Analysis of Human Skeletal Remains from Nadin Iron Age Burial Mound

Petra Rajić Šikanjić

Institute for Anthropological Research, Zagreb, Croatia

ABSTRACT

This analysis attempts to reconstruct health, disease and life conditions of the population buried in Nadin, a burial mound, situated in central Dalmatia, Croatia. The analyzed skeletal material belongs to Liburnian culture and could be dated to early Iron Age, from 9th to 6th century B.C. The sample consists of a minimum number of 37 individuals, 7 children and 30 adults. The frequency of all the observed conditions is relatively low. Cribra orbitalia was observed only in females, the frequency of periosteal reaction on the tibiae is 26.1%. Two cases of cranial trauma were observed. Analyzed teeth exhibit low prevalence of carious lesions, ante mortem tooth loss and linear enamel hypoplasia. The case of hyperostosis frontalis interna on the endocranial surface of the frontal bone was observed. The affected skull belongs to the older adult female.

Key words: *life conditions, Nadin, Iron Age, Croatia, burial mound, skeletal remains*

Introduction

The importance of human skeletal remains in answering questions on the demography, health and behavior of past human populations has already been widely acknowledged[1].

Single skeleton offers much information about the life of the individual represented. Large number of skeletons from well documented archaeological context provides information about the population they represent. Bioarchaeological researches focus on both individual, and population level to gather information in order to get a wider picture of the analyzed population[1].

When studying archaeological samples, one faces various problems. These mostly result from the nature of the material studied i.e. skeletal remains. In the ideal scenario, the skeletal sample is of representative size and well preserved. However, this is not always the case and very often we lack some of the information about the studied population. Despite the limitations, studies of such material can provide some useful information on health and lifestyle of populations. This is especially important for the periods and populations for which we have limited data.

One of such cases is the sample analyzed in this work. Although relatively small in size and rather fragmented and poorly preserved, we believe that its analysis will shed some light on characteristics of the Croatian Iron Age population. Iron age period in Croatia is archaeologically very well documented, but until now, only one skeletal analysis was published.

The analyzed skeletal sample from »Vinkovci-Nama« site is rather small (n=11)[2]. Even though, its analysis provided the first available data about health, disease and stress levels in this sample of Iron Age continental Croatian population[2]. Due to the small sample size, the interpretation of the published results should be taken with caution. Thus, our study will add to the overall understanding of the lifestyle of Croatian Iron Age population.

The skeletal sample analyzed in this work comes from the site located in the coastal part of the Croatia. According to the burial characteristics, ceramics and grave goods they belong to Liburnian culture dated from 9th to 6th century B.C.[3]

The Liburnians were the ancient inhabitants of Liburnia, a region along the Adriatic coast between the rivers Titius (now Krk) in Dalmatia and Arsia (now Raša) in Istria. Their territory also included islands of the Kvarner bay (Krk, Rab, Cres, Lošinj and Pag)[4]. Their neighbors were Illyrian tribes Histri in Istria, Dalmatae in Dalmatia and Japodes in the hinterland[4,5].

The earliest mention of the Liburnians in a classical source is by Hecateus in the 6th century B.C., who placed them on the Adriatic coast. In the Periplus of Pseudo Scylax from the 4th century, the whole chapter describes Liburnians located between Ilyrians and Histri[5].

The Liburnians were known as seafarers along the Adriatic sea and Romans described them as pirates. In the 8th century B.C. they have controlled the sea down to the Corfu, but in 734 B.C. following the fight with the Greek navy, they were pushed back to their original borders[4,5].

Liburnian material culture has been recovered from their cemeteries and settlements. The majority of the settlements were located on the hilltops, like Radovin and Bribir that where later fortified with walls. Other lowland sites on the coast, such as Zadar and Nin, later become well known as Roman cities[6]. The preferred burial rite among Liburnians is inhumation in flat cemeteries, although burial mounds, like the one we analyze here were recorded. The deceased were in a flex position with graves located in the circles[5]. Grave goods were mostly jewelry, parts of dress, and personal things. The pottery is relatively little known as it rarely occurs in graves, but some quantities of imported wares, such as Daunian from south Italy, Hellenistic and small quantities of classical Greek were found[5,7].

By the middle of the 1st century B.C. Liburnians started losing their territory to their Illyrian neighbors, the Delmatae and Ardiaei. In the year 35 B.C. the Romans conquered the Liburnians and incorporated their territory into the province of Dalmatia[4].

Material and Methods

The skeletal material for this study comes from the burial mound 13 in Nadin. Archaeological site of Nadin is located about 30km from the town of Zadar, in central Dalmatia, Croatia.

The mound excavated in 2004 is a part of the group of 12 mounds that surround the hillfort from the northeast. During the excavation 19 damaged graves were revealed[3]. They were positioned in three concentric circles with three graves in its center. Majority of the graves were in the middle circle, with only six in the outer[3,8].

Three burial types were identified: inhumation in flexed position, inhumation in extended position, and cremation. Majority of the deceased (n=11) were in flexed position, in graves situated in the middle of the circle. Two cremated individuals were buried in urns[3,8]. Their burials, along with those of the deceased in the extended position were located in two outer circles. Although multiple burials were present, the majority were single inhumations[3,8].

The grave goods mostly consisted of jewelry, such as needles, fibulae and iron bracelets. Based on the burial characteristics, ceramic and grave good typology, the site can be dated to the early Iron age, from 9th to 6th century B.C.[3,8].

The mound 13 is important as it offers a series of new data on the Liburnian culture. This is the site with the highest number of graves found in a single mound[3,8]. One specific of the mound is the use of the three different burial types, as well as their location in three concentric circles. Furthermore, this is the first documented example of cremation burials after the Bronze age in the region. Their existence confirms that incineration was also one of the Liburnian funerary rites[3,8].

The preservation and the completeness of the analyzed bones varied from generally good, to fragmented and poorly preserved. The reason for this state of the preservation is the position of the graves, which is very close to the modern ground surface.

The demographic parameters of the population (minimum number of individuals – MNI, sex, age) were determined first, as this provided the basis for all further analyses. All other indicators were then scored for each individual. Data collecting followed the procedures described by Buikstra and Ubelaker[9].

Due to the fragmentary state of the bones and presence of the multiple burials the minimum number of individuals present in the sample was determined. In order to determine MNI, the procedure described by White was used[10]. After all the skeletal remains were identified and separated according to elements and side of the body, the MNI within each category was counted. The frequency of the most prevalent bone category was used as a MNI in analyzed sample.

The age and sex of each individual was determined using the standard morphological criteria. Sex was determined following the methods based on cranial and pelvic morphology discussed in Buikstra and Ubelaker[9], White[10] and Bass[11]. There was no attempt to sex the subadult remains. In the cases when the skeletal material was not sufficient to make sex determination, the category indeterminate was used.

The age of the adults was estimated using Meindl and Lovejoy[12] method for ectocranial suture closure, Lovejoy[13] and Brothwell[14] method for the dental wear. The methods by Ubelaker[15] and Smith[16] for dental formation and eruption were used for the subadults. In the cases were the skeletal material was too fragmentary for age determination, categories adult or subadult were used.

Due to the fragmentary state of the skeletal remains, adults were assigned to rather broad age categories: young adults (18–25 years), mature adults (26–45 years) and older adults (>45 years). Subadults were assigned to the following categories: <5 years, 5–9 years, 10–14 years and 15–17 years.

Data were also recorded for some diseases and stress conditions. These included cribra orbitalia, periosteal reactions, and trauma. Observations were made for linear enamel hypoplasia, caries, alveolar abscesses, and ante mortem tooth loss of permanent teeth as indices of oral and general health.

Results

The minimum number of 37 individuals was in the Nadin sample. Sample consisted of 7 (18.9%) subadults and 30 (81.1%) adults. Among the adults (over 18 years),

9 (30%) were males, 9 (30%) females, and 12 (40%) of undetermined sex. This clear under-representation of subadults can be explained by the position of the graves. Their position close to the modern surface resulted in the removal and destruction of the fragile bones. The best represented age category for age assessed remains was the 26–45 years (30%), though of course this is the broadest category. A small number of individuals (13.3%) appear to have survived over 45 years. In the young adults category were 23.3% of the individuals, of which majority were females (57.1%). Taking into consideration preservation problems and relatively low sample size, the age distribution cannot be considered as representative of living population.

Due to the fragmented preservation of the remains all parameters could not be used for all the individuals in the sample, that resulted in different sample size for each condition.

Cribra orbitalia

Cribra orbitalia as a skeletal reaction to iron deficiency affects the upper surface of the orbits[17]. Its porous appearance is caused by the expansion of diplöe towards the outer table of the skull[18]. The frequency of the lesion is 40%, or 4 of 10 observable individuals. All of the ob-

served cases were in adult females. Lesions were not found within subadult category, because their orbits were not preserved. We believe that the prevalence of this lesion, especially among the children, might be higher considering the preservation of the cranial material available for the study.

Periostitis

Evidence of periostitis, inflammation of the periosteum, is visible as an abnormal bone deposition, or porosity, on the bone surface[18]. This condition is frequently observed in archaeological populations, and usually suggests presence of infection, but can also be related to a direct trauma to the soft tissue[19]. The frequency of the lesion is 26.1%, or 6 out of 23 preserved tibiae of both sex have the lesion.

Trauma

Skeletal fractures provide the direct evidence of both accidental and intentional human actions[19]. Only the evidence of cranial trauma was observed in the sample. Two out of 14 individuals were affected, making the frequency of 14.3%. An older adult male and an adult female both have small and circular cranial depressed fractures. The male had a fracture in the posterior portion of the left pa-
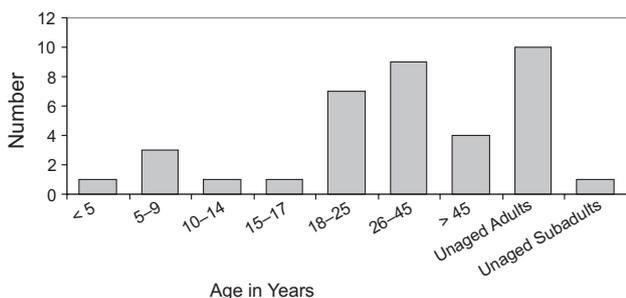

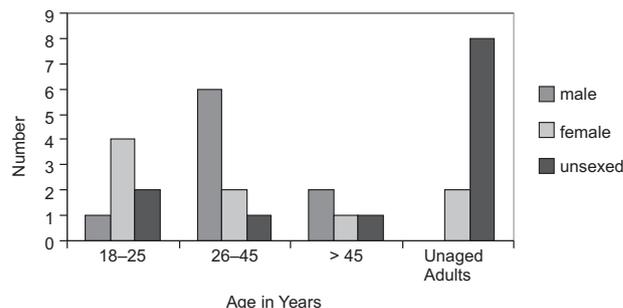Fig. 1. Age at death for subadults and adults irrespective of sex.

Fig. 2. Age at death for adults by sex.

Fig. 3. Fracture of left parietal bone.

Fig. 4. Endocranial view of Hyperostosis frontalis interna in an older female.

rietal bone and it was in the process of healing. Female had fracture in the posterior portion of the frontal bone that did not penetrate the inner table of the bone.

Dental pathologies

The available adult remains were scored for dental pathologies such as caries, alveolar abscesses, and ante mortem tooth loss. A total number of 292 permanent teeth were recovered from the site.

Carious lesion occurs when oral bacteria metabolize fermentable carbohydrates present in mouth. The consequence of this process is demineralization of the tooth[20]. The presence of lesions can be the result of the poor oral hygiene, but also indicative of a diet rich in carbohydrates, such as sugar[21,22]. Dental caries was observed in 13 of 292 available permanent teeth (4.5%). Lesions were more common in mandibular (8.2%) then in maxillary teeth (0.7%). The highest caries frequency in the mandibular teeth is found on the molars (58.3%) and on maxillary dentition, the lesions were only present on molar teeth.

Ante mortem tooth loss is caused by several factors, such as caries, occlusal wear, trauma, tartar or periodontal disease that weakens the root–supporting ligament[22]. Ante mortem tooth loss was scored in both jaws by counting the closed and reabsorbed alveolar sockets. Of 359 observations for ante mortem tooth loss, 31 teeth or 8.6% were missing. Ante mortem tooth loss was more common on mandibular (14.3%) then maxillary teeth (1.3%). Majority of the lost teeth were molars (54.8%). The loss of other teeth was less frequent and observed only in mandible: 25.8% premolars and 16.1% of canines and incisors.

Linear enamel hypoplasia is the developmental defect characterized by linear grooves in the enamel of the tooth. This cessation in the enamel formation is caused by infections, malnutrition and metabolic diseases, as well as other types of stress[23]. In this analysis, the linear enamel hypoplasia was scored on all available teeth. All the 292 permanent teeth were observed for evidence of dental hypoplasia. Prevalence is relatively low, only 4.8%, or 14 teeth were affected. The mandibular and maxillary teeth were equally (4.8%) affected.

Hyperostosis frontalis interna

In the examined skeletal material from Nadin, a case of a bilateral new bone formation on the endocranial surface of the frontal bone was observed, which I believe is a case of hyperostosis frontalis interna. The affected skull belongs to an older adult female and is consistent with the results from already published diagnosis[18].

Hyperostosis frontalis interna is manifested as an irregular bony growth on the inner surface of the frontal bone[24]. Generally, the lesion is bilateral and affects only the frontal bone, but some cases in which it extends to other bones, such as parietals, temporals and occipitals have been documented[18,25]. The etiology of this condition is still ambiguous. It has been associated with Morgagni syndrome, a metabolic disorder affecting older women. It

can also result from hormonal disturbances such as prolonged estrogen stimulation, menstrual disorders, as well as from obesity or genetic factors[25,26]. Until now, several cases of the hyperostosis were documented in the archaeological material. Clinical studies on modern populations as well as archaeological cases show that the condition is age and sex specific, more frequently affecting older, postmenopausal women[18,25].

Discussion

The relatively low sample size and the fact that the preservation and completeness of available skeletal material was sometimes rather poor, do not allow us to make interpretations without caution. Whenever it was possible comparison with the Vinkovci–Nama serie was made.

Analysis of the skeletal markers of health showed that the major health problem in this population identifiable on the skeletal remains are conditions causing cribra orbitalia (40%). The lesions were observed in 4 adults, all females. This apparent sex difference could maybe be explained by different iron demands between sexes. Women, as well as children, require the highest amount of iron as a consequence of periodical loss of blood, pregnancy, lactation and growth requirements[27]. The lesions were not observed in the subadults while their orbits were not present. At the Vinkovci-Nama site, this type of lesion was found in two, out of three, subadults and in one adult male (out of five adults). Comparing to Vinkovci serie, where only two individuals (one subadult and one adult female) show evidence, the prevalence in the Nadin seems more realistic.

The evidence of periostitis is observed on 26.1% of the preserved tibiae of both sexes. In the Vinkovci-Nama serie only two individuals have evidence of periostitis on tibia. Both tibiae of subadult show new bone deposits, while female has localized periosteal new bone formation on distal third of the diaphysis of the left tibia.

In the Nadin sample, traumas were rare, and only two were observed on crania, in adult male and female. In the Vinkovci-Nama serie two individuals exhibit evidence of trauma, a healed fracture on the frontal bone of a male and a compression fracture of the first lumbar vertebra in a female.

Analysis of the dental status revealed low frequency of caries and ante mortem tooth loss, as well as linear enamel hypoplasia, indicating rather good overall dental health. The relatively low frequency of caries in the analyzed sample is indicative of low consumption of carbohydrates. Carious lesions were more frequently on the molar teeth, which can be explained by the fact that plaque more easily accumulates on the broad occlusal surfaces. Food particles that are trapped in their fissures and pits cannot be easily removed by the natural mechanisms such as saliva, tongue and cheeks[28]. Ante mortem tooth loss can be created by different causes, but I believe that in the analyzed sample, caries was the most likely explanation. The majority of the lost teeth (51.7%) are molars, the most susceptible to caries. The higher frequency in

mandibular dentition follows the distribution of caries, but is also a result of better preservation of mandibular alveolar bone. Low frequency of linear enamel hypoplasia suggests that individuals from Nadin were not under the strong systemic stress during their childhood. In the Vinkovci-Nama serie, 11.6% of the teeth had carious lesions and 26.2% of adult tooth sockets exhibit evidence of alveolar bone disease. The better dental health in Nadin could be explained by the fact that the site is located near the sea. Proximity of the sea and fact that Liburnians were famous sailors implicates that their diet was rich in sea food which is less cariogenic.

Only one case of hyperostosis frontalis interna was observed in the sample. The new bone formation was observed on the endocranial surface of the frontal bone of an older adult female.

Conclusion

At this moment, the available skeletal data do not allow us to make conclusions about the demography, health and behavior for the Croatian Iron age population. A more detailed picture must await additional analyses of samples from both the continental and coastal Croatia. We hope that this analysis of the skeletal material from the Nadin burial mound, despite its limitations, is a contribution leading in that direction.

Acknowledgement

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P. Rajić

Institute for Anthropological Research, Amruševa 8, Zagreb, Croatia
e-mail: petra@inantro.hr

ANALIZA LJUDSKIH SKELETNIH OSTATAKA IZ NADINA, ŽELJEZNODOBNOG TUMULA

S A Ž E T A K

U radu se pokušalo rekonstruirati zdravstveno stanje, bolesti i uvjeti života populacije pokopane u grobnom humku Nadin u Dalmaciji, Hrvatskoj. Analizirani skeletni materijal pripada liburnskoj kulturnoj grupi i može se datirati u rano željezno doba, od 9. do 6. stoljeća pr. K. Uzorak predstavlja minimalni broj od 37 individua, unutar kojih je prisutno sedmero djece i 30 odraslih osoba.. Učestalost uočenih stanja je relativno niska. Cribra orbitalia je uočena samo kod žena, dok je učestalost periostealnih reakcija na goljeničnim kostima 26.1%. Uočena su samo dva slučaja kranijalne traume. Analizirani zubi pokazuju nisku stopu karioznih lezija, gubitka zubi prije smrti i linearne hipoplazije. Kod starije individue ženskog spola uočen je slučaj hiperostoze frontalne kosti na endokranijalnoj površini čeone kosti.