

## ANATOMICAL VARIATIONS OF THE DARWIN'S TUBERCLES OF THE HUMAN EAR IN YOUNG POPULATION

Svetlana Jovevska

Faculty of Medical Sciences, University "Goce Delcev" - Stip, R. North Macedonia,  
svetlana.jovevska@ugd.edu.mk

**Abstract: Background:** Human external ear is a morphologically complex structure and plays a vital role in the collection of sound. The present study would provide the information regarding the shape and size of the various morphological structures of the ear in normal individuals which may help the plastic surgeons to reconstruct the anatomy of the deformed ear and the physical and forensic anthropologists to study variations and establishing its use as a biometrics. The aim of the study was the morphological examination of the ear and its features to investigate the biological variations, sex differences, bilateral variations and further attempt to provide a database of external ears

**Methodology:** The sample for the present study comprises of 60 males and 57 females aged of the 19 years. Darwin's tubercle is an important structure of the ear which is considered to have some evolutionary significance was examinations.

**Results:** In this study shows the frequency distribution of the various shapes of the Darwin tubercles present on the left and right ears of the subjects. Darwin's tubercle refers to a congenital prominence usually found on the posterior part of the helix of the ear. In the present study, it shows a variety of structures in both the left and right sides in both sexes. The trait is usually found on the posterior aspect of the helix; however, in some cases, it was also found on the superior aspect in the present study. The study also shows that the nodosity type Darwin's tubercle was more often found on the males' ears than the females' ears. Enlargement and projection form of the Darwin's tubercle was among the rest of the subject, and in few subjects, the Darwin tubercle was totally absent.

**Conclusion:** The present study shows that the individualistic characteristics of the ear can provide very useful information for personal identification in forensic examinations. Darwin's tubercle show a variety of structures and individuality.

**Keywords:** Forensic science, Forensic anthropology, Personal identification, Human ear, Morphological variations .

### 1. INTRODUCTION

The human ear is another organ of the body which is unique to an individual. Like fingerprints and other characteristics of the human body, the ear retains certain individualistic characteristics which are unique due to variations in the anatomical structure of the external ear. In certain situations, where the dead body The Darwin tubercle showed a variety of structures in both the left and right sides in both sexes. The extensive variability of the human ear may be attributed to the unique structure and characteristics of the ear. Previous studies (Cameriere et al. 2011; Guyomarc'h and Stephan 2012; Swift and Ruttly 2003; Singh and Purkait 2009) have also shown that the variability of the external human ear in individuals is enough to enable individualization in forensic examinations and may help to solve the question whether a certain suspect could be identified as being offender. All these variable features and individualistic special characteristics of the ear may also help in individualization of the person in the CCTV footage of the crime scene (Hoogstrate et al. 2001). A few studies are available in the literature (Rubio et al. 2017; Cameriere et al. 2011; Purkait 2016; Verma et al. 2016; Vanezis et al. 1996; Purkait and Singh 2008; Alexander et al. 2011; Kearney 2003) regarding the morphological characteristics of the ear which enhance the anthropological and forensic knowledge about the ear and its variability in different populations. The results of the morphological features of the ear in the Darwin's tubercle is an important structure of the ear which is considered to have some evolutionary significance (Loh and Cohen 2016). It can be described in various conditions/categories such as nodosity, enlargement, and projection. Bertillon (1893) described four conditions of Darwin's tubercle, i.e., nodosity, enlargement, projection, and tubercle. In the present study, the Darwin's tubercle was not only found on the posterior part of the helix but on the superior helix also. In the present study, the Darwin tubercle was absent in just 3.4% of the population; otherwise, it is present on the ear of the subject in one or the other form. A variety of the structures of these morphological features of the ear may be helpful in personal identification in forensic examinations. However, these features are not sufficient to establish the personal identity; this kind of evidence may always be corroborated with some other indications present at the scene of crime.

### 2. MATERIALS AND METHODS

The study was conducted in department of anatomy in Faculty of Medical Sciences, University "Goce Delcev" -

Stip. The sample for the present study comprises of 60 males and 57 females aged of the 19 years . The photographs of the ears were taken with the help of Dig. Camera Sony DSC-W810 Cyber-Shot at the same distance in all the subjects

Table 1 shows the frequency of Darwin’s tubercle in males (N = 60) and females (N = 57) bilaterally distribution of the shape of the tragus (Fig. 1) Photographs showing the different forms of Darwin’s tubercles. a Nodosity. b Enlargement. c Projection among both sexes in the studied subjects.

### 3. METHODOLOGY

Morphological characteristics of the study were evaluated in order to develop standards for the unique morphology of the ear in the population. The ears of the subjects were photographed, and some peculiar characteristics were noted in the studied population. The photographs of the ears were taken with the help of Dig. Camera Sony DSCW810 Cyber-Shot at the same distance in all the subjects

### 4. RESULTS

In this study shows the frequency distribution of the various shapes of the Darwin tubercles present on the left and right ears of the subjects. Darwin’s tubercle refers to a congenital prominence usually found on the posterior part of the helix of the ear In the present study, it shows a variety of structures in both the left and right sides in both sexes. The trait is usually found on the posterior aspect of the helix; however, in some cases, it was also found on the superior aspect in the present study .The study also shows that the nodosity type Darwin’s tubercle was more often found on the males’ ears than the females’ ears. Enlargement and projection form of the Darwin’s tubercle was among the rest of the subject, and in few subjects, the Darwin tubercle was totally absent.

**Table 1 Frequency of Darwin’s tubercle in males (N = 60) and females (N = 57) bilaterally**

Darwin’s tubercle	Male		Female	
	Right (N, %)	Left (N, %)	Right (N, %)	Left (N, %)
Absent	3, 3.3%	5, 5.6%	3, 3.4%	3, 3.5%
Enlargement	5, 5.6%	6, 6.7%	16, 18.4%	19, 21.8%
Nodosity	61, 67.8%	53, 53.8%	41, 47.1%	40, 46%
Projection	21, 23.3%	26, 28.9%	27, 31%	25, 28.7%
Total	90, 100%	90, 100%	87, 100%	87, 100%



**Fig. 1 Photographs showing the different forms of Darwin’s tubercles. a Nodosity. b Enlargement. c Projection**

The modern system of identification using new computerized techniques such as automatic identity recognition and local information fusion by ear images is based upon some computerized algorithms; however, they must be compensated with the anthropological knowledge-based morphological variations. We need to isolate endogamous communities and ethnicities based upon the special characteristics of the ears so that these characters can be combined with computerized algorithms for identification purposes. Some characters found associated with T-box protein 15 (TBX15) gene. Worldwide genetic studies related to the variations in ear morphology should be

conducted in different population groups so that knowledge of their associated gene may be enhanced in order to further use the genetic technology of this trait in family linkage and human identification.

## 5. CONCLUSION

The study provides new information on the ear variability and characteristics of a population which will add to the anthropological knowledge and morphological variability of the ear structure for further use in the forensic examinations particularly in the identification process involving facial and ear images. The researchers are encouraged to explore possibilities for working on the other populations of the world so that a comparison and conclusion can be established regarding further variability in the structure of the ear in these population groups.

## REFERENCES

- Emersic, Z., Struc, V., & Peer, P. (2017). Ear recognition: more than a survey. *Neurocomputing* 255(13):26
- Krishan, K., & Kanchan, T. (2016). In: Payne-James J, Byard R, Academic Press (eds) *Identification: prints - earprints in encyclopedia of forensic and legal medicine*, 2nd edn. Elsevier B.V., Oxford, pp 74–80.
- Kumar, A., & Chan, T.S. (2013). Robust ear identification using sparse representation of local texture descriptors. *Pattern Recogn* 46(1):73–85
- Kumar, A., & Wu, C. (2012). Automated human identification using ear imaging. *Pattern Recogn* 45(3):956–968
- Loh, T.Y., & Cohen, P.R (2016). Darwin's tubercle: review of a unique congenital anomaly. *Dermatol Ther (Heidelb)* 6(2):143–149
- Purkait, R. (2016). External ear: an analysis of its uniqueness. *Egypt J Forensic Sci* 6(2):99–107
- Purkait, R., & Singh, P. (2007). Anthropometry of the normal human auricle: a study of adult Indian men. *Aesthet Plast Surg* 31(4):372–379
- Rubio, O., Galera, V., & Alonso, M.C. (2015). Anthropological study of ear tubercles in a Spanish sample. *Homo* 66(4):343–356
- Sforza, C., Grandi, G., Binelli, M., Tommasi, D.G., Rosati, R., & Ferrario, V.F. (2009). Age- and sex-related changes in the normal human ear. *Forensic Sci Int* 187(1–3):110. e1–110.e7
- Singh, P., & Purkait, R. (2009). Observations of external ear—an Indian study. *Homo* 60(5):461–472
- Van der Lugt, C. (2001). *Ear Identification*. Elsevier, Bedrijfsinformatie's Gravenhage, Amsterdam
- Verma, P., Sandhu, H.K., Verma, K.G., Goyal, S., Sudan, M., & Ladgotra, A. (2016). Morphological variations and biometrics of ear: an aid to personal identification. *J Clin Diagn Res* 10(5):ZC138.  
<https://doi.org/10.7860/JCDR/2016/18265.7876>