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DOI: 10.21857/yk3jwhxeq9
Original scientific paper
Received: 12.V.2021.
Accepted: 13.X.2021.

BIOARCHAEOLOGICAL ANALYSIS OF THE LATE ANTIQUE SKELETONS FROM THE OREŠAC – LUKA II SITE

Orešac (*Bolentio*) is situated near Suhopolje in the Virovitica–Podravina County. Based on the various finds, the site is dated between the 1st and 4th centuries. Archaeological excavations are conducted since the 80s of the 20th century, however the skeletal material studied in this paper derive from the excavations carried in the 1997 by the Institute of Archaeology under the guide of T. Sekelj Ivančan.

For the purpose of the analysis the following pathologies were observed: *cribra orbitalia*, linear enamel hypoplasia, non specific periostitis, caries, alveolar pathologies, Schmorl's nodes, osteoarthritis on vertebrae and joints, benign cortical defects and estimation of height.

Relatively low frequencies of the biological and physical stress recorded among the analysed individuals suggest better quality of life in comparison to other late antique populations. Since the obtained results refer only to a small part of the excavated cemetery, further excavations and anthropological analyses are needed in order to supplement the existing knowledge and receive new information about the population that lived in the area of today's Orešac.

Key words: Orešac – Luka II; *Bolentio*; anthropological analysis; pathologies; average height / *Ključne riječi: Orešac – Luka II;* Bolentio; *antropološka analiza; patologije; prosječna visina*

Introduction

Most of the late antique cemeteries that were archaeologically explored and anthropologically analysed are situated in the east part of Croatia (Štrbinci (*Certissia*), Osijek (*Mursa*), Vinkovci (*Cibalae*), Zmajevac). A certain number of published bioarchaeological scientific papers have emerged in the last 25 years.[1] Only few cemeteries derive from the other parts of the continental Croatia: Sisak–Pogorelac[2] and Tekić – Treštanovačka gradina[3] and this study opened the possibility for the publication of another late antique site.

It is well known Roman site recorded on Peutinger's map under the name *Bolentio*, which Ivan Kukuljević Sakcinski placed in Orešac.[4] It is situated near Suhopolje in the Virovitica–Podravina County. First archaeological excavations were conducted in the 80s of the 20th century in collaboration of the Archaeological Museum in Zagreb and the Virovitica Municipal Museum when D. Nemeth Ehrlich located the residential part of the settlement and necropolis.[5] Based on the various finds (bricks, mortar, frescoes,

1 Šlaus 1998, 2001; Šlaus *et al.* 2004a, 2004b; Bedić *et al.* 2009; Novak *et al.* 2009; Vyroubal *et al.* 2013.
2 Bedić, Drnić 2020.
3 Bedić *et al.* 2013.
4 Kukuljević Sakcinski 1873: 92.
5 Nemeth Ehrlich 1986.

pottery, glass, jewellery, coins and other items used in everyday life) it is thought that this was a large and important Roman city of long duration (1st–4th century).[6]

Contrary to numerous finds of material culture from this site there are no historical records about people inhabiting Orešac, work they performed, health, diet and other aspects of their everyday life. For this reason human osteological material excavated at this site is important because it can provide the data for reconstructing the life and death of this community. In order to obtain the results following pathologies were included: *cribra orbitalia*, linear enamel hypoplasia, non specific periostitis, caries, alveolar pathologies, Schmorl's nodes, osteoarthritis on vertebrae and joints, and estimation of height.

Material and methods

The site of Orešac – Luka II (Orešac in further text) was excavated in 1997 by the Institute of Archaeology under the direction of Tajana Sekelj Ivančan in collaboration with Silvija Salajić from the Virovitica Municipal Museum.

Five simple graves arranged in two rows contained skeletons placed in an east-west orientation with the head to the west. Two graves were damaged by ploughing and lacked grave goods. In other three graves bronze belt buckles, a belt mount and two coins were found. The coins of Julian II the Apostate and Valens date the graves in the second half of the 4th century.[7]

The skeletal material was kept at the Institute of Archaeology in Zagreb until 2010 when it was transferred to the Croatian Academy of Sciences and Arts for anthropological analysis.

One previous paper employing paleoradiological research – CT scan and radiography was published. Skeletons from graves 2 and 3 were analysed in context how "increased" radiographic opacities in some air sinus(es) and medullar cavities of tubular bones can mimic possible pathology.[8]

Sex and age on the skeletons from the Orešac were estimated using standard anthropological methods.[9]

Cribra orbitalia appears on the orbital roof as a porous, slightly bulging bone in active or healed form. Although the aetiology is complicated, it is thought to be an anaemia resulting from the iron deficiency. Unhygienic living conditions, chronic gastrointestinal ailments, inadequate diet or endemic parasitism can cause this condition.[10] All skeletons with at least one preserved orbit were included in the study.

A macroscopic defect on the surface of the tooth enamel is called linear enamel hypoplasia which arises due to acute, time-limited stresses. Usually it is related to vitamin deficiency, the presence of anaemia, starvation, mental and/or physical trauma.[11] In the study were included maxillary incisors, mandibular and maxillary canines because incisors and canines are more susceptible to enamel hypoplasia, and canines take a relatively long time to develop.[12]

6 Salajić 2001: 11.
7 Sekelj Ivančan 1999.
8 Boljunčić 2017.
9 Buikstra, Ubelaker 2004.
10 Hengen 1971; Mensforth *et al.* 1978; Stuart-Macadam 1985.
11 Pindborg 1970; Goodman, Armelagos 1985; Goodman, Rose 1991.
12 Goodman, Rose 1991; Lysell *et al.* 1962.

Periostitis is pathological change affecting the external (periosteal) surface of the bone and it is the most common form of non-specific periosteal reactions found in archaeological populations. It is caused by non-specific bacterial infections, traumas, specific infectious diseases or metabolic diseases.[13] For the purpose of this study, periostitis was diagnosed only in skeletons exhibiting at least 50% of all long bones.

Caries is demineralisation of the inorganic part of the tooth, and the destruction of the organic part of the tooth by organic acids that develop as a result of bacterial fermentation of dietary carbohydrates.[14] The frequency and the type of carious changes depend on the type and consistency of the consumed food,[15] pH value inside the oral cavity, dental hygiene, age of an individual, gum disease, presence of fluoride in diet and water[16] and food preparation techniques.[17]

Alveolar pathologies are defined as presence of alveolar abscess or antemortem tooth loss. An alveolar abscess occurs when bacteria from tooth spreads through the root to dental alveoli where an opening in the cortical bone is created due to pressure of the accumulated puss.[18] If infected tooth due to abscess falls out and the tooth socket shows any sign of alveolar bone resorption the process is considered as antemortem tooth loss.[19] This is a complex process caused by advanced dental caries, dental wear, nutritional deficiency diseases, cultural or ritual ablation, and trauma.[20]

Osteoarthritis is a degenerative chronic joint disease characterised by the degradation of articular cartilage and the loss of cartilage. On the edges of the articular surface a progressive formation of osteophytes occur. Physical activity and mechanical load to the joints are the most common causes of osteoarthritis.[21] In the anthropological analysis all major joints (shoulders, elbows, hips, and knees) as well as all vertebrae were analysed if at least half of the joint surfaces were present.

Schmorl's nodes are the result of the protrusion of the intervertebral disc into the vertebral body. They can be recognized on the superior or inferior surface of the vertebral body as shallow rounded or kidney-shaped defects. Their existence is typically associated with strong mechanical loads on the spine.[22] Well preserved thoracic and lumbar vertebrae of adults were included in the analysis.

Benign cortical defects are recognized as narrow elongated depressions with smooth cortical edges and irregular bottom placed at sites for muscles attachments.[23]

In order to calculate the average height of adults all well preserved femurs were included in the study. The maximum length of the femur was inserted into a regression formula developed by Trotter.[24]

As the sample was small, comparisons with other sites should be taken with a caution. For the same reason it was not possible to conduct a statistical analysis.

13 Mann, Murphy 1990; Ortner 2003.
14 Larsen 1997.
15 Wells 1975; Powell 1985.
16 Bowen 1994; Woodward, Walker 1994.
17 Silverstone *et al*. 1981.
18 Lukacs 1989.
19 Ortner, Putschar 1981.
20 Lukacs 2007.
21 Hough, Sokoloff 1989; McKeag 1992.
22 Schmorl, Junghanns 1971.
23 Silverman *et al*. 1993.
24 Trotter 1970.

Results

Only five skeletons from five excavated graves were analyzed – four males (80%) and one subadult (20%).

All adults from the sample died between 25 and 55 years of age. The average age at death for males was 38.5 years.

Cribra orbitalia was not recorded in the Orešac sample although three orbits were well preserved. The linear enamel hypoplasia per tooth in males exhibited 72.7% (8/11). Non-specific periostitis was found in one out of four (25.0%) adults, and it was in healed form.

Caries frequency per tooth in the Orešac adult sample was 5% (5/101). Alveolar diseases were observed on 7 out of 95 adult alveolae (7.4%).

The vertebral osteoarthritis was found in only one out of 49 vertebrae (2.0%) while joint osteoarthritis was recorded in one out of 10 joints (10%). Osteoarthritic change was recorded in right shoulder.

Schmorl's nodes were found in 5 out of 37 vertebrae (13.5%). Benign cortical defects were recorded in three individuals: rhomboid fossa on the right clavicle of a male from grave 5, *pectoralis maior* on both humeri of a male from grave 3 and *latissimus dorsi* on the right humerus of a male from grave 1 (**Fig. 1**).

Altogether 3 cortical defects on 7 humeri (42.9%) and 1 pronounced rhomboid fossa on 4 well preserved clavicles (25.0%) were found.

The only fracture was recorded on the right talus of a male from grave 1 (**Fig. 2**).

It was an antemortem (healed) fracture on the *facies articularis calcanearis* recognized by the fracture line measuring 21 mm and imprinted bone surface.

The average height calculated based on the height of three male femurs is 174.9 ± 3.27 cm, with the shortest male being 169.7 ± 3.94 cm tall, while the highest one 178.7 ± 3.27 cm.

The only subadult in the sample was aged between 2 and 3 years at the time of death. It was poorly preserved, with only lower part

Fig. 1. Benign cortical defect at *latissimus dorsi* muscle attachment on the right humerus of a male from grave 1 (photo by Ž. Bedić) / *Sl. 1. Benigni kortikalni defekt na hvatištu mišića* latissimus dorsi *desne nadlaktične kosti muškarca iz groba 1 (snimila: Ž. Bedić)*

Fig. 2. Antemortem fracture on the right talus of a male from grave 1 (photo by Ž. Bedić) / *Sl. 2. Antemortalna fraktura desne skočne kosti muškarca iz groba 1 (snimila: Ž. Bedić)*

of the body from the pelvic bones to the feet. The only pathology he exhibited was mild healed periostitis on both tibiae.

Discussion

It has to be emphasised that exceptionally small sample was analysed in the study because the site has not been fully explored. The material belongs to a small excavated part of the cemetery therefore it cannot represent the whole population. This is especially recognized in the demographic distribution where most of the sample is consisted of males while females are completely missing. Subadults are represented by only one individual. Nevertheless, collected biological data contribute to new insights into living conditions of the people who inhabited former *Bolentio*.

Since among adult subsample only males were present, biological indicators were compared to males from several late antique skeletal samples[25] from continental Croatia (**Table 1**). Besides the same chronological period, these sites were part of the similar ecological environment.

The remains of the western necropolis of Sisak – Pogorelac were registered on the right bank of the Kupa River. Archaeological excavations were conducted from 2012 until 2019 by the Archaeological Museum in Zagreb under the guidance of I. Drnić. According to elements of costume of the deceased and grave goods the cemetery was dated to a period from the end of the 3rd century to the first half of the 5th century.[26] 28 skeletons were anthropologically analysed: twelve males, eight females and eight subadults.[27]

Treštanovačka gradina site situated north of Tekić near Požega was systematically excavated between 1972 and 2007 by the archaeologist D. Sokač-Štimac from the Town Museum in Požega. 124 graves oriented W-E with heads on the west were unearthed and rich grave goods date the necropolis to the second half of the 4th century.[28]

Anthropological analysis was carried on dental and skeletal remains of 28 individuals from 27 graves – thirteen males, six females, six subadults, one probably male, and two adult individuals of indeterminable sex.[29]

The excavations of the late antique cemetery in Štrbinci near Đakovo have been systematically conducted from 1999 under the leadership of B. Migotti from the Department of Archaeology of the Croatian Academy of Sciences and Arts and I. Pavlović

25 Bedić, Drnić 2020; Bedić *et al.* 2013; Novak *et al.* 2009.
26 Drnić, Groh 2018; Bedić, Drnić 2020.
27 Bedić, Drnić 2020.
28 Sokač-Štimac 1997, 2005, 2006; Sokač-Štimac, Bulat 1974.
29 Bedić *et al.* 2013.

from the Museum of the Đakovo Region (until 2004).[30] Numerous grave goods date the use of this cemetery to the second half of the 4th century and possibly to the beginning of the 5th century.[31] The Štrbinci sample consists of 139 individuals of whom 61 were males, 44 females and 34 subadults.[32]

Table 1. Comparison with other late antique skeletal samples from continental Croatia / Tablica 1. Usporedba s drugim primjercima kasnoantičkih kostura iz kontinentalne Hrvatske

	Orešac – Luka II	Sisak – Pogorelac	Tekić	Štrbinci
Average age at death	38.5	34.2	37.8	39.0
Cribra orbitalia	0.0	42.9	-*	26.4
LEH	72.7	76.3	-*	56.9
Periostitis	25.0	42.4	-*	44.4
Caries	5.0	9.0	7.6	8.8
Alv. bone dissease	7.4	7.3	15.1	7.3
Schmorl's nodes	13.5	27.4	44.3	20.9
Vertebral OA	2.0	14.7	32.1	15.8
Joint OA	10.0	14.6	28.2	32.4

* Information about frequency of certain pathological condition not available for male sample.

Average age at death in males from Orešac was similar to Tekić – Treštanovačka gradina and Štrbinci sample, while males from Sisak – Pogorelac lived quite shorter.

In comparison to other sites Orešac sample exhibited low frequencies of *cribra orbitalia* and non-specific periostitis while the frequency of LEH is similar to Sisak – Pogorelac site and higher than in the Štrbinci site. These frequencies of LEH were noted in sedentary populations which base their diet on agriculture.[33]

Factors such as metabolic disorders, contagious diseases, parasitism, starvation etc. can induce the occurrence of the indicators of subadult stress, especially during the childhood.[34] All skeletal indicators of subadult stress suggest that males in the Orešac sample were exposed to some level of physiological stress, but not a major one.

Caries frequency in males from the Orešac sample were lower than in other three sites, however frequencies between 5 and 9% in all late antique sites suggest economy based on hunting and agriculture,[35] i.e. the similar proportion of carbohydrates and proteins in the diet. Unfortunately, stable isotope analyses which can provide the information about an individual's diet during their lifetime based on the proportion of carbon and nitrogen isotopes in the body were not conducted in any of the late antique sites from continental Croatia thus unabling the diet reconstruction.

Alveolar bone diseases in the Orešac sample are similar to frequencies recorded in Sisak – Pogorelac and Štrbinci which is twice less than noted in Treštanovačka gradina. Earlier, some studies have shown that caries is the most important cause of alveolar diseases,[36] so it would be reasonable to consider it as the main etiological factor in the Orešac sample.

30 Migotti, Pavlović 2005.
31 Migotti 2006.
32 Novak *et al.* 2009.
33 Lanphear 1990.
34 Stuart-Macadam 1991; Ortner 2003; Brickley, Ives 2008; Walker *et al.* 2009; Guatelli-Steinberg, Lukacs 1999.
35 Lukacs 1989.
36 Littleton, Frohlich 1993; Hillson 2000.

The Orešac sample exhibits a lower frequency of vertebral osteoarthritis as well as the frequency of osteoarthritis of joints compared to other late antique sites. Since it was previously noted that osteoarthritis mostly develops as a result of mechanical stress and physical activity, it can be concluded that analysed males did not perform the jobs that required hard labour.

The same situation is with another indicator of hard physical labour – Schmorl's nodes. Among all late antique series the Orešac sample shows the lowest frequency of this pathology. Since they suggest a continuous mechanical load exerted on the spine[37] it would be implied that males from the Orešac did not experienced strong mechanical burdens on the spine.

On the other hand in the Orešac sample a high frequency of benign cortical defects was noted. Three out of four males displayed certain changes related to prominent points of muscular attachment, one on clavicle and two on humeri. These changes are usually interpreted as an excessive use of muscles.[38] Therefore this result is not in accordance with previous conclusion. It is possible that the reason lies in the preservation of the skeletons where long bones were relatively well preserved being able to present a realistic frequency of benign cortical defects as opposed to vertebrae and joints which were half missing.

The only fracture recorded in the sample was antemortem fracture (occurred before death and healed well) of the right talus. Fractures like this usually result from high energy impacts or a fall from a significant height[39] which would mean it can be attributed to accident. Unlike Orešac, in other sites an occasional occurrence of intentional violence was present, for example in Štrbinci two nasal fractures, in Tekić two cranial fractures and in Sisak one cranial fracture and two defensive fractures on left ulnae.

The average height for males in Orešac is 174.9 ± 3.27 cm, which is 10 cm higher than calculated average stature for males in Tekić (164.9 ± 3.27). Average height for other two sites was not estimated.

Someone's height during the development is determined by the genetic component as well as by the environmental factors such as diet, psychosocial stress, diseases and living conditions.[40] A study performed on the modern population concluded that a better diet and fewer pathological conditions result in a larger height.[41] Therefore, it is possible that the lower frequency of all pathologies in the Orešac sample is a realistic representation of the quality of life, regardless of the unrepresentative sample.

Since only one subadult was present in the sample, the comparison with other sites was not applicable. The only recorded pathology, a mild healed periostitis on both tibiae testifies of certain biological stress which this child survived.

37 Schmorl, Junghanns 1971.
38 Resnick, Greenway 1982.
39 Adelaar, Madrian 2004.
40 Batty *et al*. 2009: 137–152.
41 Bogin 1998.

Conclusion

The results of the detailed anthropological analysis conducted on the skeletal remains from the Orešac – Luka II site have revealed relatively low frequencies of the biological stress (*cribra orbitalia*, linear enamel hypoplasia and non-specific periostitis) and physical stress correlated with hard labour (degenerative osteoarthritis and Schmorl's nodes). Only indicators that stand out are benign cortical defects and the average height. Compared to other late antique series from continental Croatia, which was situated in the same climate-environmental system, the Orešac sample exhibits a better health condition in all categories.

Since the obtained results refer only to a small part of the excavated cemetery, further excavations and anthropological analyses are needed in order to supplement the existing knowledge and receive new information about the population that lived in the area of today's Orešac.

Acknowledgements

The author would like to thank Tajana Sekelj Ivančan from the Institute of Archaeology and Mario Novak from the Institute for Anthropological Research.

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SAŽETAK

Bioarheološka analiza kasnoantičkih kostura s nalazišta Orešac – Luka II

Orešac (*Bolentio*) se nalazi pored Suhopolja u Virovitičko-podravskoj županiji. Na temelju raznolikih nalaza, nalazište se datira između 1. i 4. stoljeća. Arheološka istraživanja provode se od 80-ih godina prošlog stoljeća, međutim koštani materijal analiziran u ovome radu potječe iz istraživanja provedenog 1997. godine od Instituta za arheologiju i Tajane Sekelj Ivančan.

Za potrebe ovog rada analizirane su sljedeće patologije: *cribra orbitalia*, hipoplazija zubne cakline, nespecifični periostitis, karijes, alveolarna oboljenja, Schmorlovi defekti, osteoartritis na kralješcima i velikim zglobovima, benigni kortikalni defekti te prosječna visina.

U analiziranom uzorku zabilježene su relativno niske učestalosti biološkog i fizičkog stresa, što bi sugeriralo bolju kvalitetu života u usporedbi s ostalim kasnoantičkim populacijama. S obzirom na to da se dobiveni rezultati odnose na mali dio istraženog groblja, potrebna su buduća iskopavanja i antropološke analize, kako bi se nadopunili postojeći podaci i dobile nove informacije o populaciji koja je obitavala na području današnjeg Orešca.