

ANTHROPOMETRIC MEASUREMENTS OF HUMAN EXTERNAL EAR.Sidra Shireen¹, Vrushali P. Karadkhelkar²**HOW TO CITE THIS ARTICLE:**

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ABSTRACT: AIMS AND OBJECTIVES: This study aimed at determining the normal anthropometric measurements of external ear in males and females and their comparison on either sides and in either sex. **MATERIALS AND METHODS:** The study was carried out on 147 medical students of BRIMS, Bidar Karnataka with no evidence of congenital ear anomalies or previous ear surgeries. The study cohort consisted of 70 females and 77 males aged 18-25years. Vernier Calipers were used to measure the bilateral sizes of auricles. Parameters were total ear height, ear width, lobular height and lobular width. **OBSERVATIONS AND RESULTS:** It was observed that all parameters were significantly larger on right side in both males and females which was statistically significant. All measurements were found higher in males than in females on both sides, total ear height and ear width were found to be significantly greater. **CONCLUSION:** These findings suggest that the normal anthropometric study will have implications in the cosmetic surgeries, correction of malformations, designing of head phones, ear phones and hearing aids.

KEYWORDS: Anthropometry, Morphometry, Ear Lobule, Auricle, Vernier Calipers.

INTRODUCTION: Anthropometry refers to the measurements of living human body dimensions for the purpose of understanding human physical variation as it plays an important role in plastic surgery, prosthetics and so on for data collection.¹ The human ear is divided into external, middle and internal parts. Pinna and external acoustic meatus form the external ear. The external ear is composed of three primary components: the helix-ant helical complex, the conchal complex, and the lobe.² 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 female's counterpart.³ Ears increase in both length and width with increase in age,⁴ 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.

The mean values of different age groups such as 4-5 (34.16mm), 15-17 (35.74mm), 18-30 (34.51mm) and 31-40 (35.72mm) for auricular width and 4-5 (50.30mm), 15-17 (60.26), 18-30 (56.11) and 31-40 (58.43) for auricular length were documented.⁵ 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 present study aimed at determining the normal anthropometric measurements of external ear in males and females and their comparison on either sides and in either sex as no such study has been conducted so far in this institute.

MATERIALS AND METHODS: SUBJECTS: The study was carried out on 147 medical students of BRIMS, Bidar, Karnataka with no evidence of congenital ear anomalies or previous ear surgeries. The study cohort consisted of 70 females and 77 males aged 18-25 years. Clearance of institutional ethical

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committee was obtained before starting the work. The purpose of study was explained to the subjects; their willingness and cooperation were considered.

ANTHROPOMETRIC MEASUREMENTS: After explaining the purpose of study, bilateral sizes of auricles were measured. The Parameters were total ear height (THE), ear width (EW), lobular height (LH) and the lobular width (LW) for each right and left ears of the subject when the head was in Frankfort horizontal plane. Figure 1 shows the measurement of auricle by a vernier caliper. Figure 2 demonstrates the, which was measured as the distance between the inferior projection of ear lobule and the most superior projection of helix. Similarly the EW (Figure 2) was measured as the distance between the most anterior and the most posterior points of auricle. The LH was taken as the distance between the most inferior ends of lobule to base of tragal notch. The LW was measured as horizontal width of lobule.

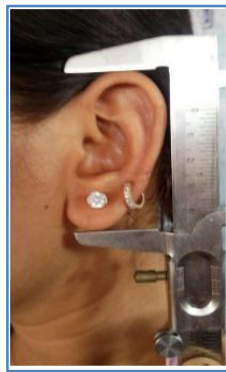


Fig. 1

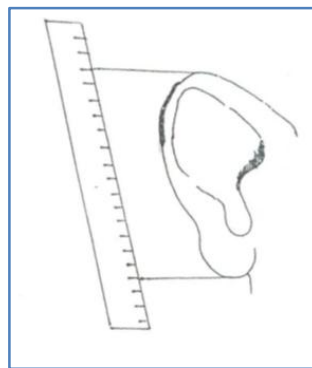


Fig. 2

All the measurements were taken by the single investigator using vernier calipers capable of measuring to the nearest 0.1mm. Comparison of the measurements according to gender were performed using an independent samples t-test. Comparison of measurements taken from the right and left ears of a given sex was performed using paired samples t-test.

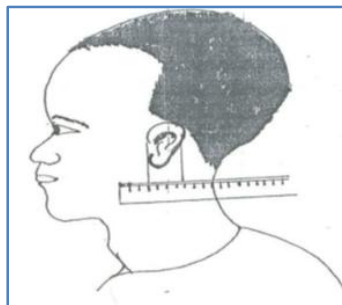


Fig. 3

OBSERVATIONS AND RESULTS: The measurements and comparison of results according to genders who participated in the study are shown in table 1 and table 2 where all the dimensions were higher in males as compared to the female subjects. Tables 3 and 4 showed that the right ear indices were significantly larger than the left ear indices in both male and female subjects.

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Comparison of Male Vs Female Right Ear					
Variables	Gender	Mean	SD	t	p
Ear Height (EH)	Male	6.42	0.61	0.896847213	0.371458282
	Female	6.34	0.39		
Ear Width (EW)	Male	2.94	0.28	3.379448921	0.000933206
	Female	2.79	0.25		
Lobular Height (LH)	Male	2.01	0.30	3.09174183	0.000301990
	Female	1.85	0.21		
Lobular Width (LW)	Male	1.96	0.25	5.91064834	0.000000123
	Female	1.77	0.16		

Table 1

Comparison of Male Vs Female Left Ear					
Variables	Gender	Mean	SD	t	p
Ear Height (EH)	Male	6.19	0.44	0.633534143	0.527396869
	Female	6.14	0.45		
Ear Width (EW)	Male	2.87	0.49	2.029975074	0.044607937
	Female	2.74	0.26		
Lobular Height (LH)	Male	1.91	0.31	3.160751721	0.001921235
	Female	1.77	0.24		
Lobular Width (LW)	Male	1.85	0.18	9.317662232	0.000000000
	Female	1.57	0.18		

Table 2

Comparison of male right ear Vs Left Ear					
Variables	Male ear	Mean	SD	t	p
Ear Height (EH)	Right	6.42	0.61	2.697315208	0.007855422
	Left	6.19	0.44		
Ear Width (EW)	Right	2.94	0.28	1.075991664	0.284071723
	Left	2.87	0.49		
Lobular Height (LH)	Right	2.01	0.30	1.951566367	0.052828042
	Left	1.91	0.31		
Lobular Width (LW)	Right	1.96	0.25	3.278231263	0.001321908
	Left	1.85	0.18		

Table 3

Comparison of female right ear Vs left ear					
Variables	Female ear	mean	SD	t	p
Ear Height (EH)	Right	6.34	0.39	2.860679099	0.004900458
	Left	6.14	0.45		
Ear Width(EW)	Right	2.79	0.25	1.176706048	0.241338548
	Left	2.74	0.26		
Lobular Height(LH)	Right	1.85	0.21	2.164315365	0.032199365
	Left	1.77	0.24		
Lobular Width(LW)	Right	1.77	0.16	3.950147257	0.000125673
	Left	1.57	0.18		

Table 4

DISCUSSION: The auricle reaches its mature height at 13 years in male and at 12 years in females.⁶ Anthropometric studies had been carried out on the external ear of children with different conditions such as cleft lip/palate,⁷ Down's syndrome,⁸ chromosomal abnormalities, like aneuploidy.⁹ 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.¹⁰ An acquired deformity that develops with aging may include elongation or Ptosis of the ear lobe. This condition has been attributed to the loss of elastic fibres and gravitational forces.¹¹ Earrings add additional weight on the ears, and they therefore affect ear lobe.¹²

Existence of sexual dimorphism in external ear dimensions were documented.¹³ It was shown that sexual dimorphism exists in auricular linear dimensions between males and females with higher values in males.¹⁴ 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 auricular height and width were longer in males within the Turkish population. It was therefore concluded that all auricular dimensions were significantly larger in males than in females. It was therefore concluded that all auricular dimensions were significantly larger in males than in females. 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.¹⁵ The variations in gender may also be influenced by genetic factors which vary with sex.

The present study shows existence of sexual dimorphism in the auricular dimensions on both sides, significant differences were observed in right and left sides respectively. For more accuracy and consistency in measurements, the following point 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.¹⁶

CONCLUSION: This study provides the mean values of different morphometric measurements of right and left ears in the students of BRIMS, Bidar. As a result, the present study has established the existence of sexual dimorphism in external ear dimensions and also the differences between the auricular indices of both sides. The result shows that there is significant correlation between the ear variables.

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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. Knowledge about the normal auricular dimensions is important in the diagnosis of congenital malformations, syndromes and acquired deformities thus the study has implications in the cosmetic surgeries, correction of malformations, designing of head phones, ear phones and hearing aids.

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