**ORIGINAL ARTICLE**

# Morphometry of Normal External Ears, Head and Neck in people of the province of Punjab in Pakistan

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## ABSTRACT

OBJECTIVES: To determine the mean values of different morphometric measurements from the both ears, head and neck in the study population and to explore the variations in their size.

STUDY DESIGN: Cross sectional survey

PLACE AND DURATION OF STUDY: This study was conducted in Department of ENT Unit 1, Mayo Hospital associated with King Edward Medical University, Lahore.

MATERIAL AND METHOD: A total of 75male volunteers from 28 main cities of the Punjab, visiting ENT department of Mayo Hospital Lahore, were randomly selected and recruited for the study. Surface measurements were taken directly from the ears, head and neck of all the subjects included in the study, by inch tape and electronic digital caliper. Each variable was measured twice in centimeters by the same investigator. Demographic profile and relevant data was recorded in a standard proforma. Mean of different morphometric values of both ears and Head & Neck were taken.

RESULTS: Average vertical, horizontal and circumferential length of right ear was 6.728 cm, 2.992 cm and 13.766 cm while of the left ear, it was 6.757 cm, 3.16 cm and 10.684 cm respectively. Average circumference of head and neck remained 55.59 cm and 32.257 cm respectively. Mean length of the neck (between mental protuberance and suprasternal notch) was 17.869 cm among all the volunteers.

CONCLUSION: This study furnished the first set of metric data of auricular dimensions for normal Pakistani males between 14 to 63 years of age. It can be helpful to correct congenital malformations and external ear deformities and may be useful for hearing instruments industry and forensic applications.

KEY WORDS: Ear, Morphometry, Punjab

## INTRODUCTION

The human ear is the defining feature of the face. The appearance and symmetry of the auricle is essential for facial harmony. Ears play a vital role in producing a natural and harmonious look and an aesthetically fine facial appearance. They are helpful in defining ergonomic design of the hearing aids and are important to the hearing instruments industry.[1]

The human ear is composed of five critical elements namely concha, helix, antihelix, tragus, lobule and parts of lesser importance including antitragus, inter-tragic notch and Darwin's tubercle. Anomalies of ears such as missing external ear, lobule ptosis, prominent ear and microtia may result in facial deformation. Knowledge concerning anatomy of the external ear is important to plastic surgeons for planning treatment of the congenital malformations and external deformities. In addition, to treat auricular deformities or to perform facial rejuvenation, normative data for auricular dimensions is required. The metric standards vary in various ethnic groups.[2, 3]

Individual variations in head, neck and outer ear size, as well as growth of these structures during development, can markedly alter the values of the binaural and monaural cues which form the basis for auditory localization. It is also known that the size of human auricle increases throughout the life, after completion of its development. The lobule contributes the most, to overall elongation of the auricle. It is considered to be an important attribute of beauty in many societies. [4, 5]

Data on growth and age of maturation of the ears in the normal population can be useful in choosing the optimal time for ear reconstruction. Population norms are useful in calculating the amount of tissue needed to rebuild the ear to adequate size and natural position. Very few studies are available in Pakistan and worldwide in which external ear is examined and investigated in normal population. The purpose of the present study was to obtain the average morphometric values and variations in different parameters of ears, head and neck in people from different cities of the Punjab.[6, 7, 8]

**Objective**

To determine the mean values of different morphometric measurements from the both ears, head and neck in the study population and to explore the variations in their size.

## MATERIAL AND METHOD

A total of 75 male volunteers from 28 main cities of the Punjab, visiting ENT department of Mayo Hospital Lahore, were randomly selected and recruited for this study. Surface measurements were taken directly from ears, head and neck of the subjects included in the study, by inch tape and electronic digital caliper. Each variable was measured twice in centimeters by the same investigator.

Measurements included were vertical height (from top of helix to lower end of the ear lobule), horizontal width (between the helix and projection of the tragus) and circumferential length (axis) of the external ears. Similarly circumference of head and neck was measured. Length of the neck vertically between mental protuberance and suprasternal notch was also taken into account.

Demographic profile and relevant data was recorded in a standard proforma. Mean and standard deviation were computed for qualitative variables like age. Mean of various morphometric measurements of ears, head and neck were taken.

## RESULTS

In our study the average age of the patients was 29.186 years (SD 38.5±24.5).All patients were male and they ranged in age from 14 to 63 years. 50 adult males were aged between 14-30 years and remaining 25 were older individuals between 31-63 years.

Average vertical, horizontal and circumferential length of right ear was 6.728 cm, 2.992 cm and13.766 cm with minimum length 5.6 cm, 2.3 cm and 11.6 cm and maximum length 8.1 cm, 4 cm and 16 cm respectively in the above volunteers.

On the other hand average vertical, horizontal and circumferential length of left ear was 6.757 cm, 3.16 cm and 10.684 cm with minimum length 5.7 cm, 2.5 cm and 11.2 cm and maximum length 8 cm, 4.1 cm and 16.5 cm respectively. (Fig 1)

Average circumference of head remained 55.59 cm with minimum 52.3 cm and maximum 60 cm. While average circumference of the neck was 32.257 cm with minimum of 20.2 cm and maximum 45.6 cm. Mean length of the neck (between mental protuberance and suprasternal notch) was 17.869 cm. However maximum length of the neck was 21 cm and minimum 14.6 cm among all the volunteers.

**Table 1:** (n=75)-Descriptive Statistics of Age (years)

| | |
|---|---|
| Mean | 29.186 |
| Std. deviation | 38.5 ±24.5 |
| Range | 49 |
| Minimum | 14 |
| Maximum | 63 |

**Table 2:** (n=75) Average morphometric measurements of external ears, head &neck

| Part | Vertical Length | | | Horizontal Length | | | Circumferential Length | | |
|---|---|---|---|---|---|---|---|---|---|
| | mean | minimum | maximum | mean | minimum | maximum | mean | Minimum | maximum |
| **Right Ear** | 6.728 cm | 5.6 cm | 8.1 cm | 2.992 cm | 2.3 cm | 4 cm | 13.766 cm | 11.6 cm | 16 cm |
| **Left Ear** | 6.757 cm | 5.7 cm | 8 cm | 3.16 cm | 2.5 cm | 4.1 cm | 10.684 cm | 11.2 cm | 16.5 cm |
| **Head** | - | - | - | - | - | - | 55.59 cm | 52.3 cm | 60 cm |
| **Neck** | 17.869 cm | 14.6 cm | 21 cm | - | - | - | 32.257 cm | 20.2 cm | 45.6 cm |

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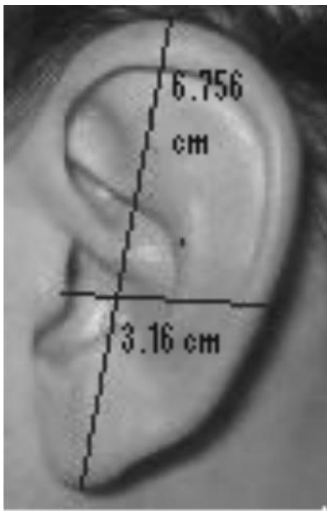


Fig.1 Average vertical and horizontal length of left ear Horizontal =3.16 cm Vertical =6.757 cm

## DISCUSSION

Within each grade size of the all parameters varied greatly and bilateral asymmetry was observed in almost all the measurements. The mean width of the left ear was found to be wider than the mean width of the right ear in our study an observation also made by Turkish researchers Barut C and Aktune E. Most of the left ear indices were relatively higher than right ear indices in almost all of the subjects. According to our results, average ear height and horizontal width of right ear was 6.728 cm and 2.99 cm and of left ear were 6.757 cm and 3.16 cm respectively. Contrary to this in a foreign study by Bozkir MG and Karkas P, mean values for total ear height and width were to be 6.29 cm and 3.31 cm for the right ear and 6.31 cm and 3.33 cm for the left ear respectively. [1, 2, 4]

Our study was confined to get mean values of different morphometric measurements and to explore the variations in size of the male subjects only. This study furnishes the first set of metric data of auricular dimensions for normal Pakistani males between 14 to 63 years of age. According to Sforza C et al all, ear dimensions were significantly larger in men than in women. A significant effect of age was found, with larger values in older individuals. Ear lobule was the only ear structure that changed significantly with age. In addition, lobular width decreased significantly with age. Contrary to Sharma A and Sidhu NK, Indian males seem to have the smallest auricular and lobular lengths, although their respective widths are comparable with those of others.[3, 4, 8, 10]

## CONCLUSION

With analysis of normative cross-sectional data, this study explored anatomic and aesthetic differences in the ear. Data collected in the present investigation could serve as a data base for the quantitative description of the human ear morphology. It can be helpful to correct congenital malformations and external ear deformities and may be useful for hearing instruments industry and forensic applications.

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