Comparison of Auricular Anthropometric Measurements of Pupils in Deaf and Regular Schools in Kaduna Metropolis, Kaduna-Nigeria

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Abstract

Background: Individuals with abnormal set of ears feel depressed, and this could affect their self esteem.
Methods: A cross-sectional study that assessed auricular anthropometric measurements of pupils at the schools for the deaf and those in regular schools within Kaduna metropolis, Kaduna. Ethical approval was obtained from the state Ministry of Health. Consent was obtained from the parents/guardians of the pupils and assent from the pupils. Pupils were selected in a multi-staged sampling fashion. Digital Vernier Caliper was used to measure the total ear height, the ear width and the ear projection of the deaf pupils and normal pupils. The generated data was analysed with SPSS version 20.
Results: Age range of subjects was 8-17 years, mean of 13.5±2.4 against 7-17 years, mean of 13.1±1.8 for controls. Mean right total ear height among subjects was 61.5±7.2mm against 61.3±4.6mm among controls. Left mean total ear height among subjects and controls was 61.6±7.2mm and 61.5±4.4 respectively. Mean right ear width among subjects and controls was 33.4±5.2mm and 37.2±4.0mm respectively. Mean left ear width among subjects was 33.4±5.3mm and 37.2±4.1mm among controls. Mean right ear projection among subjects was 21.7±4.1mm and 21.5±2.4mm among controls. Mean left ear projection among subjects and controls was 21.9±3.7mm and 21.4±2.3mm respectively.
Conclusion: Our study showed that the deaf pupils had lower values of ear width in both ears compared to the general population.

Keywords: Anthropometry, Auricular, Kaduna, Pupils

Highland Med Res J 2019;19(1&2):20-23

Introduction

Individuals with abnormal set of ears feel depressed, and this could affect their self esteem[1]. Caucasians have larger dimensions of the pinna compared to the negroid race[1]. The auricular dimension may also vary within different ethnic groups[2,3] and even within the same ethnic group[1]. Size of the pinna generally vary between races and occasionally between genders, as well as age of an individual. Ear height and width in children, mean of 62mm±4SD and 32mm±2SD has been documented[4]. Auricular anthropometry could also vary between same race but living in different geographical location[4].Pukrait and Singh documented variation in anthropometric measurements of the auricles of Indian men from the different regions within the country[5].

Auricular anthropometric index like total ear height, measured as the distance from the most superior projection of the helix to the most inferior projection of the auricular lobule, is important in the overall assessment of congenital external ear abnormalities especially in patients with Down's Syndrome, Apert Syndrome and Crouzon Syndrome[6]. It could be of essence in evaluating patients with congenital palatal clefts such as clefts of the lip and or palate while checking for other associated congenital anomalies. In the assessment of pupils with congenital external ear deformities, auricular anthropometry provides quantitative value for the size of the pinna[7]. Auricular anthropometry was previously being measured with a tape rule; however, due to observer error and non-reliability of reproducibility, Vernier calipers are now being used[8].Vinita et al[8] opined that photogrammetry saves more time compared to anthropometric measurements on live participants considering the length of time it takes to take all the measurements. Another point put forward was that the photograph can be accessed anytime the need arises. The photograph can also be utilized in cases of children and uncooperative subjects when identification of the landmarks become difficult[8].

Participants and Methods

This was a cross-sectional study that assessed auricular anthropometric measurements of pupils at the schools for the deaf and those in regular schools within Kaduna metropolis between November 2016 and August, 2017. Kaduna metropolis has a population of 1,139,578 with

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an estimated annual growth of population of 2.53%[9] and is located within the guinea savannah with co-ordinates latitude $10^0 31'$ 23^0 N, Longitude $7^0 26'$ 25^0E. Ethical approval was obtained from the Kaduna State Ministry of Health with protocol number MOH/ADM/744/ Vol.1/446 dated 8th September, 2016. The sample size was calculated using the Fisher formula for cross sectional study,

$n = Z^2 pq / D^2$.

Where n = minimum sample size, z = normal standard deviate which is 1.96 (at 95% confidence interval), P = prevalence of auricular anthropometric measurements among deaf pupils. No prevalence study was documented on auricular anthropometric measurements of deaf pupils in Nigeria, the West African sub-region and Africa. Therefore, an estimated prevalence of 50% was used to calculate the sample size. Therefore: p =0.5, q =1-p, q =1-0.5 = 0.5, D = Degree of Precision set at 5% = 0.05. Minimum sample size, n = 1.96^2 x 0.5x0.5 /0.05x0.05. Calculated minimum sample size was 384.16, 10% of the total was added for attrition giving 422. Thus, the minimum sample size for the study was taken as 422. Written consent was obtained from the parents/guardians of the pupils and assent obtained from the pupils. The study was explained to the deaf pupils using sign language by one of their Teachers. Four hundred and thirty pupils were enrolled from the deaf schools and also 430 pupils were enrolled from regular schools using a multi-staged sampling method.

A measuring tape was used to measure the uppermost border of the pinna to align it with a line joining the lateral canthus of the eye to the external occipital protuberans to determine whether the pinna is low set or not. Low set ear is when the upper most aspect of the helix is below the imaginary line drawn from the lateral canthus to the external occipital protuberans. Digital Vernier Caliper was used to measure the total ear height (distance between the highest point of the auricle and the lowest point of the ear lobe), the ear width (distance between the most anterior and most posterior points of the ear) and the ear projection (distance from the helix to the mastoid process at the tragal level)

Data collected was analyzed using Statistical Product and Service Solutions (IBM SPSS for Windows Chicago Illinois) version 20. Results of the study were presented as means and standard deviations of the means. Student t-test was used to compare the independent means of the quantitative data and the level of statistical significance was set at $p < 0.05$.

Results

The mean age of the subjects was 13.48±2.36 years, minimum age was 8 years and maximum age was 17 years while in the control population, the mean age was 13.08±1.81 years. The minimum age in the control population was 7 years of age and the maximum age was 17years. Sixty three percent of the subjects were between 10 – 14 years old while 76.0% of the control populations were between 10 – 14 years.

Two hundred and forty two (56.3%) subjects were males and 188 (43.7%) were females. An equal number (242 males and 188 females) were enrolled in the control group with a Male: Female ratio of 1.29:1. Table l shows the age and gender distribution of the participants.

Table 1: Grouped Age and Gender Distribution of Subjects and Controls

Subjects			Controls	
Grouped Age (Years)	Frequency	%	Frequency	%
6 - 9	13	3.0	5	1.2
10 - 13	268	62.3	333	77.4
14 - 17	149	34.6	92	21.4
Total	430	100	430	100
Gender				
Males	242	56.3	242	56.3
Females	188	43.7	188	43.7
Total	430	100	430	100

Auricular anthropometric measurements of right pinna revealed mean total ear height of 61.5±7.2mm among the subjects against 61.3±4.6mm for the control group. On the left side, the subjects had a mean total ear height of 61.6±7.2mm against 61.5±4.4 for the control group.

The right ear width measurements revealed a mean width of 33.4±5.2mm and 37.2±4.0mm in the subjects and controls respectively. On the left side, the mean ear width in the subject group was 33.4±5.3mm and in the control group, the mean ear width was 37.2±4.1mm.

Right ear projection measurements showed a mean distance of 21.7±4.1mm for the subjects and 21.5±2.4mm for the controls which was not statistically significant (p=0.383) while on the left side, the mean ear projection among the subjects and controls was 21.9±3.7mm and 21.4±2.3mm respectively.

The mean ear height among the male participants on the right was 62.6±6.3mm while the mean ear height among the female participants on the right was 59.9±5.1mm. The mean ear height on the left among the male and female participants were 62.7±6.3mm and 60.1±5.2mm respectively.

The mean ear width on the right among the male and female participants were 36.2±5.3mm and 34.2±4.4mm respectively. The mean ear width among the male participants on the left was 36.2±5.3mm while the mean ear width among the female participants on the left was 34.2±4.5mm.

The mean ear projection among the male participants on the right was 22.2±3.2mm while the

mean ear projection among the female participants on the right was 20.8±3.4mm. The mean ear projection on the left among the male and female participants were 22.3±3.1mm and 20.9±3.2mm respectively.

There were two deaf pupils with bilateral low set ears. None of the controls had low set ears.

Discussion

Generally, there is paucity of studies on the anthropometry of deaf pupils in the English literature. Anthropometric measurements in most studies showed wide range, with some statistical difference between males and females[11]. This study did not find any significant difference between the ear heights of the subjects and the control group. Mean right ear height of 61.5±7.2mm and 61.3±4mm was noted among the subjects and controls respectively, the difference was not statistically significant (p=0.683). While on the left, it was 61.6±7.2mm and 61.5±4.4mm for the subjects and controls respectively, this was also not found to be statistically significant (p = 0.898). A study conducted by Sidra et al [10] on the anthropometric measurements of human external ear among subjects aged 18-25 years showed that mean total ear height on the right as 64.2±6mm and 61.9±4.4mm on the left. In another study by Akpa et al[1]in Southeast Nigeria, the mean ear height was found to be 59.8±3.9mm and 60.2±2.9 on the right and left ears respectively. This was also similar to the findings in this study.

Ekanem et al[12]in Maiduguri Northeast Nigeria examined the auricular anthropometry of adults resident in Maiduguri and found that the mean total ear height was 56±5.6mm, which was lower than the findings from this study. This current study found that the male participants had longer distances of total ear height than the females. Ekanem et al[12]in Maiduguri also reported that when compared to the females, males generally had longer distances of the total ear height, contrasting with the observation made by Sidra et al[10] and Akpa et al.[1]Vinita et al[8] observed mean total ear height of 63.7mm among Indian adult males and 61.1mm amongst their adult female counterparts. They found that irrespective of the laterality, the total ear height for males was slightly higher than their female counterparts. Similarly, they documented the mean total ear height among South Korean males as 64.6mm compared to 60.3mm in their female counterparts, same entity was found to be similar among Italians; 61.9mm among males and 56.1mm among Italian females. Among the Germans, males were documented to have mean total ear height of 65.0mm compared to 61mm in their female counterparts. Maitreye[13] found that the probability of any two individuals having exactly same pinna generally is 0.0008%. Ear height and width can be of practical use when it comes to pinna reconstruction.

This study found significant statistical differences in the mean ear width of 33.4±5.2mm and 33.4±5.3mm in the right and left ears respectively among the subjects, 37.2±4mm and 37.2±4mm in the right and left ears of the controls respectively. Vinita et al[8] found mean right ear width of 34.78±3.32mm and left ear width of 33.06±3.08mm among normal Indian subjects. Similarly, Akpa et al[1] in Nigeria found right ear width of 31.8±2.76 and left ear width of 32.2±1.58mm among normal subjects. In contrast to this study, Sidra et al[10] in India found lower values of ear width among normal subjects they studied. The difference in auricular anthropometry could be attributed to geography and cultural practices. Nidhi Sharma[14] attributed higher values of auricular anthropometry seen in females to the use of auricular ornaments by the females, especially in India. However, this study found lower auricular anthropometric values compared to the males.

Subjects were noted to have right ear projection of 21.7±4.1mm while it was 21.5±2mm among the controls whereas the left ear projection was 21.9±3.7 and 21.4±2.3 among the subjects and controls respectively. Left ear projection was significantly different between subjects and controls. Wilfred[15]in Zimbabwe found mean right and left ear projection of 19.5±2.143mm and 19.6±2.09mm among Zimbabwean children. This finding was lower than the findings of this study. In a study conducted by Pukrait[6], the mean right ear projection was 24.8±4.9mm and the left mean ear projection was noted to be 24.8±4.9mm among normal adults in India. This finding was higher than the findings of this study. The low variation of ear projection between this study and the studies of Wilfred[15] and Pukrait[6] can be explained by the age limits of their subjects; Wilfred's subjects were 9 – 13 year olds, hence lower values while Pukrait's subjects were 18 – 30 year olds hence higher values than this study.

Low set ear was seen in 2 subjects but none in controls. The two subjects had bilateral low set ear but no other associated congenital external ear abnormality was seen among them. Chromosomal analysis should have been carried out on such pupils but for financial constraints of care givers as such investigations are usually expensive within and outside the country. Iseh et al[16] in Ibadan Southwestern Nigeria found two cases of low set ear among the general population in a study to find the pattern of congenital external ear abnormalities among the general population.

Conclusion

Our study showed that the deaf pupils had lower values of ear width in both ears compared to the general population, but there were no statistically significant differences between the two groups in terms of ear projection and total ear height in both ears. However,

there was statistically significant difference between males and females in terms of ear height, ear width and ear projection in both ears with the males having higher values than the females.

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