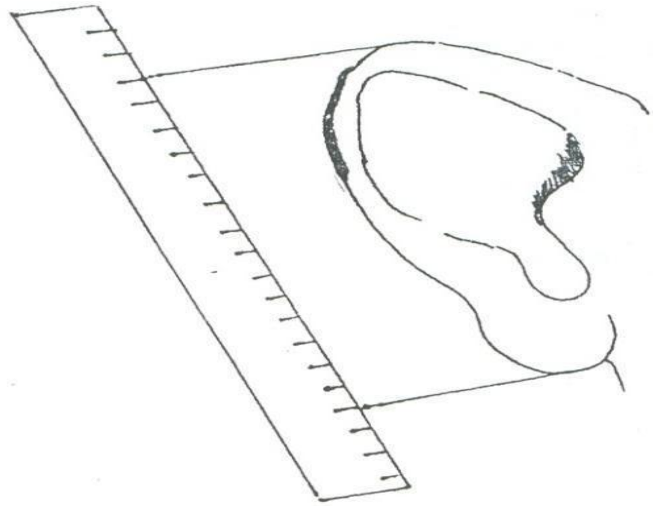

Figure 1. Demonstration of ear length measurements. Landmarks: superior aspect of the outer rim of the helix to the most inferior border of the ear lobe.

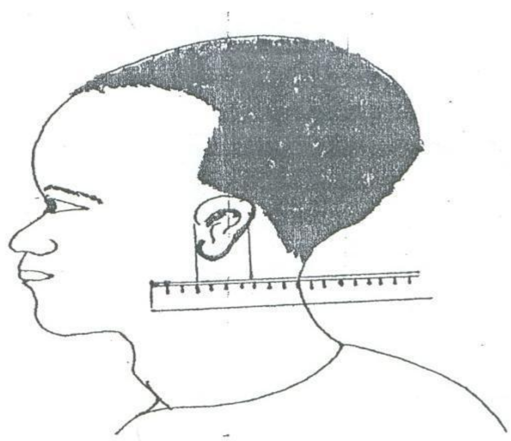

Figure 2. Demonstration of ear width measurements. Landmark: Transversely from the anterior base of the tragus to the margin of the helcal rim at the widest point.

Table 1. General characteristics of the study population (n =219).

Variables	Mean	SEM	SD	Range	Min	Max	Variance
Age	20.41	0.20	2.94	24.00	16.00	40.00	8.67
REL	60.31	0.27	3.93	20.00	50.00	70.00	15.47
LEL	59.95	0.25	3.66	20.00	50.00	70.00	13.37
REW	30.46	0.17	2.52	15.00	23.00	38.00	6.36
LEW	29.54	0.16	2.33	12.00	24.00	36.00	5.41
REI	50.59	0.27	3.94	23.79	40.00	63.79	15.55
LEI	49.36	0.25	3.69	24.04	37.50	61.54	13.60

REL; Right ear length, LEL; Left ear length, REW; Right ear width, LEW; Left ear width, REI; Right ear index, LEI; Left ear index, SEM; standard error of mean, SD; standard deviation.

Table 2. Sexual dimorphism between male and female subjects on the right side.

Variables	Sex	Mean	SD	SEM	t	P
Ear length	Male*	60.82	3.84	0.33	2.50	0.013
	Female**	59.46	3.97	0.44		
Ear width	Male	30.85	2.50	0.21	2.98	0.003
	Female	29.82	2.45	0.27		
Ear index	Male	50.81	3.95	0.33	1.04	0.301
	Female	50.24	3.93	0.43		

*n= 137, **n=82.

Table 3. Sexual dimorphism between male and female subjects on the left side.

Variables	Sex	Mean	SD	SEM	t	P
Ear length	Male*	60.31	3.54	0.30	1.92	0.057
	Female*	59.34	3.80	0.42		
Ear width	Male	30.09	2.22	0.19	4.68	0.000
	Female	28.63	2.22	0.25		
Ear index	Male	49.95	3.48	0.30	3.17	0.002
	Female	48.36	3.83	0.42		

*n= 137, **n=82.

Table 4. Correlation matrix of the variable of the ear dimension.

	LEL	REW	LEW	REI	LEI
REL	0.893** 0.000	0.481** 0.000	0.413** 0.000	-0.333** 0.000	-0.299** 0.000
LEL		0.490** 0.000	0.460** 0.000	-0.235** 0.000	-0.338** 0.000
REW			0.720** 0.000	0.665** 0.000	0.364** 0.000
LEW				0.425** 0.000	0.678** 0.000
REI				.	0.653** 0.000

**. Correlation is significant at the 0.01 level (2-tailed).

different between each method, but the standard deviation among the three methods was found to be higher in direct anthropometry compared to other methods (Liu et al., 2010). For more accuracy and consistency in measurements, the following point suggested by Gavan (1950) was put into consideration ; decrease in the number of measurers (only single author involved in measurement), increase in the experience of the measurer (repeated measurement method was adopted), and the landmarks were clearly and well defined.

In conclusion, the present study has established the existence of sexual dimorphism in the ear linear dimensions among Hausas of Nigerian population. Therefore, the use of ear dimensions in anthropometry for characterization of the differences in sex was highlighted in the present study. An alternative method adopted in the study for measurement of linear ear dimensions was proved to have potential in ear morphometry. Research regarding the comparison of the data obtained in this study with other African populations is ongoing, which aims at defining the differences that may exist between Africans and other populations.

REFERENCES

Bhatia G, Vannier, MW, Smith, KE, Commean PK, Riolo J, Young VL (1994). Quantification of facial surface change using a structured light scanner. Plast. Reconstr. Surg., 94: 768-774.

Bozkir MG, Karakas P, Yavuz M, Dere F (2006). Morphometry of the external ear in our adult population, Aesth. Plast. Surg., 30: 81-85

Brucker MJ, Patel J, Sullivan PK (2003). A morphometric study of the external ear: Age and sex related differences. Plast. Reconstr. Surg., 112: 647-652.

Gavan JA (1950). The consistency of anthropometric measurements. Am. J. Phy. Anthro., 8, 417-426

Healthcote JA (1995). Why do old men have big ears? BMJ, 311: 1668

Inoue K, Ichikawa R, Nagashima M, Kodama G (1995), Sex differences in the shapes of several parts of the young Japanese face. Appl. Hum. Sci., 14: 191.

Ito I, Ikeda M, Sueno K, Sugiura M, Suzuki S, Kida A (2001). Anthropometric study on normal human auricle in Japan, Nippon Jibiinkoka Gakkai Kalho, 104(2): 165-174.

Lettieri L, Rodis JF, Vintzileous AM, Feeney L, Craffey A (1993). Ear length in second-trimester aneuploid foetuses. Obstetr. Gynaecol., 81: 57-60.

Liu B, Tseng H, Chia T (2010). Reliability of External Ear Measurements Obtained by Direct, Photocopier Scanning and Photo Anthropometry. IEMS, 9(1): 20-27.

Meijerman L, van der Lugt C, Maat GJR (2007). Cross-sectional anthropometric study of the external ear. J. Forensic Sci., 52: 286-293.

Moss JP, Linney AD, Grindrod SR, Mosse CA (1989), A laser scanning system for the measurement of facial morphology. Opt. Lasers Eng., 10: 179-190.

Nathan N, Latham K, Cooper J, Perlyn C, Gozlan I, Thaller SR (2008). Anthropometry of the external ear in children with cleft lip and palate in comparison to age-matched controls. J. Craniofac. Surg., 19: 1391-1395.

Nechala P, Mahoney J, Farkas LG (1999). Digital two-dimensional photogrammetry: A comparison of three techniques of obtaining digital photographs. Plast. Reconstr. Surg., 103: 1819-1825.

Niemitz C, Nibbrig M, Zacher V (2007). Human ears grow throughout the entire lifetime according to complicated and sexually dimorphic patterns – conclusions from across-sectional analysis. Anthropol. Anz., 65: 391-413.

Perrin P, Baithelme H, Moyot D, Pem C, Schmitt M (1999). External ear and abnormality of the urinary tract: A cornparative study of 2 series (100 and I50 cases). Rev. Laryngol. Otol. Rhinol. (Bord), 112: 399-403.

Sforza C, Dellavia C, Tartaglia GM, Ferrario VF (2005). Morphometry of the ear in Down's syndrome subjects: A three-dimensional computerized assessment. Int. J. Oral Maxillofa. Surg., 34: 480-486.

Sforza C, Grandi G, Binelli M, Tommasi DG, Rosati R, Ferrario VF (2009). Age and sex related changes in the normal human ear. Forensic Sci. Int., 100.e1-110.e7.

Sharma A, Kumar A, Poonam S (2008). Age dependant changes in lobule of human ear and its influence on individual identification. Indian J. Forensic Med. Toxicol., 2(2): 7-8.