

ANTHROPOMETRIC COMPARISON OF EAR LOBULE AMONG MALES OF HARYANA AND HIMACHAL REGION

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ABSTRACT

In recent years, external ear and its prints have developed important role in medico-legal practice. It suggested being an identification tool analogous to fingerprinting as well as facial recombustion. Different ethnic groups have different parameters in relation to the various body parts and furthermore population specific standards can give accurate statistical estimation of biological attributes. Therefore, this study was done to establish the comparison of ear lobe dimensions in two population groups (Haryanvi and Himachali males). In present study, morphometry of ear lobule and its prints was done in 200 healthy males (100 Haryanvi and 100 himachali) in the age range 18-40 years. Significant difference was found in the lobular height in both the methods. Lobular height is more in Haryanvi males as compared to the himachali males. No significant difference was seen in the lobular width in both methods. Lobular index was significantly higher in Haryanvi males than Himachali males.

KEY WORDS: Ear morphometry, Ear lobule, Lobular height, Lobular width.

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INTRODUCTION

Ear is an elementary organ according to the Darwin, who attracted the attention of the scientific world regarding the ear and ear prints during Darwin's research about its relation with the primates. Doctor G. Schwalbe was the first to invent the method for the measurements of external ear. He proved Darwin's theory i.e. "tubercle of Darwin". He was the first to attract scientific attention to the racial peculiarities in the structure of the ear [1].

The external ear is made up of auricle or pinna

and external acoustic meatus. The auricle contains elastic cartilage covered by skin on both sides. The lower part of the auricle is known as lobule which contains connective tissue covered by skin. Plastic surgeons use a vast knowledge of normal ear dimensions for curing the possible pinna defects. The ear pinna dimensions are useful for forensic specialist to identifying a person, whereas the manufacturer needs for making ear prosthesis. The dimensions differ in different ethnic groups, which necessitate them to base their observations on the data

specific to the ethnic group. The morphometric standards vary in various ethnic groups [2].

Lobule dimensions are essential for plastic surgeons who target to achieve a proper balance between right and left earlobes in reconstruction surgeries. These dimensions also give useful information on age and sex and are also important in forensic investigations. In the development of auricle, the ear lobule is the last part to develop. The elongation ear lobe is associated with the natural aging process. The lobule is best developed in civilized races and absent or rudimentary in Anthropoids. It is a new feature that apparently serves no useful function unless it is pierced for carrying ornaments, tobacco tins etc. [3]. External ear is an infinitely complex structure with great variation between individuals. It has also noted that variations also exist between the two sides of the same individual. The structural differences in the human ear create unique shapes and morphology similar to the unique fingerprint of each human being [4].

The ear is a part of the human body that is under-exploited from the forensic point of view. It is possible that in the next few years the establishment of a solid scientific basis will permit ear prints to be used in a similar way to fingerprints [5]. The use of ear found in scene of crime can be of huge help in ruling out person as a possible suspect and enabling the search to be narrowed down. The latent ear prints can be used as helpful proof against a given suspect [6].

A latent earprint is the result of the secretions such as fats and waxes of the ear coming into contact with a surface. These secretions are regulated by hormones and the amount of fats and waxes on the surface of the ear vary from person to person. In those cases where the secretions are present in large quantities a very clear latent earprint can be obtained. Ear-print is potential evidence and it is as powerful as other types of body trace evidence, such as that finger prints and DNA. Though criminals have learned to tamper with fingerprints and DNA evidence, ear-print evidence is more resistant to such attack, Ear-print evidence can be utilized to place a suspect at the scene of a crime like fingerprints and DNA. The value of this is

exemplified by the fact that there are sometimes complications with fingerprint and DNA evidence. It is an additional benefit of ear-prints that they can be used to confirm fingerprint and DNA evidence [7].

MATERIALS AND METHODS

The present study was done on 200 males including 100 from Haryana and 100 from Himachal population aged 18-40 years. The whole study was conducted at the department of anatomy, MMIMSR, MMU, Mullana. The study was undertaken after approval by institutional ethics committee. Subjects with earlier trauma, congenital malformation of head and neck including were excluded from the study.

Following were the decided parameters measured on all the subjects. The parameters were measured in millimeter.

1. Lobular height
2. Lobular width
3. Lobular index

In the present study the parameters of the ear lobule were measured on the subjects by using vernier caliper. The ear prints were also taken from the each subject on transparency sheet and the same ear parameters were measured on the print as well by using ruler and were compared with results of the ear parameters obtained from the measurements on the same subjects.

Following were the various somatometric landmarks used for the measurements of parameters: Lobule Anterior (la) - the lowest point of lobule where it is attached to cheek. Lobule Posterior (lp) - the most posterior point on the margin of lobule at the midpoint of lobular length. Intertragic Incisura/Notch- the space between tragus and antitragus. Sub Aurale (sba) - the lowest point on the lower margin of ear lobe.

Measurements taken on the ear of the subject: Lobular Height (LH) was measured from the most inferior end of the lobule to the base of intertragic notch (figure 1).

Lobular width (LW) was measured as the maximum transverse or horizontal width of the lobule (figure 1).

On the basis of the above parameters the lobular index calculated -

Lobular index = height of ear lobule/ Width of ear lobule X 100.

The measurements were statistically analyzed (arithmetic mean and standard deviation were calculated) and tabulated.

Fig. 1: Measurements taken on the ear (lobular height=A-B Lobular breadth =C-D).

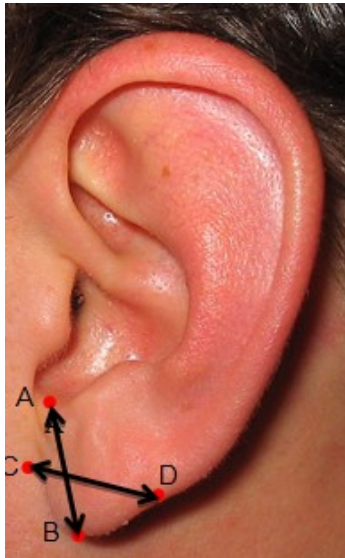


Fig. 2: Measurements taken on ear print (lobular height=A-B Lobular breadth =C-D).



Measurements taken on the ear of the subject – Lobular Height (LH) was measured from the most inferior end of the lobule to the base of intertragic notch (figure 1).Lobular width (LW) was measured as the maximum transverse or horizontal width of the lobule (figure 1).On the basis of the above parameters the lobular index calculated - lobular index = height of ear lobule/ Width of ear lobule X 100.The measurements were statistically analyzed (arithmetic mean and standard deviation were calculated) and tabulated.

RESULTS

Table 1 shows the comparison of the both ear lobe parameters in Haryanvi and Himachal male population. The measurements of the parameters were taken on the subject itself and the ear print of the same subjects. No significant difference in measurements was found in both the methods (Table 1).When parameters of ear lobe of both the population were compared a statistically significant difference was found in lobular height (pd"0.05). The lobular height was found more in the Haryanvi males as compared to the Himachali males (Table 1).

Table 1: Comparison of indices of ear morphometry and ear print parameters in haryana and himachal.

Variables		Haryana Population (N=100) Mean±Sd	Himachal Population (N= 100) Mean±Sd	p-value	
Ear Lobule Morphometry	Lobular height	Right	16.35±3.36	15.13±3.15	0.0082
		Left	16.32±3.30	15.14±3.17	0.0106
	Lobular width	Right	16.59±3.53	16.31±3.38	0.5575
		Left	16.55±2.53	16.30±3.37	0.5537
Lobular index	Right	107.33±92.97	90.66±16.01	0.0927	
	Left	107.54±81.28	91.39±15.96	0.0526	
Ear Lobule Print	Lobular Height	Right	16.33±3.35	15.14±3.17	0.0106
		Left	16.31±3.30	15.11±3.14	0.0106
	Lobular width	Right	16.60±2.54	16.29±3.37	0.5149
		Left	16.54±2.53	16.30±3.37	0.4635
Lobular index	Right	97.98±19.84	91.31±15.90	0.0094	
	Left	98.91±19.29	90.89±15.86	0.0015	

p value < 0.05 is significant.

The lobular indices found similar with both the methods. When lobular indices of both the population were compared a statistically significant difference was found. Lobular index was found more in Haryanvi males than the Himachali males (Table 1).

DISCUSSION

The ear defines the features of face. Its shape gives the information about age and sex. Moreover, the auricles are important keys to the natural and aesthetically pleasing human face. The external ear is primarily composed of three primary components: the helix-antihelix complex, conchal complex and the lobule [8]. Ear can be divided into external, middle and

internal parts. External ear is formed by pinna. Lateral surface of pinna is irregularly concave, faces slightly forward and displays many depressions. These structures are the first series of stimulus modifiers in hearing apparatus [9]. It is a proven fact that there is no such thing as standard ear. Even in the same ethnic group, great diversity exists in both size and shape of the external ear [10]. Structural differences in the human ear have made it unique as fingerprint of each human being. The differences in the measurements among people of different ethnic and socio cultural origins may also be caused by environmental and nutritional factors [11]. The ear reaches its mature height at 13 years in males and at 12 years in females. Moreover, the ancient Chinese believed that each part of the ear represented a different prospect, maintaining that total ear height shows association with long life and status [8].

Human ear possesses individual characteristics that are unique to each person on earth and can be used for identification next to the fingerprint system [12]. Both ears show different morphology from one another in same individual and of course more difference seen in two different people. Growth differences of ear have been seen between the races. It is also have been observed that ear pinna except ear lobe decomposes at a later stage than other soft parts of body [13]. Apart from anatomical and anthropometric descriptions knowledge of the qualitative normal ear morphology can help in the clinical diagnosis of several developmental alterations. Postnatal anomalies in ear parameters and position are common findings in several alterations of human chromosomes and karyotype and in developmental defects of the first and second branchial arches. Recently, ear length has been cautiously proposed as a further marker for ultrasound based prenatal screening [14].

Ear has a stable structure and so do not change with age except ear lobule. Ears do not alter their shape due to facial expressions and are firmly fixed on sides of the head. These unique characteristics of ear and then their prints are the reasons to have potential and so they can be used for personal identification along with other biometrics such as face, fingerprints and iris [15]. Earlier parameters of pinna were studied

for the surgical treatment of congenital deformities and reconstruction, but now a day it gives information on age and sex, hence plays a significant role in medical and forensic investigation [16]. Human ear pinna prints can be easily lifted from a window or phone and may help to identify the culprit even if no other clue or fingerprints are available. Human pinna can also be identified in the photograph of close circuit cameras even if that person's face is covered by a mask, beards, moustaches or spectacles [15].

In the present study no significant difference was found in right and left ears in both the populations but Haryanvi males had higher lobular height than Himachali males. Similarly, Barut and Aktunc observed Turkish higher lobular height in males. Sharma et al found left lobular height was significantly higher in north Indian male population. While Deopa et al and Kalra et al did not find any significant difference in lobular height in right and left ears in males and females (Table 2). No significant asymmetry was found in lobular widths on both ears in the males of Haryana and Himachal. In a previous study done by Barut and Aktunc found males have wider lobules than females in Turkish population. While Sharma et al, Kalra et al and Deopa et al did not find any significant difference in lobular width in north Indian population (Table 2). No significant difference was found in lobular indices on right and left sides in both populations. But on comparison Haryanvi males had more lobular index than males of Himachal. In previous studies done by Kalra. et al and Deopa et al males were found to have more lobular index than females. They also observed that the right lobular index was more in both males and females. While Barut and Aktunc found no significant difference in lobular indices of both sides in Turkish population (Table 2).

Sexual dimorphism was found in lobule width among Sudanese Arabs in contradiction to the findings among Indians. This indicate that, when using the ear dimensions, the expression of sexual dimorphism is not only different between populations but also different between sides, which necessitates the utilization of side specific equations for sex estimation. The conclusions of this study can be accredited primarily

Table 2: Comparison of lobule length and breadth of present study with previous studies.

Author	Population	Gender	Lobular height(mm)		Lobular width(mm)		Lobular index	
			Right	Left	Right	Left	Right	Left
Sharma et al on ear lobule	North Indian	Only males (n=260)	16.7 ± 0.25	18.2 ± 0.25	21.3 ± 0.32	21.4 ± 0.28	-----	-----
Barut and Aktunc on ear	Turkish	Males (n=87)	14.95 ± 2.23	14.88 ± 2.11	15.98 ± 2.16	15.99 ± 2.41	25.86 ± 3.42	25.84 ± 3.08
		Females (n=66)	13.91 ± 2.41	14.15 ± 2.34	14.77 ± 2.62	14.50 ± 3.05	25.16 ± 3.00	25.61 ± 3.23
Kalra et al on ear	North Indian	Males (n=93)	16.7 ± 0.20	16.9 ± 0.20	19.6 ± 0.20	19.6 ± 0.23	119.07 ± 14.60	117.33 ± 16.70
		Females (n=84)	16.6 ± 0.24	16.8 ± 0.21	19.2 ± 0.21	19.5 ± 0.22	117.33 ± 19.28	116.86 ± 15.01
Deopa et al on ear	North Indian	Males (n=93)	16.7 ± 0.20	16.9 ± 0.20	19.6 ± 0.20	19.6 ± 0.23	119.07 ± 14.60	117.33 ± 16.70
		Females (n=84)	16.6 ± 0.24	16.8 ± 0.21	19.2 ± 0.21	19.5 ± 0.22	117.33 ± 19.28	116.86 ± 15.01
Present study on ear	Haryana	Only males (n=100)	16.35 ± 3.36	16.32 ± 3.30	16.59 ± 3.53	16.55 ± 2.55	107.33 ± 92.97	107.54 ± 81.28
Present study on ear	Himachal	Only males (n=100)	15.13 ± 3.15	15.14 ± 3.14	16.31 ± 3.38	16.30 ± 3.37	92.66 ± 16.01	91.39 ± 15.96

to genetic factors and differential patterning in auricle expansion. Inconsistency in lobule dimensions can also be accredited to the ear piercing habits among Sudanese female. However, this has not been previously assessed in Sudanese Arabs who have African genes. These alterations in ear lobe dimensions between different populations can mainly be accredited to genetic factors, in addition to environmental and nutritional factors. This further indicates the importance of developing population-specific norms and sex estimation equations. This study has its limitations, although the sample used for present study was limited to two different populations. But it may not be the representative of the specific ethnic groups. Furthermore, length of lobule is known to be affected by age and only age category included in our study was between 18 to 40 years. Further future studies need to be undertaken to address these limitations. Nevertheless, our results provide important statistical parameters to medico-legal experts which they can apply when they are confronted with ear or ear print alone [16].

Conflicts of Interests: None

REFERENCES

- [1]. Lugt CVD. (Ears and) ear prints, individualizing crime scene marks. *Probl Forensic Sci.* 2001;46:38-45.
- [2]. Kumar BS, Selvi GP. Morphometry of ear pinna in sex determination. *Int J Anat Res.* 2016;4(2):2480-4.
- [3]. Sharma A, Sidhu NK, Sharma MK, Kapoor K, Singh. Morphometric study of ear lobule in northwest Indian male subjects. *Anatoamic Sci Int.* 2007;82:98-104.
- [4]. Muteweye W, Muguti GI. Prominent ears: Anthropometric study of the external ear primary school of Harare, Zimbabwe. *Ann Med Surg.* 2015;4:287-92.

- [5]. Arcaute AMCLD. Ear print as an identification method. *Acta Otorrinolaringol Esp.* 2006;57(7):329-32.
- [6]. Dhanda V, Badhan JS, Garg RK. Studies on the development of latent ear prints and their significance in personal identification. *Problems Forensic Sci.* 2011;88:285-95.
- [7]. Kaushal N, Kaushal P. Human earprints: A review. *J Biomet Biostat.* 2011;2(5):1-5.
- [8]. Kalcioğlu MT, Miman MC, Toplu Y, Yakinci C, Özturan O. Anthropometric growth study of normal human auricle. *Int J Pediatric Otorrinolaringol.* 2003;67(11):1169-77.
- [9]. Oludiran OO, Omotoso DR. A morphometric study of the external ears at Benin city. *Nig J Plast Surg.* 2012;8(1):1-5.
- [10]. Farkas LG, Posnik JC, Hrekzko TM. Anthropometric growth study of ear. *J Cleft Palate craniofac.* 1992;29(4):324-9.
- [11]. Bozkir MG, Karakas P, Yavuz M, Dere F. Morphometry of the external ear in our adult population. *Aesth Plast Surg.* 2006;80:81-5.
- [12]. Lugt CVD. Ear identification. In: H.C. Lee and R.E. Gaensslen, editors. *SP/TP. Proceedings of the Shoeprint and Toolmark Examiners, Noordwijk kerhout*;1997:133-4.
- [13]. Singh I R, Bhasin M K. Introduction a laboratory manual on biological anthropology, 1st ed. Delhi: Kamla- Raj Enterprises; 1968.P.2-3.
- [14]. Sforza C, Grandi G, Binelli M, Tommasi DG, Rosati R et al. Age and sex related changes in the normal human ear. *Forensic Sci Int.* 2009;187:110e1-e7.
- [15]. Hurley DJ, Arbab-Zavar B, Nixon MS. The ear as a biometric. *Eur Signal Process Conf.* 2007;25-9.
- [16]. Ahmed AA, Omer N. Estimation of sex from the anthropometric ear measurements of a Sudanese population. *Leg Med.* 2015;1-7.

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