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ETHNIC DIFFERENCES IN THE MORPHOLOGY OF THE PINNA

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ABSTRACT

Metric features of the ear are important for diagnosis of congenital malformations, pre-operative planning and design of hearing devices. Non-metric features including earlobe attachment is a marker of population genetics. Although these features vary with sex and populations, it's unclear whether they show ethnic variations. This study describes ethnic differences in the morphology of the pinna. Both ears of one hundred and forty-eight (148) medical students (80males and 68 females) [recruited from four ethnic groups: Kenyan Indian, Kenyan Arab, Kikuyu and Luhya] were studied**.** Ear projection, heights and widths of ear, earlobe and concha were measured. For the Kenyan Indians, Arabs, Kikuyus and Luhyas respectively, proportion of free earlobes was 70.1%, 48.6%, 37.8%, 43.2%, attached lobes was 21.6% 27.1%, 42.9%, 32.4%. Mean earlobe height was 18.2mm, 16.7mm, 15.8mm, 15.8mm (p=0.001), ear projection at mid-tragus was 14.5mm, 13.5mm, 12.5mm, 12.6mm (p=0.035). Ethnic differences are present in earlobe height, attachment type and ear projection at mid-tragus. Earlobe height among indigenous Kenyans is significantly smaller compared to Kenyan Indians and Arabs. The attached earlobe is most prevalent among Kenyan indigenous while the free earlobe is most prevalent among Kenyan Indians. These features ought to be considered in aesthetic reconstruction of ear during earlobe rejuvenation and correction of projected ears.

Keywords: Pinna morphology, Ethnic difference, Variations

INTRODUCTION

The pinna, also known as the ear auricle, is a defining feature of the human face. Together, the pinna and the external acoustic meatus form the external ear. The lateral surface of the auricle displays a unique contour in terms of prominences and depressions. These are formed through a complex developmental process which eventually gives the pinna a unique morphology in every individual (Moore et al., 2011). The features of the pinna are used by clinicians in diagnosis of congenital disorders (Hunter and Yotsuyanagi, 2005). It is used as an index to determine microtia and macrotia, to diagnose first arch disorders including Treacher Collins' syndrome (Farkas, 1978), and chromosomal abnormalities like Down's syndrome (Sforza et al., 2005). Wide and narrow ears have been observed in congenital anomalies like Apert's and Crouzon's syndromes and in patients with cleft palate respectively (Bozkır et al., 2006; Nathan et al., 2008). Ear dimensions are also used by plastic surgeons in pre-operative planning of otoplasty procedures involving correction of lobular ptosis and ear projection. Features of the pinna which serve these important functions include the heights and widths of the ear, earlobe, and the concha as well as ear projection dimensions. These features have been reported to vary with gender (Murgod et al., 2013) and between populations (Jung and Jung, 2003). Numerous studies have assessed for age and gender differences in morphology of the pinna but ethnic differences in the morphology remain largely unexplored. Findings of studies in Nigeria among the Urhobo and Hausa tribes seem to suggest that ethnic

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differences may exist. Eboh (2013) reported a mean height of 56.79±4.26mm among the Urhobo people while Taura et al (2013) found a mean of 60.31±3.54 mm among the Hausa of Nigeria. The differences are, however, yet to be clearly elucidated. This study therefore aims to determine ethnic differences in the morphology of the pinna in a select young adult Kenyan population.

MATERIALS AND METHODS

Both ears of One hundred and forty-eight (148) undergraduate medical students, 37 students each from 4 ethnic groups, of the University of Nairobi (UoN) were studied following ethical approval from Kenyatta National Hospital/University of Nairobi Ethics and Research Committee (KNH-UoN/ERC). Male and female medical students of age range 18-25 years, from Kikuyu, Luhya, Kenyan Arab and Kenyan Indian ethnic groups were included in this study. Convenient sampling was used. Students were recruited based on their availability and willingness.

Students with evidence of visible trauma around the ear, those with congenital malformations of the ear including keloids and those with history of previous surgery on the ear were excluded from the study. The age group 18-25 years was used to provide data of a young adult population since ear reconstruction is normally done to return the ear to a youthful appearance.

The study involved the following measurements for each subject's right and left ears: ear height, ear width, earlobe height, earlobe width, conchal height, conchal width and Ear projection at superaureale level and mid-tragal level (Figure 1). All the measurements were made with the subjects' heads in the Frankfort horizontal position with reference from standard landmarks using a digital vernier caliper (Pittsburgh TM) with an accuracy of 0.1mm as per the methodology of Murgod et al (2013) and Deopa et al (2013). The earlobe attachment type was classified into Free, Attached or Intermediate based on the methodology by Murgod et al (2013) [Figure 2].

Comparisons of means between the 4 ethnic groups was done using one way-Analysis of Variance (ANOVA) test. A p value of ≤ 0.05 was considered significant at 95% confidence interval.

RESULTS

In the current study, significant ethnic differences were observed in Earlobe height (ELH) (p=0.001), ear projection at mid-tragal level (EPm) (p=0.035) and in earlobe attachment (p=0.036) (Table 1). Indians had the longest ears while the Luhya group had the shortest ears. The difference in means in ear height between the groups approached statistical significance (p=0.051). Indians had the longest earlobe while Kikuyus and Luhyas had the shortest. After Bonferonni correction, significant difference was observed in the mean ELH between Indians Vs Kikuyus and Indians Vs Luhyas (p= 0.001) (Table 2). The difference between Kikuyus and Luhyas was not statistically significant (P value= 1.000).

There was significant difference in the proportions of the lobe attachment type between the ethnic groups (p =0.036). Kenyan Indians had the largest proportion of free type of earlobe attachment (70.1%) while Kikuyus had the least (37.8%) The attached type was most prevalent among Kikuyus and Luhyas. Indians had the lowest number of intermediate type when compared to the other groups (Table 3).

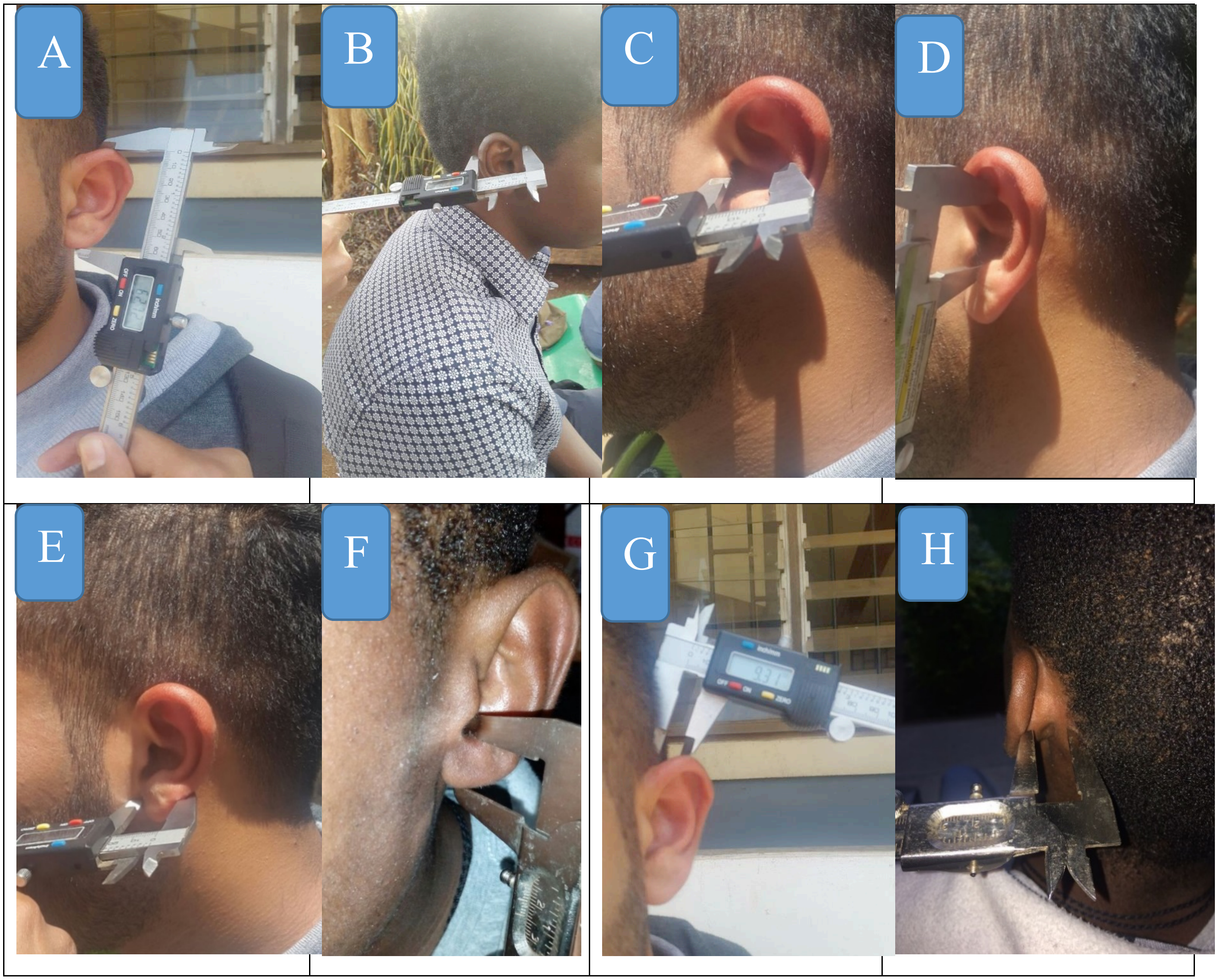

Figure 1: Images showing how ear measurements were made: A- ear height (from the most superior projection of the helix to the most inferior projection of the earlobe) B- ear width (from crus of the helix anteriorly to the most posterior aspect of the helix) C- conchal width (from the highest part of the antihelix to the inter-tragic notch) D- conchal height (from the highest part of the antihelix to the inter-tragic notch) E- earlobe width (measured at mid-level of the ear lobe from the most anterior aspect to the most posterior aspect) F- Ear projection at supra-aureale level (most superior part of the medial (inner) surface of the helix to the temporal bone).

Table 1: Table showing dimensions of various features of the pinna in different ethnic groups

	ARABS (n=37)	INDIANS (n=37)	KIKUYUS (n=37)	LUHYAS (n=37)	P value
EH	56.3±5.9	58.9±5.0	56.5±3.3	54.7±4.6	0.051
EW	32.6±3.3	33.0±3.7	32.5±2.7	32.8±3.9	0.895
ELH	16.7±2.2	18.2±2.4	15.8±2.1	15.8±2.3	0.001
ELW	19.2±2.1	20.0±2.8	19.4±2.2	20.0±2.3	0.394
CH	24.3±2.9	23.5±1.9	23.4±2.8	22.6±2.9	0.114
CW	17.4±2.0	16.7±2.0	17.7±2.1	17.4±2.4	0.157
EPs	3.4±1.9	4.8±1.7	4.7±1.8	4.4±1.8	0.056
EPm	13.5±3.6	14.5±3.6	12.5±3.0	12.6±2.5	0.035

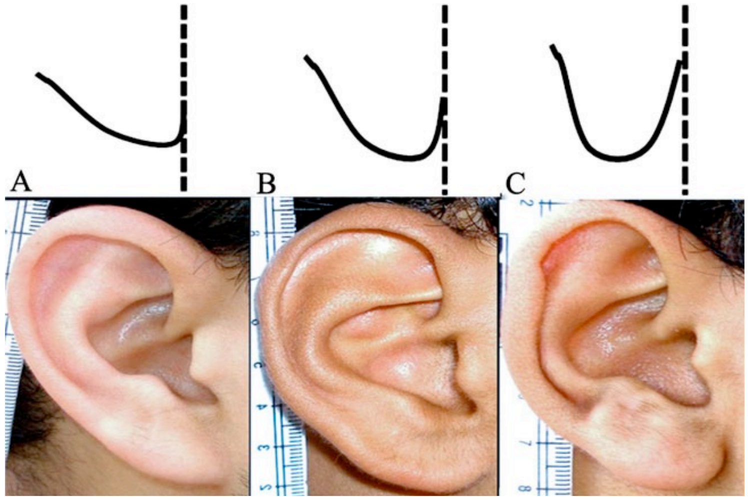

Figure 2: Image showing classification of ear lobe attachment as per Murgod et al (2013). A-attached B- intermediate C-free

Table 2: Table showing difference between groups after Bonferroni correction

	Arab-Indian	Arab-Kikuyu	Arab-Luhya	Indian-Kikuyu	Indian-Luhya	Kikuyu-Luhya
ELH	0.639	0.682	0.752	<0.001	<0.001	1.000
EPm	1.000	0.826	0.820	0.05	0.059	1.000

Table 3: Table showing prevalence of earlobe attachment type in the groups

Lobe attachment type	ARAB n=37	INDIAN n=37	KIKUYU n=37	LUHYA n=37
FREE	(48.6%)	(70.1%)	(37.8%)	(43.2%)
ATTACHED	(27.1%)	(21.6%)	(42.9%)	(32.4%)
IM	(24.3%)	(8.1%)	(18.9%)	(24.3%)

DISCUSSION

The present study reports significant differences in the ELH between Indians when compared with Kikuyus and Luhyas. There was however no significant difference between Kikuyus and Luhyas. Their similarity in ELH is possibly because they are both members of the Bantu ethnic group in Kenya. Similarity in ELH was also reported in the study of Sharma et al (2007) between the northwest Indian sample population, the Onge and Andhra Indian people. The difference in earlobe height between the Kenyan Indians and Kikuyus and Luhyas could be due to the varying prevalence of earlobe attachment types in these groups. Free earlobes are generally longer compared to non-free. Indians had a higher prevalence of free earlobes compared to the Kikuyus and Luhyas who had more of the non-free earlobes (attached and intermediate). The difference could also be attributed to the genetic differences in the ethnic groups. Adhikari et al (2015) found that four genomic loci, 2q 12.3, 2q 31.1, 3q23 and 6q 24.2, were linked with earlobe size and the lobe attachment type was associated with loci 2q 12.3 and 2q31.1. They showed that variations in single nucleotide polymorphisms (SNPs) at these

loci existed in different Carribean populations and this explained their earlobe morphology differences. It is then possible that variation in the SNPs between Indian and the kikuyus and Luhyas could explain the difference observed in the ELH.
The presence of ethnic difference observed should be considered by plastic surgeons during earlobe reconstruction procedures for better outcome. Absence of ethnic difference among the Kikuyus and Luhyas suggests that the data provided could be suitable for use as reference data for the Bantu people in Kenya. It was also noted that Kenyan Indians had more projected ears than Kikuyus at mid-tragal level. Indians also had more projected ears than Luhyas but the difference was marginally significant (0.056). Ear projection has been shown to be associated with genomic locus 2q12.3 and it is the variations in SNPs at this locus that could explain the difference in these groups (Adhikari et al., 2015). The difference in EH in the present study was marginally statistically significant ($p<0.051$). It is possible that this difference could be significant upon increasing the sample size. The difference in EH between the groups could be due to the variation in the earlobe height. It is reasonable that the earlobe height affects total ear height. Therefore, it is possible that the large proportion of free type earlobe among Indians contributed to their longer ELH and EH. Luhyas on the other hand had the attached type as their most prevalent attachment type which may partly explain their low mean EH.
The earlobe attachment type is polymorphic trait where more than one gene locus is involved (Dronamraju, 1966; Adhikari et al., 2015). Ear lobe attachment variations have been linked with single nucleotide polymorphisms in two regions in chromosome 2 (2q 12.3 and 2q 31.1) (Adhikari et al., 2015). It is conceivable that genetic variation in the ethnic groups could explain the differences in prevalence of earlobe attachments. Earlobe attachment type is known to affect the rate of lobular ptosis with age. The free earlobe type has a higher rate of sagging with age compared to the attached type (Azaria et al., 2003; Sharma et al., 2007). It is therefore conceivable that populations with larger frequency of free type may have higher incidences of lobular ptosis with age compared to those with attached ear lobes.

In conclusion, ethnic differences are present in the earlobe height, attachment type and ear projection at mid-tragal level. The earlobe height among indigenous Kenyans was significantly smaller compared to Kenyan Indians and Kenyan Arabs. The attached earlobe was the most prevalent among the Kenyan indigenous while the free earlobe was the most prevalent in the Kenyan Indians. These features ought to be considered in aesthetic reconstruction of ear during earlobe rejuvenation and correction of projected ears. Further studies in different populations to corroborate these findings are warranted.

CONFLICT OF INTERESTS

None

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