Coll. Antropol. 40 (2016) 1: 23–28
Original scientific paper

Sexual Dimorphism in the Dimensions of Teeth in Serbian Population

Gordana Filipovic[1], Tatjana Kanjevac[2], Bojana Cetenovic[3], Zorica Ajdukovic[1] and Nenad Petrovic[1]

[1] University of Nis, Medical Faculty in Nis, Department of Orthodontics, Nis, Serbia
[2] University of Kragujevac, Faculty of Medical Sciences in Kragujevac, Department of Dentistry, Nis, Serbia
[3] University of Belgrade, Faculty of Dental Medicine, Clinic for Pediatric and Preventive Dentistry, Belgrade, Serbia

A B S T R A C T

The study of teeth is of great interest to anthropologists, biologists, orthodontists and forensic scientists. The existence of sexual dimorphism in permanent teeth is a known phenomenon. Aim of this study was to analyze the presence of sexual dimorphism in the mesiodistal and vestibulolingual diameter of permanent teeth in the sample of Serbian population. Measurements were taken on plaster casts of 201 individuals of both sexes, ages between 18–25 years, using a digital caliper with 0.01 mm precision. The mesiodistal and vestibulolingual diameter of each permanent tooth was determined. A Student's t-test and a Mann-Whitney U test were used to statistically analyze the obtained results. There were no statistically significant differences in the teeth crown diameter between the right and left side of the same dental arch. Majority of the teeth examined were larger in male than in female patients. Statistically significant difference in the mesiodistal diameter of male and female maxillary and mandibular canines was found. The results of this study indicate that there are significant differences in teeth size between sexes in Serbian population. Males have larger diameters in teeth crowns than females. Canines show the greatest dimorphism.

Key words: *anthropology, sex dimorphism, tooth size, Serbian, forensic dentistry*

Introduction

The study of teeth is of great interest to anthropologists, biologists, orthodontists and forensic scientists[1]. Teeth are organs made of the most enduring mineralized tissues in the human body and are relatively resistant to dissolution and destruction. Various features of teeth, including their detailed morphology, crown size, root lengths etc. tend to differ between males and females. These differences can help a forensic scientist to identify the gender of the victims of mass disasters, since the teeth are generally preserved even when the soft tissue and bones have been destroyed[2–8]. Determination of sex is significant in the cases of major disasters where bodies are often damaged beyond recognition. Sex determination builds the biological profile of the unidentified human remains, thereby excluding about half of the population in search operations. However, it is necessary to use population specific reference data because the degree of sexual dimorphism varies between different populations.

The existence of sexual dimorphism in permanent teeth is a known phenomenon, as observed in several investigations[9–13]. The vestibulolingual and mesiodistal diameters of the teeth are higher in males than in females[14–16]. The size of teeth varies between the sexes, races and populations[5,17–20].

Considering the fact that there are differences in odontometric features in specific populations[21], it is necessary to determine specific population values, in order to make a putative identification possible, based on dental measurements[22]. Currently there are no odontometric standards for distinguishing genders based on teeth size of Serbian population. The purpose of this study is to examine the degree of sexual dimorphism in the permanent teeth of Serbian people.

Matherials and Methods

The materials used in the present study consisted of plaster casts of the permanent dentitions of 201 subjects of Serbian origin (101 males and 100 females). The sample was drawn from the patients on the waiting list for orthodontic treatment in the Department of Orthodontics at

Received for publication January 1, 2015

the Medical Faculty of the University of Nis, Serbia, ranging from 18 to 25 years of age. The selection criteria were:

– The presence of completely erupted teeth of the permanent dentition from the first molar on one side to the first molar on the other side in both dental arches.
– Good quality study models.
– The absence of mesiodistal and occlusal wear, and carious lesions.
– The absence of any restoration that might affect the accuracy of the measurements being taken.
– The absence of anomalies of tooth morphology.

Measurements were taken using a digital calipers (Model No. CD6 GS, Mitoyoto, Tokyo) with 0.01 mm precision. We determined the mesiodistal and vestibulolingual diameters of each permanent tooth following the procedures described by Moorrees et Reed[23].

The mesiodistal (MD) dimension was defined as the greatest distance between the contact points on the proximal surfaces of the crown, measured with the calipers aligned along the MD axis of the tooth. In cases where the teeth were rotated or misaligned, measurements were taken between the points on the proximal surfaces of the crown where it was considered that contact with adjacent teeth would normally occur. The vestibulolingual (VL) measurement was defined as the greatest distance between the labial/buccal surface and the lingual surface of the crown measured with the calipers held at 90° angles to the MD axis.

Each dimension was measured twice at a different time interval by one examiner. The possibility of inaccuracies occurring due to intra-examiner error was assessed by repeated measurement of ten models selected at random, at ten day intervals, which were compared using the Wilcoxon two-sample test. There were no statistically significant differences in these results.

The mean values, standard deviations (SD) and coefficients of variation (CV) for the mesiodistal and vestibulolingual dimensions were then calculated for each type of tooth in the entire sample (Tables 1, 2). Percentages of sexual dimorphism were calcuated for mesiodistal and vestibulolingual dimensions using the formula of Garn et al.[9]. Depending on the distribution of the data, a Student's t-test or Mann-Whitney U test were used for comparison of descriptive parameters of continued variables between male and female samples (IBM SPSS 20).

Results

In comparing the pooled dimensions of the teeth from the left side of the dentition with those of the right side, no significant differences were found. Most of the teeth examined were larger in males than in females but the differences were not statistically significant (Tables 1, 2). For the mesiodistal dimension the only significant difference between male and female samples were found in maxillary and mandibular canines. Measurements for the vestibulolingual dimensions were significantly higher in males with p values <0.05 for mandibular I1, <0.01 for maxillary I1, mandibular I2 and P2, <0.001 for maxillary I2, C and M1 and mandibular C, P1 and M1. The percentage of sexual dimorphism was calculated for MD and VL diameters using the formula of Garn et al.[9] and the results of present study were compared with the percentage of sexual dimorphism in different populations (Table 3).

TABLE 1

SIGNIFICANCE OF DIFFERENCES IN THE MESIODISTAL DIAMETERS OF THE MAXILLARY AND MANDIBULAR TEETH FOR MALES AND FEMALES

Measurement	Male			Female			Xa	%b	Rank
	MV	SD	CV	MV	SD	CV			
Upper I1	8.62	0.56	6.52	8.57	0.51	5.94	0.05	0.53	9
Upper I2	6.71	0.48	7.12	6.59	0.49	7.42	0.12	1.85	3
Upper C	7.90	***0.39	4.97	7.60	0.51	6.74	0.30	3.96	1
Upper P1	6.84	0.38	5.59	6.85	0.53	7.77	0.00	–0.06	11
Upper P2	6.58	0.42	6.44	6.65	0.48	7.20	–0.06	–0.93	8
Upper M1	10.11	0.66	6.56	10.11	0.55	5.46	0.00	0.03	12
Lower I1	5.50	0.31	5.57	5.47	0.31	5.62	0.03	0.53	10
Lower I2	6.06	0.37	6.18	6.00	0.35	5.84	0.06	1.03	7
Lower C	6.93	***0.35	5.02	6.70	0.39	5.75	0.23	3.46	2
Lower P1	6.94	0.41	5.85	6.84	0.46	6.78	0.10	1.42	5
Lower P2	7.02	0.41	5.81	6.93	0.43	6.25	0.09	1.35	6
Lower M1	10.56	*0.60	5.68	10.39	0.60	5.75	0.17	1.60	4

*p<0.05, ***p<0.001, MV – mean value, SD – standard deviation, CV – coefficient of variation, I1 – central incisor, I2 – lateral incisor, C – canine, P1 – first premolar, P2 – second premolar, M1 – first molar

TABLE 2

SIGNIFICANCE OF DIFFERENCES IN THE VESTIBULOLINGUAL DIAMETERS OF THE MAXILLARY AND MANDIBULAR TEETH FOR MALES AND FEMALES

Measurement	Male			Female			Xa	%b	Rank
	Mean	SD	CV	Mean	SD	CV			
Upper I1	7.43	**0.59	7.92	7.21	0.48	6.62	0.22	3.05	4
Upper I2	6.59	***0.60	9.18	6.31	0.51	8.06	0.28	4.42	3
Upper C	7.99	***0.78	9.75	7.61	0.66	8.63	0.38	5.04	1
Upper P1	9.36	0.58	6.20	9.27	0.45	4.83	0.09	0.96	12
Upper P2	9.52	0.57	5.96	9.37	0.49	5.20	0.15	1.64	11
Upper M1	11.36	***0.70	6.17	11.07	0.58	5.23	0.29	2.60	9
Lower I1	6.30	*0.59	9.30	6.18	0.54	8.67	0.12	1.96	10
Lower I2	6.52	**0.53	8.06	6.34	0.38	6.00	0.18	2.91	7
Lower C	7.44	***0.78	10.45	7.09	0.57	7.99	0.35	4.87	2
Lower P1	7.87	***0.48	6.04	7.65	0.40	5.19	0.22	2.93	6
Lower P2	8.59	**0.52	6.11	8.38	0.49	5.90	0.22	2.61	8
Lower M1	10.87	***0.49	4.52	10.55	0.42	3.94	0.31	2.98	5

*p<0.05, **p<0.01, ***p<0.001, MV – mean value, SD – standard deviation, CV – coefficient of variation, I1 – central incisor, I2 – lateral incisor, C – canine, P1 – first premolar, P2 – second premolar, M1 – first molar

TABLE 3

PERCENTAGE OF SEXUAL DIMORPHISM FOR MESIODISTAL AND VESTIBULOLINGUAL DIAMETERS IN DIFFERENT POPULATION GROUPS

Population group	Tooth dimension	Teeth											
		UI1	UI2	UC	UP1	UP2	UM1	LI1	LI2	LC	LP1	LP2	LM1
Serbian	MD	0.53	1.85	3.96	–0.06	–0.93	0.03	0.53	1.03	3.46	1.42	1.35	1.60
	VL	3.05	4.42	5.04	0.96	1.64	2.60	1.96	2.91	4.87	2.93	2.61	2.98
Turkish[37]	MD	1.19	3.85	5.34	1.60	1.99	1.99	0.94	0.34	5.62	1.01	1.71	1.67
	VL	4.04	4.88	8.19	3.52	2.81	3.86	6.20	3.02	9.81	3.46	2.38	1.13
Greek[26]	MD	3.87	1.57	6.48	6.52	6.06	2.37	1.43	2.94	5.81	5.16	2.54	2.51
	VL	8.10	6.03	11.80	8.76	6.77	4.71	5.36	4.82	10.51	8.31	4.09	4.35
Spanish[13]	MD	–15.54	–3.11	4.78	4.70	1.99	4.50	–	–	–	–	–	–4.65
	VL	26.48	20.59	8.16	3.52	3.61	3.49	–	–	–	–	–	–
Chilean[13]	MD	1.62	0.13	–7.98	–0.87	–2.60	2.71	–	–	–	–	–	2.42
	VL	3.25	7.47	8.18	1.26	0.63	2.98	–	–	–	–	–	3.05
Indian[29]	MD	1.81	0.92	2.70	0.44	–1.53	0.92	1.71	1.91	2.78	–0.88	–0.44	2.65
	VL	2.69	1.60	4.39	2.31	2.33	3.33	0.0	–0.16	4.70	2.32	3.14	3.34
Mexican[35]	MD	2.44	1.54	6.67	6.06	6.06	2.91	1.85	1.69	7.69	4.48	5.71	2.83
	VL	2.82	4.84	7.50	4.30	4.25	2.68	5.17	3.23	4.17	5.13	3.57	3.77
Jordanian[27]	MD	3.59	3.43	5.12	2.42	2.64	3.23	1.62	3.13	5.25	4.84	3.61	4.14
	VL	–	–	–	–	–	–	–	–	–	–	–	–
Sothern Chinese[1]	MD	1.84	2.51	4.80	2.51	2.25	3.00	0.90	1.30	6.10	2.99	2.86	3.54
	VL	2.85	2.97	3.20	4.17	4.37	3.19	3.62	2.26	2.27	4.37	3.03	4.21

MD – mesiodistal, VL – vestibulolingual, UI1 – upper central incisor, UI2 – upper lateral incisor, UC – upper canine, UP1 – upper first premolar, UP2 – upper second premolar, UM1 – upper first molar, LI1 – lower central incisor, LI2 – lower lateral incisor, LC – lower canine, LP1 – lower first premolar, LP2 – lower second premolar, LM1 – lower first molar

Discussion

Teeth are resistant to mechanical, chemical, physical and thermal types of destruction and therefore very important in the identification of skeletal remains when the identification is not possible by standard methods. Combining the examination of craniofacial and odontometric features enables an accurate sex determination in 86% of the cases[22].

Teeth may be used for differentiating sex by measuring their mesiodistal and vestibulolingual dimensions[24]. Sexual dimorphism is population specific. However, there are no studies on sex determination using teeth in the Serbian region, and no standards in using teeth to identify sex in the Serbian population. The present study has ventured to evaluate the degree of sexual dimorphism in Serbian people. Previous studies in other regions show significant differences between male and female tooth crown dimensions[9,11,14–16,25]. Males have larger tooth crowns than females, although the degree of dimorphism varies within different populations[15,21,26,27]. Results of this research show that males have larger diameters in teeth crowns than females, which coincides with numerous reaserches conducted by other authors[14–16,32].

Sexual dimorphism of the teeth is the result of the different amount of enamel[33] and different amount of dentin[34]. Harris et al. found that males typically have significantly thicker dentine and pulp dimensions than females; while marginal enamel thickness is similar in both sexes[34]. Moss et al. suggested that dimorphism is related to a longer period of amelogenesis for both deciduous and permanent dentitions[35].

In our study the most pronounced differences are registered between the upper and lower canines ($p<0.001$), as well as upper between lateral incisor and first permanent molars, especially lower first molars. Adeyemi, Doris and Bishara et al. in their investigations report similar results, that the most pronounced differences are present exactly in these teeth[16,36,37].

Canines, especially the mandibular canines, are found to exhibit the greatest sexual dimorphism amongst all teeth[9,29–32,38]. The mandibular canines have a mean age of eruption of 10.87 years, and they are the last teeth appear with respect to age. They are less affected by periodontal diseases and are most likely to survive severe trauma such as air disasters, hurricanes or conflagration.

These findings indicate that mandibular canines can be considered as the „key teeth" for personal identification and sex differentiation[39]. Researching the vestibulolingual diameter of permanent dentition in Turkish students Iscan and Kedici found a statistically significant difference between males and females in the maxillary and mandibular canine[21]. Muller et al. also confirmed the difference between males and females in the vestibulolingual diameter of mandibular canine[31]. Lew and Keng found a statistically significant difference between males and females in the mesiodistal and vestibulolingual crown diameter of the permanent canine, M1 for the upper and P1 and M2 for the lower dentition[32]. Acharya and Mainali have found that apart from the canines, upper I1 and molars also exhibit sex differences[40]. This study has also shown that both maxillary and mandibular canines are the most dimorphic teeth, followed by maxillary lateral incisor and mandibular first molar. Premolars, first and second molars, as well as maxillary incisors, are also known to have significant differences[24]. Sexual dimorphism in canine size is influenced markedly by genetic factors. Both X and Y chromosomal involvement has been reported on this subject by various reaserchers[41,42].

In major air crash, train and hurricane disasters where the postcranial bones of victims are fragmented, permanent mandibular and maxillary canines can provide evidence for sex identification[43].

When comparing the dimensions measured in this study, the VL dimensions showed greater statistically significant difference between the sexes, than the MD dimensions. This finding was consistent with the results presented in similar studies[12,40]. Ates et al.[44] found that the most dimorphic variables are the VL diameters of the lower lateral incisors and canines. These studies also suggested that the VL dimension was more reliable in sex determination than the MD, due to its great sexual dimorphism. Garn et al.[9], Iscan and Kedici[21] also imply that vestibulolingual dimension is more reliable.

The MD dimension is more difficult to measure than the VL, due to the proximal contact that exists between the teeth, and crowding in the anterior segment of the jaws. Also, excessive attrition and interproximal wear can disrupt this dimension.

A comparison of sexual dimorphism in teeth between different populations showed that it varies among different groups[26]. In most cases sexual dimorphism is present, but the amount differs between different populations. Researchers have advocated the need for population-specific data[28].

In the Serbian sample, the levels of sexual dimorphism are more similar to European than to Asian populations. Zorba et al.[26] also showed similar results in comparison between the Greeks and the Turks, which showed that the percentage of sexual dimorphism is higher in the Greek population for both of the examined diameters, but for some teeth (e.g. canines) the percentage was similar between the two populations, and this was explained by the geographic proximity of Greece and Turkey. Although comparison between the Serbs and the Turks shows that the percentage of sexual dimorphism is lower in the Serbian population for both diameters, a certain degree of similarity is present, and can be explained by the fact that these two populations have common elements in their nutrition. Ates et al.[44] refers that teeth have larger diameters of crowns in populations relying more on plant food than meat. The degree of sexual dimorphism in teeth size differs between populations and is influenced by genetic, epigenetic and environmental factors[26]. It needs to be emphasized that, while the findings do demonstrate that male teeth tend to have larger crowns than female teeth, there is a very large area of overlap between the two, and

outliers can occur in both populations. In forensic work, it is simply not possible to say that an isolated tooth or few teeth from one individual can be identified with any degree of certainty as being of male or female origin. The most one can say about the teeth that lie closer in size to the two extremes, is that there is a likelihood of the subject being male/female as the case may be.

Conclusion

The present study has presented sexual dimorphism in Serbian people. It represents the first odontometric study for sex determination in this population. Canines in both jaws are the most dimorphic teeth for mesiodistal and vestibulolingual dimensions. Vestibulolingual dimensions showed greater statistically significant difference between the sexes. Considering the fact that the degree of sexual dimorphism varies in different populations, there is a need for population specific data. More comprehensive examination of the larger number of subjects is necessary in order to set specific standards for forensic sex determination for the Serbian population.

REFERENCES

1. LING JYK, WONG RWK, Homo, 58 (2007) 67. DOI: 10.1016/j.jchb.2006.08.003 — 2. VAN DER KUIJL B, VAN DER POLS LC, Ned Tijdschr Tandheelkd, 102 (1995) 236. — 3. BLAU S, HILL Q, BRIGGS CA, CORDNER SM, J Forensic Sci, 51 (2006) 386. DOI: 10.1111/j.1556-4029.2006.00051.x — 4. ERMENC B, RENER K, Forensic Sci Int, 103 (1999) 67. DOI: 10.1016/S0379-0738(99)00076-6 — 5. BRANNON RB, MORLANG WM, SMITH BC, J Forensic Sci, 48 (2003) 1331. — 6. BUX R, HEIDEMANN D, ENDERS M, BRATZKE H, Forensic Sci Int, 164 (2006) 155. DOI: 10.1016/j.forsciint.2005.12.025 — 7. NDIOKWELU E, MIQUEL JL, COUDERT N, Odontostomatol Trop, 26 (2003) 33. — 8. DAWIDSON I, Forensic Sci Int, 169 (2007) 47. DOI: 10.1016/j.forsciint.2007.04.105 — 9. GARN SN, LEWIS AB, SWINDLER DR, KEREWSKY RS, J Dent Res, 46 (1967) 963. — 10. GOMEZ MJ, Revista Eshumar, 2 (2005) 13. — 11. KONDO S, TOWNSEND GC, Homo, 55 (2004) 53. DOI: 10.1016/j.jchb.2003.10.001 — 12. SUAZO GI, CANTIN IM, LOPEZ FB, SANDOVAL MC, TORRES MS, GAJARDO RP, GAJARDO RM, Int J Morphol, 26 (2008) 609. — 13. ASTETE JC, SAN PEDRO VJ, SUAZO GI, Int J Odontostomat, 3 (2009) 47. — 14. BERNABE E, MAJOR P, FLORES-MIR C, Am J Orthod Dentofacial Orthop, 125 (2004) 125. — 15. SCHWARTZ GT, DEAN MC, Am J Phys Anthropol, 128 (2005) 312. DOI: 10.1002/ajpa.20211 — 16. ADEYEMI TA, ISIEKWE MC, Afr J Med Med Sci, 32 (2003) 23. — 17. BERNABE E, FLORES-MIR C, Angle Orthod, 76 (2006) 76. — 18. SMITH SS, BUSCHANG PH, WATANABE E, Am J Orthod Dentofac Orthop, 117 (2000) 169. DOI: 10.1016/S0889-5406(00)70228-9 — 19. SANTORO M, AYOUB ME, PARDI VA, CANGIALOSI TJ, Angle Orthod, 70 (2000) 303. — 20. TA TA, LING JYK, HAGG U, Am J Orthod Dentofacial Orthop, 120 (2001) 556. http://dx.doi.org/10.1067/mod.2001.118998 — 21. ISCAN MY, KEDICI SP, Forensic Sci Int, 137 (2003) 160. — 22. VODANOVIC M, DEMO Y, NJEMIROVSKIJ V, KEROS J, BRKIC H, J Arch Science, 37 (2007) 905. — 23. MOORREES CF, REED RB, Arch Oral Biol, 115 (1964) 685. — 24. SHAFER WG, HINE MK, LEVY BM, RAJENDRAN R, SIVAPATHASUNDHARAM B. Eds. Shafer's Textbook of Oral Pathology, (Elsevier, New York, 2006). — 25. FILIPOVIC G, Comparative analysis of intermaxillary relations size of permanent teeth in different occlusal anomalies. Ph Thesis In Serb (University of Niš, Niš, 2007). — 26. ZORBA E, MORAITIS K, MANOLIS KS, Forensic Sci Int, 210 (2011) 74. DOI: 10.1016/j.forsciint.2011.02.001 — 27. HATTAB FN, AL-KHATEEB, SULTAN I, Arch Oral Biol, 41 (1996) 641. DOI: 10.1016/S0003-9969(96)00066-0 — 28. SUAZO GI, CANTIN LM, LOPEZ FB, SANDOVAL MC, TORRES MS, GAJARDO RP, GAJARDO RM, Int J Morphol, 26 (2008) 609. — 29. PRABHU S, ACHARYA AB, Forensic Sci Int, 192 (2009) 129. DOI: 10.1016/j.forsciint.2009.08.008 — 30. KAUSHAL S, PATNAIK VVG, AGNIHOTRI G, J Anat Soc India, 52 (2003) 119. — 31. LING JY, WONG RW, Angle Orthod, 76 (2006) 632. — 32. MULLER M, LUPI-PEGURIER L, QAUTREHOMME G, BOLLA M, Forensic Sci Int, 121 (2001) 194. DOI: 10.1016/S0379-0738(01)00399-1 — 33. LEW KK, KENG SB, Aust Orthod, J 12 (1991) 105. — 34. DORIS JM, BERNARD BW, KUFTINEC MM, STOM D, Am J Orthod, 79 (1981) 326. DOI: 10.1016/0002-9416(81)90080-4 — 35. BISHARA SE, JAKOBSEN JR, ABDALLAH EM, GARCIA A, Am J Orthod Dentofac Orthop, 96 (1989) 416. DOI: 10.1016/0889-5406(89)90326-0 — 36. ZILBERMAN U, SMITH P, Adv Dent Res, 15 (2001) 42. DOI: 10.1177/08959374010150011101

G. Filipović

University of Nis, Medical Faculty in Nis, Department of Orthodontics, Serbia Medicinski fakultet, Klinika za stomatologiju, Bulevar dr Zorana Đinđića 52, 18000 Niš, Srbija,
e-mail: filip04@eunet.yu

SPOLNI DIMORFIZAM U DIMENZIJAMA ZUBI U SRPSKOM STANOVNIŠTVU

SAŽETAK

Proučavanje zuba je od velikog značaja za antropologe, biologe, ortodonte I forenzičare. Postojanje spolnog dimorfizma stalnih zuba je poznata pojava. Cilj ovog istraživanja bio je ispitati prisutnost spolnog dimorfizma kod meziodistalnog i vestibulolingvalnog promjera trajnih zuba u uzorku srpskog stanovništva. Mjerenja su izvršena na gipsanim odljevima 201 osobe oba spola, u dobi između 18–25 godina, pomoću digitalne čeljust s preciznošću od 0,01 mm. Meziodistalni i vestibulolingvalni promjer svakog stalnog zuba je određena. Student t-test i test sume rangova korišteni su za statističku

analizu dobivenih rezultata. Nije bilo statistički značajne razlike u promjeru zubi krune između desne i lijeve strane istog zubnog luka. Većina zuba su bili veći kod muških nego kod ženskih ispitanika. Pronađena je statistički značajna razlika u meziodistalnom promjeru muških i ženskih zuba gornje i donje čeljusti očnjaka. Rezultati ovog istraživanja pokazuju da postoje značajne razlike u veličini zuba među spolovima u srpskom stanovništvu. Muškarci imaju veće promjere na krunama zubiju od žena. Očnjaci pokazuju najveći dimorfizam.