

# Morphometric Analysis of External Ear in Tribal Population of South Rajasthan

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| Received: 05.04.2019 | Accepted: 14.04.2019 | Published: 23.04.2019

DOI: [10.21276/sijap.2019.2.4.3](https://doi.org/10.21276/sijap.2019.2.4.3)

## Abstract

Ear length, ear width, lobular length and lobular width are different in every human at their various stage of age. The study aimed at to obtain morphometric measurements in relation to age and combined analysis of right and left ears. 250 peoples selected for this study. All measurements were taken with help of digital vernier caliper and recorded in centimeter after taking informed written consent. The mean and SD of TEH were  $5.79 \pm 0.36$  cm,  $5.72 \pm 0.37$ cm, EW were  $2.63 \pm 0.27$  cm and  $2.71 \pm 0.29$  cm, LH of right and left ear were  $1.54 \pm 0.16$  cm and  $1.62 \pm 0.17$  cm and LW were  $1.68 \pm 0.26$  cm and  $1.69 \pm 0.21$  cm of right and left ear in 16-19 age group respectively. In the age group of 20 -22 years, the mean and SD of TEH were  $5.98 \pm 0.43$  cm and  $5.91 \pm 0.42$  cm, EW were  $2.87 \pm 0.27$  cm and  $2.81 \pm 0.26$  cm, LH were  $1.60 \pm 0.18$  cm and  $1.66 \pm 0.17$  cm and LW were  $1.70 \pm 0.26$  cm and  $1.74 \pm 0.26$  cm of right and left ear. In the age group of 23-26 years the mean and SD of TEH were  $6.16 \pm 0.29$  cm and  $6.03 \pm 0.18$  cm, EW were  $2.99 \pm 0.19$  cm and  $3.00 \pm 0.22$  cm, LH were  $1.63 \pm 0.19$  cm and  $1.67 \pm 0.13$  cm and LW were  $1.71 \pm 0.23$   $1.80 \pm 0.23$  of right and left ear. All parameter were increasing with advancing age.

**Keywords:** Morphometry, Total ear length (TEH), Ear width (EW), Lobular height (LH), Lobular width (LW), Vernier caliper.

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## INTRODUCTION

The ear is the organ of hearing and equilibrium. The ear consists of three principal regions: the outer ear, the middle ear, and the inner ear. Human ear growth is an important feature in relation to the age. Ear length, ear width, lobular length and lobular width are totally different in every person. This aspect provide an individual medico legal scenario of an unidentified body. Heathcote JA found a positive correlation between age and ear size in japan, the study said as we get older our ear size increases [1]. Ear size and pattern affects the individual human health [2, 3]. According to them defect in ear lobule (like crease) may have heart disease with other mortality. Ito I *et al.*, observed in 1958 subjects in different age group that the length of ear, ear width, lobular length and lobular width was different [4]. The study described the external ear height, width, lobular height and width in the age group of 16-26 years in both sex, in which the age is divided into three groups according to the difference occur was 16-19 years, 20-22 years and 23-26 years of age group and from this study its investigate that Anatomical and Morphological difference occur in relation to age would

be established. These study data have application in screening for or monitoring disease, otoplastic surgery, forensics, industrial design, apparel design and ergonomics.

## MATERIAL AND METHODS

This study was done on the tribal population of south Rajasthan on 250 peoples after taken permission of institutional ethical committee and consent from all subjects.

**Inclusion Criteria:** peoples between the age group of 16 to 26 years on 250 cases on both sexes.

**Exclusion Criteria:** person with physical deformity such as microtia, lobule ptosis may result from trauma or congenital deformaties.

Digital vernier caliper was used for taking various ear dimensions like total ear height (TEH), ear width (EW), lobular height (LH), and lobular width (LW) were recorded for each right and left ears. TEH is distance from the most inferior projection of the ear

lobule to the most superior projection of ear, EW is distance between the most anterior and posterior points of the ear, LH is distance from the most inferior end of the lobule to the base of the tragal notch and LW is transverse or horizontal width of the lobule. The data was divided into 16-19 years, 20-22 years and 23-26

years age groups, data were analyzed and presented as mean  $\pm$  SD.

## RESULTS

In this study we obtain morphometric measurements in relation to age in right and left ear.

**Table-1: Statistical Data of different parameters of ear according to different age group**

Age group	Parameters							
	TEH(cm)		EW(cm)		LH(cm)		LW(cm)	
	Right ear	Left ear	Right ear	Left ear	Right ear	Left ear	Right ear	Left ear
16-19 years	5.79 $\pm$ 0.36	5.72 $\pm$ 0.37	2.63 $\pm$ 0.27	2.71 $\pm$ 0.29	1.54 $\pm$ 0.16	1.62 $\pm$ 0.17	1.68 $\pm$ 0.26	1.69 $\pm$ 0.21
20-22 years	5.98 $\pm$ 0.43	5.91 $\pm$ 0.42	2.87 $\pm$ 0.27	2.81 $\pm$ 0.26	1.60 $\pm$ 0.18	1.66 $\pm$ 0.17	1.70 $\pm$ 0.26	1.74 $\pm$ 0.26
23-26 years	6.16 $\pm$ 0.29	6.03 $\pm$ 0.18	2.99 $\pm$ 0.19	3.00 $\pm$ 0.22	1.63 $\pm$ 0.19	1.67 $\pm$ 0.13	1.71 $\pm$ 0.23	1.80 $\pm$ 0.23

During this study we found that in 16-19 years of age group the mean and SD of TEH right ear was 5.79  $\pm$  0.36 cm, and in left ear was 5.72  $\pm$  0.37cm, EW of right ear was 2.63  $\pm$  0.27 cm and in left ear was 2.71  $\pm$  0.29 cm, LH of right ear was 1.54  $\pm$  0.16 cm. and in left ear was 1.62  $\pm$  0.17 cm, LW of right ear was 1.68  $\pm$  0.26 cm and for the left ear was 1.69  $\pm$  0.21 cm respectively (Table-1).

In the age group of 20 -22 years the mean and SD of TEH right ear was 5.98  $\pm$  0.43 cm and left ear was 5.91  $\pm$  0.42 cm, EW of right ear was 2.87  $\pm$  0.27

cm and for the left ear was 2.81  $\pm$  0.26 cm, LH for right ear was 1.60  $\pm$  0.18 cm and for left ear was 1.66  $\pm$  0.17 cm and LW of right ear was 1.70  $\pm$  0.26 cm and for left ear was 1.74  $\pm$  0.26 cm was found (Table-1).

In the age group of 23 -26 years the mean and SD of TEH right ear was 6.16  $\pm$  0.29 cm and in left ear was 6.03  $\pm$  0.18 cm, EW of right ear was 2.99  $\pm$  0.19 cm and for left ear was 3.00  $\pm$  0.22 cm, LH of right ear was 1.63  $\pm$  0.19 cm and in left ear was 1.67  $\pm$  0.13 cm and LW of right ear 1.71  $\pm$  0.23 cm and for left ear 1.80  $\pm$  0.23 cm was found (Table-1).

**Table-2: Statistical data of different parameter of ears**

parameters	Statistical data			
	Mean		Standard deviation	
	Right ear	Left ear	Right ear	Left ear
TEH(cm)	5.90	5.83	0.39	0.38
EW(cm)	2.75	2.79	0.29	0.28
LH(cm)	1.57	1.64	0.17	0.16
LW(cm)	1.69	1.72	0.26	0.23

In combined analysis of right ear of total data we found mean and SD of TEH was 5.90  $\pm$  0.39 cm, in left ear was 5.83  $\pm$  0.38 cm, EW of right ear was 2.75  $\pm$  0.29 cm and in left ear was 2.79  $\pm$  0.28 cm, LH of right ear was 1.57  $\pm$  0.17 cm. and for left ear was 1.64  $\pm$  0.16 cm and the LW of right ear was 1.69  $\pm$  0.26 cm and for left ear was 1.72  $\pm$  0.23 cm found (Table-2).

In the analysis of P and T value between right and left ear of combined data, TEH =0.000, EW = 0.252, LH = 0.000 and LW =0.066 is found and T value of TEH =4.232, EW =1.151, LH =5.180 and LW =1.853 were found. According to this data we found P value of TEH and LH is significant (p  $\leq$ 0.005).

## DISCUSSION

Heathcote JA found a positive correlation between age and ear size in Japan, in that study he

found that as we become older our ear dimensions increases [1]. Ito I *et al.*, observed that in different age groups TEH, EW, LH and LW increase in size and become different in every individual [4]. In study of Bozkir *et al.*, found that the ear height is increase in relation to age [5]. In study of Purkait and singh on the age group of 18-70 year found a steady increase in size with age [6]. According Sharma *et al.*, study on age group 1-80 years in north-west region of India on ear lobule and observed that the maximum length of lobule increased between 6-15 years and 41-80 years [7]. According to De Deopa study in 17-25 years of age observed that the increasing age in particular group increase ear size in all dimension [8]. According to Sforza *et al.*, a significant effect of age was found (p $\leq$  0.001) with large value in older individual [9]. Sivakumar yoga *et al.*, said that on 2000 individual on 20-39 years of age found no age change after 20 years of age in both men and women [10].

In our study on 16 -26 years of age group we found a significant change in order to age and the size of ear is increase with the related age group.

## CONCLUSION

Morphometric study of external ear is helpful in reconstructive surgery and hearing instrument industries for making hearing aids and Bluetooth devices. We calculated mean and standard deviation P and T value of all age group in parameters of TEH, EW, LH, and LW and compare all group. In relation to age all parameters were found to be increasing with advancing age in all age group. All parameters were found higher in left ear than right ear except the TEH of male. In these parameters we found TEH of male ( $p = 0.000$ ), LH of male ( $p = 0.000$ ), LH of female ( $p = 0.003$ ). The TEH of combined data ( $p = 0.000$ ), LH of combined data ( $p = 0.000$ ) were found which were highly significant ( $p \leq 0.005$ ). These study provide the mean value of different morphometric measurements of right and left ears in the population of south Rajasthan.

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