

ANTHROPOMETRIC VARIATION OF EXTERNAL EAR AND ITS CORRELATION WITH AGE

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Abstract

Objective: This study was purposed to anthropological variations of external ear in different sexes, and associative changes in male and female external ears according to their height and age. **Material and Methods:** All possible dimensions of the external ear of 300 people (211 males and 89 females, aged 18 and above, were measured in accordance with standard anthropometric measurement procedures. A total of 7 dimensions i.e. Total Ear Length, Total Ear Width, Lobular Length, and Lobular Width were measured. **Result:** Among all the parameters, Height shows correlation with Total Ear length of only left side, & Total Ear Width, & Lobular Width of the both sides. Above 3 parameters also shows correlation with age. In Females, Height shows correlation with Total Ear Width of both sides. Lobular Width also shows variation with Total Ear Width of both sides. In Males, Height varies with Total Ear length of Right side, Total Ear width of both sides, & Lobular width of both sides. **Conclusion:** As a result, the data presented, Total Ear Width is the parameter is the most significant parameter showing variation with Height, Age & Sex, just like [7] stated. It also shows that the parameters of both ear is not similar to each other, therefore we need to measure the parameters of both ears separately for preparing the database.

Keywords: Anthropometry, External Ear, Morphometry.

INTRODUCTION

Human body measurement i.e., Anthropometry has a vital role in forensic investigation, product designing, and human factors engineering. These measurements of the human body and its part vary within and among nations and can be seen within a family as well. Anthropometry can predict a Human being's age, similarly, body measurement can also predict age. Ear anthropometry is a proven crucial feature for identifying age, gender, and face detection during any forensic investigation. The Human auricle has gathered the viewpoint of forensic scientists for a long period coz of its unique morphological characteristics. Darwin's tubercle, shape, and size of the ear are a few of the many unique morphological features used

during the identification and individualization process. The human auricle was attainable for the study of its morphometric and morphological variations and feasible for existing bilateral, sex, and population differences. The distinctions and variations in different anatomical features of the external ear described as antihelix, helix, tragus, earlobe, scapha, etc., are vital features being leveraged in the identification process. Ear morphology's importance can be given by the fact that it helps in the elucidation of ear prints found in crime sites in forensic settings. It enhances the frequency of morphological characters of ears and permits anticipation of features of ear impressions. These variations are extensively used in the production of ergonomic products like hearing aids, helmets, earphones, etc. [1, 2, 3]

Being the most defining feature of the ear and signifies variation with age and sex generally. The significance of its irregular shape is the presence of core crumpled elastic cartilage covering most of the auricular dimensions. The study of normal ear dimensions, symmetry, and position help in times of reconstructive and cosmetic surgeries and in designing hearing aid instruments. Congenital and postnatal abnormalities are the commonest findings in various alterations of karyotype and human chromosomes also in developmental defects of first and second branchial arches [3].

Common congenital defects of the external ear or pinna are macrotia, microtia, accessory auricle, malposed ear, and protruding and lop ear, which can be associated with Turner Syndrome, Down Syndrome, and Potter's Syndrome. There can be acquired defects as well due to any pathological conditions and traumatic injuries, especially cancer. 5%-8% of all skin carcinomas are located in Pinna as its exposure and projection are responsible for making it more prone to actinic damage. Correction of these abnormalities requires basic information of normal dimensions of auricle, and its general conformation and bilateral position on face. Many studies shown their correlation with anomalies but only handful of studies have interpreted dimensions on normal population. The available studies suggests that male have larger ear auricles as compared to females and the length and breadth of auricle increases with age [4].

Earlier studies carried out by Saha [6] in India and by Jung and Jung in Korea [5] suggested that gender, and different ethnic populations were the determinants of ear dimensions [7].

AIMS AND OBJECTIVES:

Anthropometric variation of external ear and its correlation with age.

Objectives:

1. Anthropology variation in different sexes.
2. Anthropology variation of ear association with Height of female subjects.
3. Anthropology variation of ear association with Height of male subjects.
4. Anthropology variation of ear association with age of female subjects.
5. Anthropology variation of ear association with age of male subjects.

METHODOLOGY

A. Study Design

The present cross-sectional study was conducted in the Department of Anatomy, School of Medical Sciences and Research, Sharda University, Greater Noida.

B. Study Samples

This study was conducted on 300 normal subjects, including faculty members and students of the School of Medical Sciences and Research, Greater Noida, Uttar Pradesh. Subjects with complete and well-structured external ears were included. Subjects who provided consent were excluded. Subjects with a history of any pinna developmental defects or congenital anomalies were excluded. Subjects who didn't provide consent were excluded.

C. Data Collection Technique

This study was conducted on 300 normal subjects, and a total of 211 males and 89 females healthy subjects living in the Greater Noida region of India aged 18 and above took part in the study. The purpose of the study was well explained to each subject before taking the data. The work will be carried out in the Dissection Hall, Department of Anatomy, after obtaining clearance from the Institutional Ethical Committee. Including both teaching and non-teaching members and MBBS students will be selected as per selection criteria and detailed bilingual consent will be taken before the conduction of the study. The method we applied in our study was taken as a reference from [3], where they measured following 4 parameters as depicted in Fig.1. The Figure.1 is also taken as a reference from [3], The Following parameters were measured after taking height, age, and sex into consideration:

1. Total Ear Length (L-H)
2. Total Ear Width (A-P)
3. Lobular Length (L-T)
4. Lobular Width (C-D)

All the measurements of the ear were taken with the help of a digital calliper and height with a height measuring scale.

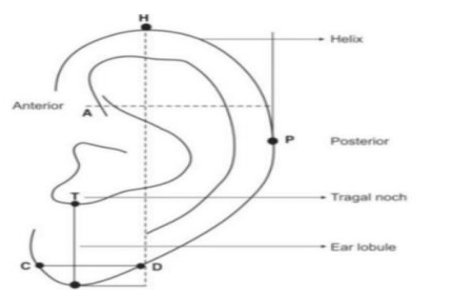


Fig. 1: Reference Points used for anthropometric measurements of ear (Total ear height=L-H, Ear width=A-P, lobular height=L-T, lobular width=C-D).

DATA ANALYSIS

Data was enlisted in Microsoft Excel. Percentage and proportion were used to summarise the data. The p-value is considered $p < 0.005$ as statistically significant.



Figure 2: Showing measurement technique and Lobular length of one of the participants



Figure 3: Showing measurement technique and Total Ear Length of one of the participants

RESULT

After analysis result we concluded are as follows:

1. Among all the parameters, Height shows correlation with Total Ear length of only left side, & Total Ear Width, & Lobular Width of the both sides. Above 3 parameters also shows correlation with age.

Age	No. of cases	Height	TEL RT	TEL LT	TEW RT	TEW LT	LL RT	LL LT	LW RT	LW LT
Average Values		169.52	61.65	61.31	26.73	26.86	20.14	19.82	20.86	20.4
18-20	67	172.73	60.04	59.42	29.01	29.34	20.91	20.49	21.81	20.89

Age	No. of cases	Height	TEL RT	TEL LT	TEW RT	TEW LT	LL RT	LL LT	LW RT	LW LT
Average Values		169.52	61.65	61.31	26.73	26.86	20.14	19.82	20.86	20.4
21-30	142	169.65	61.31	61.06	26.6	26.75	19.92	19.43	20.64	20.22

Age	No. of cases	Height	TEL RT	TEL LT	TEW RT	TEW LT	LL RT	LL LT	LW RT	LW LT
Average Values		169.52	61.65	61.31	26.73	26.86	20.14	19.82	20.86	20.4
41-Above	35	167.11	63.99	63.33	25.85	25.75	20.39	20.55	20.97	20.6

Age	No. of cases	Height	TEL RT	TEL LT	TEW RT	TEW LT	LL RT	LL LT	LW RT	LW LT
Average Values		169.52	61.65	61.31	26.73	26.86	20.14	19.82	20.86	20.4
31-40	56	166.83	62.99	62.95	24.87	24.86	19.65	19.55	20.22	20.16

2. All the parameters of ear anthropometry have shown a significant increase in the age pool of 31-40 years with respect to others, irrespective of their age
3. In Females, Height shows correlation with Total Ear Width of both sides. Lobular width also shows variation with Total ear width of both sides.
4. In Males, Height varies with Total Ear length of Right side, Total Ear width of both sides, & Lobular width of both sides.

DISCUSSION

As a result, the data presented, Total Ear Width is the parameter is the most significant parameter showing variation with Height, Age & Sex, just like [7] stated. It also shows that the parameters of both ear is not similar to each other, therefore we need to measure the parameters of both ears separately for preparing the database. As stated in [8] noteworthy disparities in ear dimensions between genders. Specifically, all measured ear dimensions were significantly greater in men than in women ($p < 0.001$). Additionally, age exerted a significant influence ($p < 0.001$), indicating that ear measurements tended to increase with advancing age. Notably, two specific parameters exhibited significant age-related changes, namely the ear width-to-length ratio and the sagittal angle of the auricle. Both of these parameters showed a consistent decrease as individuals grew older ($p < 0.001$), although these changes were not influenced by gender. [9], [13] and [14] stated in their paper that ear anthropometry increases in size

throughout life which clearly resembles the age pool result of 31-40 years of age showing a significant increase in all the parameters. It was noted in [10] that among the statistically significant parameters analyzed for identification, a substantial percentage of variations were observed primarily among males. In [12] it is mentioned that variances in ear growth patterns and maturation sizes have been documented across various populations in prior research. It remains imperative to conduct future studies that scrutinize populations with diverse social and ethnic backgrounds to enhance our understanding of universally accepted norms regarding ear size. In [15] it is stated that average height and lobule width is nearly identical in men and women but in our study we observed that there is a significant difference in both sexes.

CONCLUSION

The anthropometric measurements of the external ear help to determine the age and sex, and are beneficial in forming a medico-legal basis for unidentified skeletal remains which may be helpful in forensic sciences and analysis. Helpful in cosmetic surgeries in reconstructing the external ear as per patient request. As a result, the data presented that total Ear Width is the parameter is the most significant parameter showing variation with Height, Age, and Sex, just like [5] stated. It also shows that the parameters of both ears is not similar to each other, therefore we need to measure the parameters of both ears separately to prepare the database.

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