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A Morphometric Study of Auricular Concha in the Population of North Indian Adults

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ABSTRACT

Background: External ear consists of auricle or pinna and external acoustic meatus. The auricle projects to a variable and individual degree from the side of the head. It collects sound waves and conducts them on the external acoustic meatus inward to the tympanum. The auricle therefore acts because the 1st component of a series of stimulus modifiers within the auditory apparatus. The lateral surface of the auricle is on an irregular basis concave and faces slightly forwards. Its prominent curved rim, or helix, usually bears postero-superiorly a small auricular tubercle, a structure that is pronounced round the sixth month of intrauterine life, when the auricle closely resembles that of some adult monkeys. Another curved prominence, parallel and anterior to the posterior part of the helix, is the antihelix, dividing above into two crura flanking a depressed triangular fossa. Scaphoid fossa is curved depression between the helix and antihelix.

Aim: A Morphometric Study of Auricular Concha in the Population of North Indian Adults.

Materials and Methods: The study was conducted in department of Anatomy, IIMSR, Lucknow. This study was conducted on 420 adults (210 males and 210 females) who were randomly selected from the population of Uttar Pradesh. Approval of Institutional Research Committee and Institutional Ethical committee was obtained prior to commencement of the study. Informed consent was obtained from each volunteer before taking the measurements.

Results: In this stud the mean concha length on the left side was 26.68 ± 2.53 with maximum length of 32.6 mm and minimum length being 13.21 mm whereas the minimum length on the right side was 13.31 mm and maximum length was 32.35 mm with mean value of 26.24 ± 2.71 mm. There was no significant difference between the two sides. The mean concha breadth on the left side was 17.92 ± 1.88 mm with maximum length of 24.71 mm and minimum length being 13.68 mm whereas the minimum length on the right side was 12.42 mm and maximum length was 24.11 mm with mean value of 17.70 ± 1.93 mm. There was no significant difference between the two sides.

Conclusion: This insightful data can be applied in diagnosing congenital anomalies, planning ear reconstructive plastic surgeries, and particularly in the ergonomic design of hearing aids.

KEY WORDS: Choncha length, Choncha Breadth, Vernier Calliper, Tragon, Intertragic incisures, Cymba Choncha

Introduction

External ear consists of auricle or pinna and external acoustic meatus. The auricle projects to a variable and individual degree from the side of the head. It collects sound waves and conducts them on the external acoustic meatus inward to the tympanum. The auricle therefore acts because the 1st component of a series of stimulus modifiers within the auditory apparatus. The lateral surface of the auricle is on an irregular basis concave and faces slightly forwards¹.

Auricular sinuses appear to represent ectodermal folds that are sequestered during formation of the auricle. Bilateral preauricular sinuses are typically familial; majorities of sinuses are asymptomatic and have only minor cosmetic importance. Auricular fistulas (narrow canal), connecting the preauricular skin with the tympanic cavity or the tonsillar fossa are extremely rare². The external ear is a defining feature of the face. It helps make one have the “normal” look with an aesthetically fine appearance. A prominent ear is the most common congenital deformity of the external ear^{3,4}. This deformity has profound psychosocial effects on the bearer⁵. According to the WHO, health is not just the absence of disease or infirmity but is complete physical, mental and social well being⁶. Knowledge of traditional ear dimensions is going to be of abundant use for the plastic surgeons rectifying the potential ear pinna defects. The forensic specialist wants the ear pinna dimensions for characteristic an individual, whereas the manufacturer wants for creating ear corrective. The dimensions vary in different ethnic groups, which necessitate them to base their observations on the data specific to the ethnic group⁷. The morphometric standards vary in various ethnic groups⁸.

The body part of the external organ is used for private identification of living subjects in respect to criminal activity. There are claims in recent years that the external organ is also used for private identification of each living and deceased people^{9,10}.

Auricular appearance and symmetry contribute enormously to the facial aesthesis. Any auricular defect in the form of disproportionate size, abnormal elongation of the auricular lobe, or a missing part is corrected by surgery¹⁰. There are many studies on ear morphometry in literature. Men have larger ears than women, ears increase in each length and dimension with increasing age, and overall ear size differs keep with ethnic group¹². It is important for forensic experts for personal identity. It is also important for anatomists for research¹³.

According to many studies conducted on morphometry of external ear; the size, shape and the orientation of each external ear is unique as fingerprint, but it can be generalized. Males have

larger ears as compared to females. In female's ears increases with age from birth to 99 yrs of age but in case of males' development of ears stop around 50-70 yrs of age¹⁴.

The present study is attempted provide anthropometric data on normal adult male and female auricles from population of Uttar Pradesh. This study is required for better designing of earphone, ear buds, hearing aids and for plastic surgeons to plan reconstructive surgeries.

Methods and Materials

The study was conducted in Department of Anatomy, IIMSR&RC, Lucknow. This study was conducted on 420 adults (210 males and 210 females) who were randomly selected from the population of Uttar Pradesh. Approval of Institutional Research Committee and Institutional Ethical committee was obtained prior to commencement of the study. Informed consent was obtained from each volunteer before taking the measurements.

Inclusion criteria –

- Interested volunteers were included in the study.
- Healthy adult individuals
- Subjects belonging to Uttar Pradesh
- Subjects above 18 years of age.

Exclusion criteria -

- Subjects with ear inflammation, injury, surgery, and others ear related diseases.
- Congenital ear malformation
- Subject under 18 years of age.

All the landmark defined by De Carlo et al (1998)¹⁵ was taken-

- Tragion
- Intertragic incisures
- Maximum breadth of the tragus
- Superior margin of superaurale draw horizontal line
- Inferior margin of superaurale draw horizontal line
- Cymba Choncha
- Posterior margin of tragus
- Maximum concavity of the antihelix

Measurements: -

- The subject was made to sit in a chair or lab stool with head in Frankfurt's plane.
- After determining the landmarks with skin marker measurement were taken with the help of digital calliper capable of measuring to the nearest 0.1mm.

Following measurements were taken -

- **Tragus length** – from tragon to intertragic incisures
- **Tragus breadth** – from maximum breadth of the tragus
- **Ear length above tragus** – from tragon to superior margin of superaurale draw horizontal line
- **Ear length below tragus** – from intertragic incisures to inferior margin of subaurale draw horizontal line
- **Concha length** – from intertragic incisures to cymba concha
- **Concha breadth** – posterior margin of the tragus to the maximum concavity of the antihelix

Statistical analysis

- All data collected were systematically screened and entered MS excel spread sheets and analysis was carried out. The calculated mean, and Standard deviation was analyzed using SPSS version 16 statistical software. The data was statistically analysed using studentt-test with p- value <0.0001 taken as highly significant, p- value is 0.05 significant, and greater than p- value 0.05 is not significant.

Results

Table 1. Comparison of left and right auricular parameters -

s.no.	Parameters	Sides	N=840	min-max(mm)	mean±SD(mm)	p-value
1.	Ear length above tragus	L	420	12.19-31.78	23.14±2.83	0.282
		R	420	12.19-31.66	22.94±2.74	
2.	Ear length below tragus	L	420	10.19-26.76	16.82±2.82	0.079
		R	420	10.19-26.99	17.17±2.98	
3.	Concha length	L	420	13.21-32.6	26.68±2.53	0.014
		R	420	13.31-32.35	26.24±2.71	
4.	Concha breadth	L	420	13.68-24.71	17.92±1.88	0.103
		R	420	12.42-24.11	17.70±1.93	
5.	Tragus length	L	420	12.09-24.01	17.58±1.87	0.108
		R	420	12.59-24.42	17.37±1.96	
6.	Tragus breadth	L	420	3.28-8.99	6.11±1.03	0.197
		R	420	3.12-8.7	5.67±1.03	

The mean ear length above tragus on the left side was 23.14 ± 42.83 with maximum length of 31.78 mm and minimum length being 12.19 mm whereas the minimum length on the right side was 12.19 mm and maximum length was 31.66 mm with mean value of 22.94 ± 2.74 mm. There was no significant difference between the two sides.

The mean ear length below tragus on the left side was 16.82 ± 2.82 mm with maximum length of 26.76 mm and minimum length being 10.19 mm whereas the minimum length on the right side was 10.19 mm and maximum length was 26.99 mm with mean value of 17.17 ± 2.98 mm. There was no significant difference between the two sides.

The mean concha length on the left side was 26.68 ± 2.53 with maximum length of 32.6 mm and minimum length being 13.21 mm whereas the minimum length on the right side was 13.31 mm and maximum length was 32.35 mm with mean value of 26.24 ± 2.71 mm. There was no significant difference between the two sides.

The mean concha breadth on the left side was 17.92 ± 1.88 mm with maximum length of 24.71 mm and minimum length being 13.68 mm whereas the minimum length on the right side was 12.42 mm and maximum length was 24.11 mm with mean value of 17.70 ± 1.93 mm. There was no significant difference between the two sides.

The mean tragus length on the left side was 17.58 ± 1.87 with maximum length of 24.01 mm and minimum length being 12.09 mm whereas the minimum length on the right side was 12.59 mm and maximum length was 24.42 mm with mean value of 17.37 ± 1.96 mm. There was no significant difference between the two sides.

The mean tragus breadth on the left side was 6.11 ± 1.03 mm with maximum length of 8.99 mm and minimum length being 3.28 mm whereas the minimum length on the right side was 3.12 mm and maximum length was 8.7 mm with mean value of 5.67 ± 1.03 mm. There was no significant difference between the two sides.

Discussion

Pradhuman Verma et.al. (2016) Study on two groups- 40 subjects from North East Indian population. Ear length above tragus was found 25.93 mm in male and 25.01 mm in female for left ear, and 28.06 mm in male and 27.13 mm in female for left ear. Ear length below tragus was found 18.11 mm in male and 18.01 mm in female for right ear, and 18.47 mm in male and 18.39 mm in female for right ear¹⁶.

Another group study on 40 subjects from North West Indian population. Ear length above tragus was found 28.33 mm in male and 27.09 mm in female for left ear, and 30.00 mm in male and 28.79 mm in female for left ear. Ear length below tragus was found 20.36 mm in male and 19.27 mm in female for left ear, and 21.30 mm in male and 19.27 mm in female for right ear¹⁶.

Present study, Ear length above tragus is found 24.27 mm in male and 22.01 mm in female for left ear, and 23.91 mm in male and 21.96 mm in female for the right ear. Ear length below tragus is found 16.99 mm in male and 16.65 mm in female for the left ear and 17.49 mm in male and 16.86 mm in female for right ear.

In the present study shows length of concha is 27.24 mm in male and 26.12 mm in female of left and 26.91 mm in male and 25.56 mm in female of right ear and breadth of concha is 17.85 mm in male and 17.99 mm in female of left ear and 17.73mm in male and 17.68 mm in female of right ear.

L. Arora et.al. (2016) a study consisting of 50 males and female found the concha length to be 28.16 mm in male and 24.91 mm in female for the left ear and 27.75 mm in male and 24.88 mm in female for the right ear. Concha breadth was found 20.01 mm in left and 19.83 mm for the right ear in male, and to be 17.28 mm for the left ear and 17.20 mm for right ear in female¹⁷.

Pradhuman Verma et.al. (2016) Study on two groups- 40 subjects from North East Indian population. Concha length was found 24.96 mm in male and 18.65 mm in female for left ear, and 25.20 mm in male and 19.62 mm in female for left ear. Concha breadth was found 16.80 mm in male and 17.05 mm in female for right ear, and 17.65 mm in male and 17.32 mm in female for right ear³¹. Study on 40 subjects from North West Indian population. Concha length was found 26.01 mm in male and 17.42 mm in female for left ear, and 26.70 mm in male and 17.06 mm in female for left ear. Concha breadth was found 18.28 mm in male and 17.42 mm in female for left ear, and 21.40 mm in male and 17.06 mm in female for right ear¹⁶.

Abdelaleen SA et. al. (2016) study was carried out on 200 persons (120 males and 80 females) of both sexes of population of Upper Egypt, concha length was found 32.91 mm in male and 32.28 mm in female for the left ear, and 29.79 mm in male and 29.15 mm in female for the right ear. Lobule breadth was found 223.67 mm in male and 22.77 mm in female for left ear, and 20.73 mm in male and 21.56 mm in female for the right ear¹⁸.

Present study, concha length is found 27.24 mm in male and 26.12 mm in female for the left ear, and 26.91 mm in male and 25.56 mm in female for right ear. Concha breadth is found 17.85 mm in male and 17.99 mm in female for the left ear, and 17.73 mm in male and 17.99 mm in female for the right ear.

A study done by Vijay Laxmi et.al. (2017) on Punjab, Indian population showed that the length of the left tragus was found to be 1.57 cm in male and 1.50 cm in female, and right ear was found 1.60 cm in male and 1.51 cm in female¹⁹.

Pradhuman Verma et.al. (2016) study on two groups - 40 subjects from North East Indian population. Tragus length was found 14.9 mm in male and 14.4 mm in female for left ear, and 13.74 mm in male and 13.26 mm in female for left ear¹⁶. Study on 40 subjects from North West Indian population. Tragus length was found 14.9 mm in male and 14.4 mm in female for left ear, and 13.74 mm in male and 13.26 mm in female for left ear¹⁶.

Abdelaleen SA et. al. (2016) tragus length was found 13.49 mm in male and 13.36 mm in female for the left ear, and 11.82 mm in male and 11.94 mm in female for the right ear. Tragus breadth was 7.13 mm in male and 7.41 mm in female for left ear and 4.49 mm in male and 5.42 mm in female for the ear¹⁸.

Present study, tragus length is found 17.61 mm in male and 17.56 mm in female for the left ear, and 17.31 mm in male and 17.43 mm in female for the right ear. Tragus breadth is found 6.34 mm in male and 5.87 mm in female for the left ear, 5.85 mm in male and 5.49 mm in female for the right ear.

Conclusion

In conclusion, this study provides detailed information about the morphometric measurements of normal auricular concha among young north Indian adults in an age group of above 18 years. The findings from the current study may provide a valuable and specialized database for the quantitative analysis of concha morphometry in young adults from North India. This insightful data can be applied in diagnosing congenital anomalies, planning ear reconstructive plastic surgeries, and particularly in the ergonomic design of hearing aids.

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Standring Susan., et.al. External ear: Gray's Anatomy the Anatomical Basis of Clinical Practice. 41sted., London: Churchill Livingstone Elsevier. 2016; 627-28.
2. Moore K.L., Agur Anne M.R., Baltimore. The developing Human Clinically Oriented Embryology. 9th ed. Saunders.2017; 445-45.
3. Kelley P., Hollier L., Stal S. Otoplasty: evaluation, technique, and review, J. Craniofac. Surg.,2003; 14:643-53.
4. M.M., Madzharov. A new method of auriculoplasty for protruding ears. Br. J. Plast. Surg.,1989; 42:285-90.
5. Schwentner I., Schmutzhard J., Deibl M., G.M. Health-related quality of life outcome of adult patients after otoplasty. J. Craniofac. Surg.,2006; 17(4):629-35.
6. 9. WHO, Official records of the world health organization. 1948; 2:100.
7. Purkait R., Singh P. Anthropometry of the Normal Human Auricle: A Study of Adult Indian Men. Journal of Aesth. Plast. Surg., 2007; 31:372-79.
8. Sharma A., Sidhu N.K., Sharma M.K., Kapoor K., Sinhg B. Morphometric study of ear lobule in northwest Indian male subjects. Anat. Sci. Int., 2007; 82(2):98-104.
9. Abbas A., Ruttu G.N., Ear piercing affects ear prints: The role of ear piercing in human identification, J. Forensic Sci., 2005; 50(2):386-92.
10. Swift B,Ruttu G.N. The human ear: Its role in forensic practice, Journal of Forensic Sci., 2003; 48(1):153-60.
11. Guyuron B., Deluca L. Ear projection and the posterior auricular muscle insertion. Plast. Reconstr. Surg., 1997; 100:457-60.
12. Healthcote J.A. Why do old men have big ears. British med. Journal.1995; 311: 1668.
13. Brucker M.J., Patel J., Sullivan P.K. A morphometric study of the external ear: Age and sex-related differences. Plast. Reconstr. Surg.,2003; 112:647-52.
14. Shireen S., Karadkhelkar V.P. Anthropometric measurements of human external ear. Journal of Evolution of Medical and Dental Sci., 2015; 4(59):10333-38.
15. De Carlo D., Metaxas D., Stone M. An Anthropometric face model using variation techniques. Proceedings of the 25th Annual Conference on Computer Graphics and Interactive Techniques New York. 1998; 67-74.
16. YogaS., Balaih J., Rangdhol V., Vandana S., Paulose S., Kavva L. Assessment of age changes and gender differences based on anthropometric measurements of ear: A cross-sectional study. Journal of Advanced Clinical & Research Insights.2017;4:92–95.
17. Arora L., Singh V. Morphometric study of human auricle in the age group of 18-24 years in north west part of India. Global J. of Med. And Pub. Health.2016; 5(6):1-6.
18. S.A. Abdelaleem.,F.A.FouadAbdelbaky. Estimation of stature in Upper Egypt population from external ear morphometry. Int. J. forensic sci.pathol., 2016; 4(10):276-284.
19. Pandit R., Sharma N.,Shrestha R., Shetha S., Yadav P.K. Morphometric study of external ear of medical students in college of medical sciences and teaching hospital, bharatpur, chitwan, Nepal.Int. J. Anat. Res., 2017; 5(3.2):4269-74.

