

## MORPHOLOGICAL CHARACTERISTICS OF AURICULA IN CHILDREN FROM KYUSTENDIL REGION (SOUTHWEST BULGARIA)

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**Abstract.** The shape of human auricula is characterized by specific features. The diversity of these individual characteristics can be used in forensic identification of individuals. Inter- and intrapopulation variability in the shape of auricula is not thoroughly investigated neither in Bulgaria, nor worldwide. The present study was conducted in the town of Kyustendil (Southwest Bulgaria). The examined sample comprised 240 individuals of both sexes - 120 school boys and 120 school girls (11 to 18 years of age). The shape of auricula and the absence/presence of tuberculum auriculae Darwini were defined by the scale of Schwalbe-Martin and Saller (1959). The most common form of both ears in the examined group is form 6 (60.00%) followed by form 3 with 20.83%. When an additional tuberculum Darwini was present, it was mostly asymmetrically positioned in both sexes. High percentage of individuals with ears positioned in a greater distance from the surface of the head was also established. Within the examined male group, 20.83% had prominent ears, the percentage was higher in comparison with the females, where the percentage was 1.66 % lower than in males.

**Key words:** physical anthropology, ear, auricular shape, tubercle of Darwin, students.

### Introduction

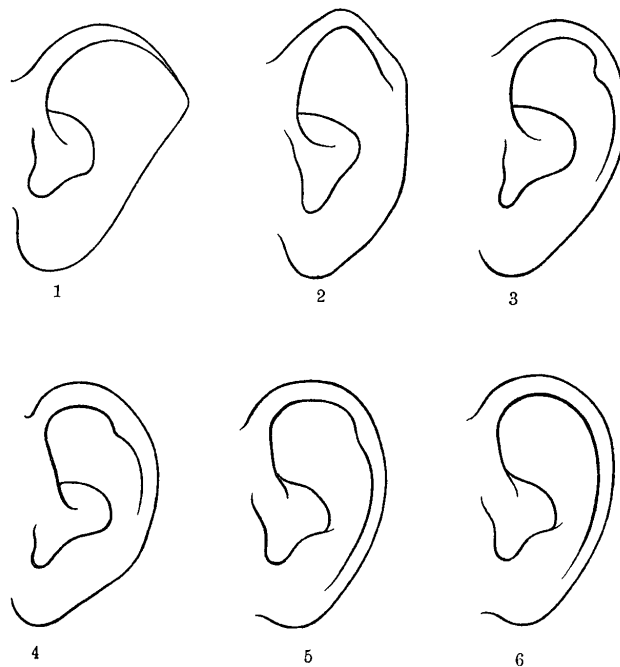
The construction of human auricula is characterized by specific features. The diversity of these individual characteristics gives us the possibility of using them in forensics for identification of individuals (Kapil *et al.*, 2014). More detailed anthropological study of the morphology and size of auricula can lead to a more complete description of human population and represents a valuable source of information in aesthetic surgery (Brucker *et al.*, 2003), especially for the removal of the consequences of traumatic injuries (Azaria *et al.*, 2003, Kollali 2009). In this field of medicine these qualitative and quantitative traits and their normal variations are widely used. Although studies based on the variability of the auricular dimensions have been performed during the last decades, inter- and intrapopulation variability of the descriptive auricular shape is poorly studied not only in Bulgaria, but also worldwide. On the Balkan Peninsula V. Bozic-Krstic (1991) examined students from Vojvodina and established the frequencies of different types of lobulus auriculae. Brodar, Bögel (1971) tracked down the relationships of the same traits between twins and their parents. In Bulgaria Todorov, Gavrilovič (1990) examined the Bulgarian population in connection with the presence of Darwin's tubercle (tuberculum auriculae Darwini) without specifying the study area. Although protruding ears are among the most common congenital

deformities in craniofacial area, clear consensus in literature in terms of their determination is still absent (Driessen *et al.*, 2011).

The purpose of this study was to determine the frequency of the auricular shapes and the tuberculum auriculæ Darwini in teenagers from Kyustendil region.

### Material and methods

The survey was performed in the area of Kyustendil town. The sample comprised 240 individuals of both genders – 120 school boys and 120 school girls (11 to 18 years of age). The shape of auricula and the absence or presence of tuberculum auriculæ Darwini, have been determined macroscopically according to the descriptive scale for auricular forms of Schwalbe cited by Martin, Saller (1957) (Fig. 1). Differences between the characters' occurrence frequencies have been estimated by means of Chi square and PAST software (Hammer *et al.*, 2001).



**Figure 1.** Auricular forms according to Martin-Saller (1957): 1 – Macacus shape, 2 – Cercopithecus shape, 3 – presence of acute tuberculum Darwini, 4 – presence of rounded tuberculum Darwini, 5 – with indefinite tuberculum Darwini, 6 – without tuberculum Darwini.

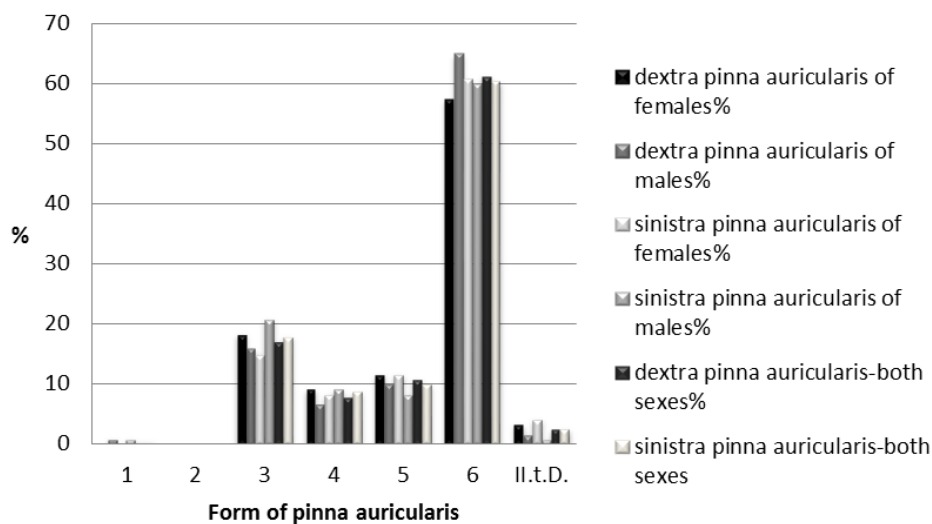
### Results

When comparing both auriculæ according to their form (table 1), the percentage of forms 3 and 4 in girls is higher on the right auricle (18.33% and 9.17% respectively) in comparison with the left (15.00% and 8.33% respectively). Reverse pattern is observed in the case of males, where the percentage of these forms is higher on the left auricle (20.83%

and 9.17% respectively), than the one on the right (15.83% and 6.67% respectively). In the case of form 5 gender differences are insignificant. Form 6 of the left auricula is, on average, equally present in both girls (60.8%) and boys (60.00%) while the same form of the right auricula shows different percentage with respect to gender (57.50% in girls – and 65.00% in boys). Form 1 is rarely observed, whereas form 2 is lacking. The most common form for both ears in the examined sample appears to be form 6 (60.00%), followed by form 3 (20.83%) (Fig. 2).

**Table 1.** Auricular forms frequencies in both ears and both genders in the studied sample from Kyustendil region.

	Gender		Trait							n
			1	2	3	4	5	6	Il.t.D.	
Auricula dextra	Males	n	0	0	22	11	14	69	4	120
		%	0	0	18.33	9.17	11.67	57.50	3.33	
	Females	n	1	0	19	8	12	78	2	120
		%	0.83	0	15.83	6.67	10.00	65.00	1.67	
	Total	n	1	0	41	19	26	147	6	240
		%	0.42	0	17.08	7.92	10.83	61.25	2.50	
Auricula sinistra	Males	n	0	0	18	10	14	73	5	120
		%	0	0	15.00	8.33	11.67	60.83	4.17	
	Females	n	1	0	25	11	10	72	1	120
		%	0.83	0	20.83	9.17	8.33	60.00	0.83	
	Total	n	1	0	43	21	24	145	6	240
		%	0.42	0	17.92	8.75	10.00	60.42	2.50	



**Figure 2.** Frequency of various forms of auricula dextra and sinistra in both sexes in the examined sample from Kyustendil town.

**Table 2.** Symmetry of auricular forms in both genders in the studied sample from Kyustendil region.

	n		Trait						II.t.D.
			1	2	3	4	5	6	
Females	86	n	0	0	11	6	7	60	2
		%	0	0	9.17	5.00	5.83	50.00	1.67
Males	92	n	1	0	16	5	5	65	0
		%	0.83	0	13.33	4.17	4.17	54.17	0
Total	178	n	1	0	27	11	12	125	2
		%	0.42	0	11.25	4.58	5.00	52.08	0.83

In view of the symmetry of forms in both genders (when concrete form is present in both ears) forms 4, 5 and 6 showed small percentage in terms of differences (table 2). The greatest difference according to gender in terms of the symmetry of forms is observed in form 3 (4.16% intergender difference). Most symmetrical among the examined teenagers is form 6 (50% girls and 54.17% boys from the total sample). There have not been observed individuals with two tuberkuli on both ears.

From tables 2 and 3 it can be concluded, that the presence of an additional tuberculum Darwini, is generally characterized by an asymmetrical position in both sexes. The most common combinations of forms in both genders are 3/5 (6.67%) and 5/6 (7.92%), referred to the total studied number. All possible combinations of forms for both ears have been established, but with no significantly great gender differences.

The sample is characterized by higher percentage of symmetry of the auricular shapes in both sexes, with a higher and statistically significant rate of symmetry in boys (76.67) in comparison with girls (71.67%) (Table 3). (Chi-square value=65.2465, P value=0).

**Tabela 3.** Asymmetry and symmetry of auricular forms in both genders in the studied sample from Kyustendil region.

Gender	Asymmetric combination										Symmetry	
	3/4	3/5	3/6	4/5	4/6	5/6	3/3II. t.D.	4/3II.t .D	5/3II. t.D	Asymmetry		
Females	n	4	1	8	1	4	11	4	0	1	34	86
	%	3.33	0.83	6.67	0.83	3.33	9.17	3.33	0	0.83	28.33	71.67
Males	n	1	1	8	3	4	8	2	1	0	28	92
	%	0.83	0.83	6.67	2.50	3.33	6.67	1.67	0.83	0	23.33	76.67
Total	n	5	2	16	3	4	19	2	1	1	62	178
	%	2.08	0.83	6.67	2.25	1.67	7.92	0.83	0.42	0.42	25.83	74.17

The dominance of auricular non-tubercular forms (1 + 6) is well illustrated (table 4). The frequency of form 1 has an extremely low rate and only in males (table 1). Form 6 is present in the majority of the surveyed individuals.

In view to the presence of tuberculum Darwini there has been established small difference between the percentages of both genders in the examined population (table 4). Nevertheless, this difference is statistically significant, as Chi square=36.4568, p=0.

**Table 4.** Occurrence frequency of tuberculum auriculae Darwini in both sexes in the studied sample from Kyustendil region.

Gender	Total number	n/%	I.t.D.*	II.t.D.**	I.t.D.* + II.t.D.**	Absence of tubercles***
Males	Auricula dextra	n	47	4	51	69
		%	39.17	3.33	42.50	57.50
	Auricula sinistra	n	42	5	47	73
		%	35.00	4.17	39.17	60.83
	Auricula dextra+ auricula sinistra	n	89	9	98	142
		%	37.08	3.75	40.83	59.17
Females	Auricula dextra	n	39	2	41	79
		%	32.50	1.67	34.17	65.83
	Auricula sinistra	n	46	1	47	73
		%	38.34	0.83	39.17	60.83
	Auricula dextra+ auricula sinistra	n	85	3	88	152
		%	35.42	1.25	36.67	63.33
Total	Auricula dextra	n	86	6	92	148
		%	35.83	2.50	38.33	61.67
	Auricula sinistra	n	88	6	94	146
		%	36.67	2.50	39.17	60.83

Individuals with protruding auriculae have also been established (table 5). "Protruding ears" were found in 20.83% of the male representatives, the percentage was higher than the one established in the female group, where it was 1.66 lower. This difference is not significant, as Chi-square=0.18, P value=0.67136. When this feature is unilateral, the trait is more present in the left ear of both sexes (5.83% in girls, 9.17% in boys).

**Table 5.** Occurrence frequency of "protruding ears" in both sexes in the studied sample from Kyustendil region.

Gender		Protruding auriculae				Normal (nonprotruding) auriculae
		Both auriculae	Auricula sinistra	Auricula dextra	Total	
Males	n	23	7	4	34	86
	%	19.17	5.83	3.33	28.33	71.67
Females	n	25	11	1	37	83
	%	20.83	9.17	0.83	30.83	69.17
Total	n	48	18	5	71	169
	%	20.00	7.50	2.08	29.58	70.42

## Discussion

Form 6 is most frequent among the established auricular forms. Intersexual differences have been noticed regarding the bilateral auricular form symmetry and presence of tuberculum auriculae Darwini only.

If we compare our data on intersexual frequencies of tuberculum Darwini with those of Todorov, Gavrilovič (1990) (men – 47.44% and women – 47.39% respectively), it can be concluded that we found slightly greater intersexual difference, but nevertheless significant.

Greater auricular distance from the skull ("protruding ears") is the most common congenital malformation. Moreover, many authors have reported significant intergender differences regarding this feature (Driessen et al., 2011). Our observed insignificant differences concerning this trait do not confirm this hypothesis. Furthermore, males have generally bigger ears than females (Healthcote 1995) and ear dimensions change through the process of growth (Meijerman *et al.*, 2007), but ear form does not. In fact, according to the method of Martin-Saller descriptive auricular shape is not extensively investigated worldwide. More information has to be accumulated in order to track down a clearer tendency. During the last decades studies on the auricular shape have been performed, but they mainly concern the variability of measured dimensions (Kapil *et al.*, 2014) or lobe conjugation, but not the auricular descriptive traits, although their frequencies also represent important characteristics for population distinction. The results obtained from the survey of high school students from Kyustendil region can greatly contribute to the population anthropology, for characterization of the studied and other populations, especially having in mind the scantiness of data on the subject.

## References

- Azaria R., Adler N., Silfen R., Regev D., Hauben D.J. 2003. Morphometry of the adalthuman earlobe: A study of 547 subjects and clinical application. *Plast Reconstr Surg* 111 (7): 2398-402.
- Bozik-Krstik V. 1991. Frequency of ear lobe types (Lobus auricularis) in the school children of Titov Vrbas and Niksic. *Acta boil. Ingosl F*, 22, №1, 61-66.
- Brodar, Vida, Meta Bögel 1971: Fenotipske variacije lobulusa pri dvojčkih in njihovih roditeljih. *Biološki vestnik, Ljubljana* 19: 11-17.
- Brucker M.J., Patel J., Sullivan P.K., 2003. A morphometric study of the external ear: age- and sex-related differences, *Plast Reconstr Surg.*, 112(2), 647-652.
- Driessen, Juliette, Borgstein, Johannes A., Vuyk, Hadé D., 2011 Defining the Protruding Ear. *Journal of Craniofacial Surgery*, Volume 22 - Issue 6, 2102-2108
- Hammer, Ø., Harper, D.A.T., and P. D. Ryan, 2001. PAST: Paleontological Statistics Software Package for Education and Data Analysis. *Palaeontologia Electronica* 4(1): 9pp.
- Healthcote J.A. 1995. Why do old men have big ears? *BMJ*, 311: 1668.
- Kapil V., Bhawana J. Vikas K. 2014: Morphological Variation of ear for Individual Identification in Forensic Cases: A study of an Indian Population. *Res. J. Forensic Sci.* Vol. 2(1), 1-8.
- Kollali R. 2009. Earlobe morphology: a simple classification of normal earlobes. *Journal of Plastic, Reconstructive and Aesthetic Surgery* Volume 62, Issue 2, 277-280.
- Martin R., K. Saller 1957. *Lehrbuch der Anthropologia*, Bd. I. Stuttgart, Gustav Fischer Verlag.
- Meijerman L., Van Der Lugt C., Maat G.J.R. 2007. Cross-sectional anthropometric study of the external ear. *J. Forensic Sci.*, 52, 286-293.
- Todorov V., Z. Gavrilović 1990. The frequency of tuberculum auriculae Darwini in Bulgarian population. *Glasnik Antropološkog društva Jugoslavije*. Beograd. *Sveska* 27, 31-34.

## MORFOLOŠKE KARAKTERISTIKE UŠNE ŠKOLJKE KOD DECE IZ ČUSTENDILSKJE OBLASTI (SEVEROZAPADNA BUGARSKA)

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**Apstrakt.** Oblik ušne školjke ima posebne karakteristike. Raznolikost ovih individualnih karakteristika može se koristiti prilikom identifikacije pojedinaca u forenzici. Varijabilnost ušne školjke u okviru populacije kao i među različitim populacijama nije detaljno ispitana kako u Bugarskoj tako i širom sveta. Ova studija sprovedena je u Čustendilu (severozapadna Bugarska). Uzorkom je obuhvaćeno 240 osoba oba pola - 120 dečaka and 120 devojčica školskog uzrasta (između 11 i 18 godina starosti). Oblik ušne školjke kao i to da li neko ima ili nema Darvinovu kvržicu definisani su pomoću skale Schwalbe-Martin i Saller (1959). Najčešći oblik ušiju u ispitanoj grupi je oblik 6 (60.00%) a odmah zatim oblik 3 (20.83%). Kod osoba kod kojih je zapažena Darvinova kvržica, ona je obično bila asimetrična kod oba pola. Takođe je utvrđen visok procenat osoba sa ušima koje su prilično udaljene od površine glave. 20.83% ispitanika muškog pola ima klempave uši, ovaj procenat znatno je manji kod osoba ženskog pola, gde je procenat 1.66 % manji u odnosu na muškarce.

**Ključne reči:** fizička antropologija, uvo, oblik ušne školjke, Darvinova kvržica, učenici.