Mario ŠLAUS

DEMOGRAPHY AND DISEASE IN THE EARLY MEDIEVAL SITE OF PRIVLAKA

UDK 611/618:572.71:576 (497.5)
Izvorni znanstveni rad
Antropologija
Original scientific paper
Anthropology
Primljeno: 1996.11.20
Received:

Mario Šlaus
HR - 10000 Zagreb
Odsjek za arheologiju Hrvatske
akademije znanosti i umjetnosti
A. Kovačića 5

Archaeological analysis of the Avaro-Slav cemetery located in Privlaka tentatively suggests high mortality rates and dietary deficiencies. Osteological evidence from a sample of 181 individuals supports this hypothesis. Paleodemographic analysis indicates high subadult mortality and peak adult mortality rates between the ages of 20 to 35 years. Paleodemographic analysis also indicates significant gender differences in age-specific mortality levels and in mean ages at death. Females lived shorter and exhibited peak levels of mortality earlier than males. High frequencies of cribra orbitalia, linear enamel hypoplasia and ectocranial porosity without vault thickening in the analysed sample indicate frequent episodes of anemia and chronic malnutrition. Gender dfifferences in the frequencies of these indicators of nutritional stress further suggest that differential access to limited food resources was the primary factor responsible for differential male/female mortality profiles. Differential frequencies of skeletal indicators of physical stress indicate that males, though buffered from the effects of malnutrition, were exposed to higher levels of excessive physical stress.

INTRODUCTION

Privlaka is a small village located approximately 11 km. south-east of Vinkovci, in the continental part of Croatia. In 1972 construction activities in the "Gole Njive" complex on the outskirts of Privlaka revealed the presence of 9 graves. Examination of these burials indicated that they dated to the Avaro-Slav period in the early Middle ages. Systematic excavation of the site was therefore begun the following year under the direction of prof. M. Šmalcelj from the Department of archaeology at the University of Zagreb. Excavations continued until 1980 during which time the presence of a relatively large cemetery with 230 graves alligned in, more or less, parallel rows was recorded. Because of the foresight of prof. Šmalcelj, Privlaka is one of the first archaeological sites in Croatia in which human skeletal remains were systematically recovered.

Archaeological data from the Privlaka cemetery confirmed the first assumptions. Based on archaeological material, use of the cemetery was dated from 700 to 800 AD or during the time of the Second Avar Kingdom (Šmalcelj 1973: 118; Šmalcelj 1976: 127). Along with several other recorded sites, Privlaka defined the southern border of the Avar kingdom and thus shared numerous characteristics common to all Avar period cemeteries (Šmalcelj 1981: 144).

Some archaeological characteristics of Privlaka are, however, unique and do not follow the pattern generally seen in Avaro-Slav cemeteries. The first feature which differentiates Privlaka is a significant lack of pottery. Avaro-Slav sites are characterised by the presence of pottery, distinctive in shape and colour. Apart from a few isolated cases, this pottery is conspicuously absent in the recovered grave goods (Šmalcelj 1973: 118; Šmalcelj 1976: 128). Grave offerings of food are also almost completely absent which differs from the pattern seen in other Avaro-Slav cemeteries. In the, for instance, Stari Jankovci cemetery which is located 8 km. east of Privlaka and is dated to the same period, food offerings in graves, in the form of large domestic animal bones, are abundant. In Privlaka this is not the case. Offerings of food are very rare and when present take the form of poultry bones or egg shells (Šmalcelj 1976: 128).

Another specific feature of the Privlaka cemetery is a concentration of subadult burials in the central area of the cemetery. These graves are closely grouped together and exhibit an identical deviation from the established northwest-southeast orientation of the graves which suggests a relatively short time span between inhumations (Šmalcelj 1973: 118).

Collectively, this archaeological evidence tentatively suggests increased mortality and possible dietary deficiencies. As allready stated, use of the Privlaka cemetery is dated to the Second, or final phase of the Avar state and coincides with the destruction of the Avar kingdom by the eastwardly expanding Franks led by Charlemaigne. Craniometric analysis of the site (Šlaus 1993) supports Liptak's (1983) argument regarding the racial composition of late Avaro-Slav sites. The percentage of true Avars of Mongoloid racial stock is relatively small. Discriminant function analysis of male crania indicates that 6% of the male population belonged to the Mongoloid race (Šlaus 1993).

The purpose of this paper is to analyse osteological information relevant to the demography, health, nutritional status and physical stress of the Privlaka population and to see if this data supports the hypothesis of increased mortality and dietary deficiency tentatively suggested by archaeological evidence.

MATERIALS AND METHODS

The Privlaka skeletal collection is one of the first systematically recovered archaeological populations from Croatia. Osteological material from each grave was carefully recovered and placed in individually labeled containers. The skeletal material was then transported to Zagreb where it was cleaned and, when necessary, reconstructed. Because of differential bone preservation detailed bone inventories were obtained for each individual. The coding format used in obtaining bone inventories is compatible with computer analysis and provides precise bone counts by left and right side including separate tabulation of the numbers of proximal and distal joint surfaces of all major long bones. These inventories were necessary for pathology data analysis.

Pathology data was scored according to a coding format which descriptively coded bone lesions according to the predominant osteoblastic or osteoclastic response as: 1) bone loss; 2) bone increase, and 3) simultaneous bone resorption and formation. All pathological features were further coded for: severity (i.e., mild, moderate, severe), 2) state (i.e., active, remodeled), 3) extent of involvement (i.e., localised, widespread) and 4) specific location on the bone.

Criteria used in the determination of sex includes pelvic (Phenice 1969) and cranial morphology (Krogman and Iscan 1986). For subadults age at death was determined by use of dental calcification standards (Moores et al. 1963) and limb bone lenghts (Fazekas and Kosa 1978). Morphological changes in the pubic symphisis (Brooks and Suchey 1990), sternal ribs (Iscan et al. 1984) and auricular surface of the illium (Lovejoy et al. 1985) were used when determining the age at death of adults.

Diagnosis of skeletal pathology was made on the basis of gross macroscopic examination of each skeleton. Paleodemographic analysis was accomplished through the use of detailed and abridged life tables (Acsadi and Nemeskeri 1970).

Age	D(x)	d(x)	l(x)	q(x)	L(x)	T(x)	e(x)
0-0.9	3	1.66	100.00	0.017	495.850	3796.900	37..97
1-2.9	4	2.21	98..34	0.022	486.175	3301.050	33..57
3-4.9	7	3.87	96.13	0.040	470.975	2814.875	29.28
5-9	14	7.73	92.26	0.084	441.975	2343.900	25.40
10-14	9	4.97	84..53	0.059	410.225	1901.925	22.50
15-19	8	4.42	79.56	0.055	386.750	1491.700	18.75
20-24	24	13.26	75.14	0.176	342.550	1104.950	14.70
25-29	27	14.92	61.88	0.241	272.100	762.400	12.32
30-34	28	15.47	46.96	0.329	196.125	490.300	10.44
35-39	21	11.60	31.49	0.368	128.450	294.175	9.34
40-44	19	10.50	19.89	0.528	73.200	165.725	8.33
45-49	5	2.76	9.39	0.294	40.050	92.525	9.85
50-54	4	2.21	6.63	0.333	27.625	52.475	7.91
55-59	3	1.66	4.42	0.375	17.950	24.850	5.62
60+	5	2.76	2.76	1.000	6.900	6.900	2.50
TOTAL	*181*	*100.00*	*0.00*	-	*3796.900*	-	-

Note: Ages are expressed in years. D(x) - actual number of individuals who died during a given age class; d(x) - percentage of individuals dying at a given age class; l(x) - percent of individuals who survive to a given age class; q(x) - probability of dying at a given age class; L(x) - number of years lived by survivors in this age class; T(x) - total number of years remaining in the lifetimes of all the individuals entering this age class; e(x) - life expectancy, or mean lifetime remaining to those individuals entering this age class.

Table 1: Life table for the complete population from Privlaka.

RESULTS

Cemetery demography

Skeletal remains were recovered for 181 individuals. The sample comprises of 37 subadults and 144 adults. The youngest individual is represented by fetal remains approximately 39 weeks old. The oldest age category, represented by one adult male and four adult females is 60+ years. The adult sample (15 years or older) includes 71 males and 73 females; the male/female ratio is thus 0.97.

The life table for the complete population from Privlaka is presented in Table 1. Life expectancy at birth was 38 years. Subadult mortality, as represented by this sample is relatively high, approximately 20% of the population did not live to adulthood. The highest age-specific mortality rates are, however, in the young adult years. Between the ages of 20 to 35 years slightly less than 44% of the complete population died.

Abridged life tables, calculated separately for adult males and females are shown in Tables 2 and 3. These tables indicate differential mortality profiles for males and females. Females exhibit higher mortality levels

Age	D(x)	d(x)	l(x)	q(x)	L(x)	T(x)	e(x)
15-19	3	4.22	100.00	0.042	489.450	2039.000	20.39
20-24	6	8.45	95.78	0.088	457.775	1549.550	16.18
25-29	14	19.72	87.33	0.226	387.350	1091.775	12.50
30-34	15	21.13	67.61	0.312	285.225	704.425	10.42
35-39	11	15.49	46.48	0.333	193.675	419.200	9.02
40-44	12	16.50	30.99	0.545	112.700	225.525	7.28
45-49	4	5.63	14.09	0.399	56.375	112.825	8.01
50-54	2	2.82	8.46	0.333	35.250	56.450	6.67
55-59	3	4.22	5.64	0.748	17.650	21.200	3.76
60+	1	1.42	1.42	1.000	3.550	3.550	2.50
TOTAL	*71*	*100.00*	*0.00*	-	*2039.000*	-	-

Note: Ages are expressed in years. D(x) - actual number of individuals who died during a given age class; d(x) - percentage of individuals dying at a given age class; l(x) - percent of individuals who survive to a given age class; q(x) - probability of dying at a given age class; L(x) - number of years lived by survivors in this age class; T(x) - total number of years remaining in the lifetimes of all the individuals entering this age class; e(x) - life expectancy, or mean lifetime remaining to those individuals entering this age class.

Table 2: Abridged life table for adult males from Privlaka.

Age	D(x)	d(x)	l(x)	q(x)	L(x)	T(x)	e(x)
15-19	5	6.85	100,00	0.068	482.875	1715.450	17.15
20-24	18	24.66	93.15	0.265	404.100	1232.575	13.23
25-29	13	17.81	68.49	0.260	297.925	828.475	12.10
30-34	13	17.81	50.68	0.351	208.875	530.550	10.47
35-39	10	13.70	32.87	0.417	130.100	321.675	9.79
40-44	7	9.59	19.17	0.500	71.875	191.575	9.99
45-49	1	0.37	9.58	0.143	44.475	119.700	12.49
50-54	2	2.74	8.21	0.334	34.200	75.225	9.16
55-59	0	0,00	5.47	0,000	27.350	41.025	7,50
60+	4	5.47	5.47	1.000	13.675	13.675	2,50
TOTAL	*73*	*100,00*	*0,00*	-	*1715.450*	-	-

Note: Ages are expressed in years. D(x) - actual number of individuals who died during a given age class; d(x) - percentage of individuals dying at a given age class; l(x) - percent of individuals who survive to a given age class; q(x) - probability of dying at a given age class; L(x) - number of years lived by survivors in this age class; T(x) - total number of years remaining in the lifetimes of all the individuals entering this age class; e(x) - life expectancy, or mean lifetime remaining to those individuals entering this age class.

Table 3: Abridged life table for adult females from Privlaka.

during young adulthood, from 15 to 30 years of age, while males show higher mortality rates in the 40 to 60+ age groups. When age specific mortality frequencies are graphed for adult males and females (Figure 1), the differences become even more observable. Females exhibit a clear peak mortality period between 20 and 29 years with the actual peak between 20 and 24 years, while males show an equally well defined peak mortality period between 25 to 34 years with the actual peak between 30 to 34 years. These differences are also reflected in mean ages at death. The mean age at death for males is 34.9 years (s.d.= 10.0), while the mean age at death for females is 31.8 years (s.d. = 11.4).

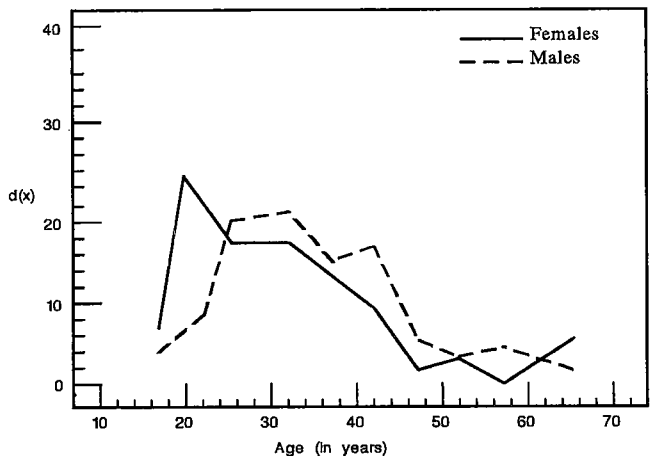

Figure 1: Age-specific mortality frequencies for adult males and females

Two non-parametric tests, the Kruskal-Wallis One-Way analysis and the Mann-Whitney test, were used to evaluate the statistical significance of the difference in ages at death between males and females. The results of both of these tests (Table 4) indicate that the difference in ages at death between males and females is statistically significant.

Nutritional deficiencies

Several indicators were used to assess possible nutritional deficiencies in the Privlaka population. These indicators are: cribra orbitalia, hypoplastic defects in tooth enamel and ectocranial porosity without concomitant vault thickening. Cribra orbitalia and hypoplastic defects in tooth enamel are well known and frequently analysed indicators of nutritional stress. Ectocranial porosity without concomitant vault thickening, as opposed to porotic hyperostosis which is as it's name implies defined by the presence ot thickened bone, is characterised by small sieve-like pits, particularly around bregma, the sagittal suture and the squama of the occipital bone, in the outer table of the skull. These tiny pits resembling the texture and appearance of an orange peel are not accompanied by vault thickening (Mann and Murphy 1990). This type of cranial porosity has been reported in some American soldiers who died as prisoners of war during the Korean conflict (McKern and Stewart 1957) and in a sample of American soldiers who died during the War of 1812 (Owsley et al. 1991). In both cases the condition was attributed to extreme and prolonged nutritional deprivation.

The frequency of cribra orbitalia in Privlaka (Table 5) is relatively high, 27% of the complete population exhibits some degree of porosity on the superior orbit. The highest incidence was recorded in subadults (47%), followed by males (25%) and females (19%). Adults uniformly exibited healed lesions with slight pitting and no expansion of the orbital wall. In subadults the lesion was overwhelmingly (13/14, 93%) expressed in the active stage with severe sieve-like lesions and considerable expansion of the orbital wall. Gender differences in cribra orbitalia frequencies were not statistically significant.

Enamel hypoplasia frequencies are also high. The mean number of occurences of these horizontal grooves in the tooth crown is 7.0 for the complete population. The highest incidence was recorded in subadults (8.2) followed by females (6.7) and males (6.6). Because

KRUSKAL-WALLIS ANALYSIS		
Sex	Sample size	Average rank
Male	71	80.5915
Female	73	64.6301
Test statistic = 5.39997		Significance level = 0.02

MANN-WHITNEY TEST		
Sex	Sample size	Average rank
Male	71	80.5915
Female	73	64.6301
Test statistic Z = -2.322		Significance level = 0.02

Table 4: Kruskal-Wallis and Mann-Whitney analysis of age at death between males and females.

State of expression	MALE		FEMALE		SUBADULT		TOTAL	
	N/T	%	N/T	%	N/T	%	N/T	%
Healed	15/59	25.4	12/62	19.3	1/30	3.3	28/151	18.5
Mild					10/30	33.3	10/151	6.6
Moderate					3/30	10.0	3/151	2.0
Severe								
TOTAL	*15/59*	*25.4*	*12/62*	*19.3*	*14/30*	*46.6*	*41/151*	*27.1*

Note: The following method of tabulation is used: N - number of observed cribra orbitalias; T - total number of frontal bones present in this subcategory; % - percent of frontal bones with cribra orbitalia.

Table 5: Cribra orbitalia frequencies by sex and state for Privlaka.

numerous causative factors have been linked to enamel hypoplasia, a significant interuption of normal development was considered when at least two teeth of different classes exhibited a hypoplastic defect which developed during the same half-year period. Slightly less than 64% of the complete population suffered at least one growth arrest period (Table 6). Males were most affected, followed by females and subadults.

Frequencies of ectocranial porosity without concomitant vault thickening are high in adult crania. Approximately 27% of all adults exhibit this condition (Table 7). All cases were classified as "mild" in expression. No examples of this condition were found in subadult crania. Gender differences are marked. The frequency of ectocranial porosity in females is more than twice as high as that in males. This difference is statistically significant, $\chi^2 = 3.86$, $p < 0.05$.

Further skeletal evidence of nutritional deprivation is seen in the probable presence of one case of craniotabes, in a subadult aged 2.5 to 3.5 years, and in the presence of seven individuals, 2 males and 5 females, with laterally bowed long bones. All cases were calassified as either "mild" (2 males and 2 females) or "moderate" (3 females) in expression and were

	% of individuals with no growth arrest periods	% of individuals with at least one growth arrest period
Male	29	71
Female	36	64
Subadult	50	50
TOTAL	*36*	*64*

Table 6: Percent of individuals with and without growth arrest periods in Privlaka.

	Number of crania	% with ectocranial porosity	
Male	59	15	(9)
Female	60	38	(23)
TOTAL	*119*	*27*	*(32)*

Table 7: Frequency and distribution of ectocranial porosity without concomitant vault thickening in adult crania from Privlaka.

localized in the femur (in 2 cases) or in the tibia (in 5 cases). This osteological evidence is compatible with the presence of rickets and further supports the argument for dietary deficiency in Privlaka.

Infectious disease

Skeletal evidence of non-specific infectious disease, in the form of periosteal reactions along the shaft of long bones or on the endocranial surface of cranial bones, was recorded in slightly less than 50% of all subadults (Table 8). In the majority of cases (16/18, 89%) these lesions were in the active state. Five subadults (13.5%) exhibited active, systemic periostitis together with active endocranial periostitis.

Periosteal lesions in adults were limited to the tibia and fibula. Gender differences are present both in the percentages of individulas with skeletal evidence of infectious didease, and in the state of the periosteal lesions. In comparison to males, females show higher frequencies of non-specific periosteal reactions; the percentage of females is exactly twice as high as that of males. Aside from being less exposed to infectious disease, Privlaka males also exhibit a greater ability to recover from episodes of infection. The frequency of healed tibial periostitis in males (10/135) is significantly greater than that recorded in females (0/141), $\chi^2 = 8.13$; $p > 0.001$.

	Number of individuals	% with infection	
Male	71	8	(6)
Female	73	16	(12)
Subadult	37	49	(18)
TOTAL	181	20	(36)

Table 8: Frequencies of infectious disease in Privlaka.

Physical stress

Gender differences are also apparent in the frequencies of skeletal markers of physical stress. The following markers were analysed: degenerative changes in major joints which were classified as lipping, porosity of the joint surface or eburnation, vertebral degenerative changes and the incidence of Schmorl's defects in vertebral bodies. The relatively young mean ages at death for both males and females suggest that the degenerative changes were not simply the result of advanced age, but rather more likely the result of strenuous physical labor.

As can be seen in Table 9, males exhibit higher frequencies of degenerative joint changes in the elbow and knee, while females exhibit higher frequencies in the shoulder and hip. Statistically significant differences are, however, present only in the frequencies of elbow arthritis ($\chi^2 = 4.61$; $p < 0.03$). Of interest are the high total frequencies of elbow and knee arthritis in the complete population. Approximately every third adult exhibited some degree of either elbow or knee arthritis.

Vertebral degenerative changes, defined by the presence of osteophytes, porosity or eburnation, were more prevalent in males (Table 10). This applies both to total frequencies and to the frequencies of degenerative changes in the cervical, thoracic and lumbar segments of the spine. No statistically significant differences were, however, present.

Males also exhibit higher frequencies of Schmorl's defects. As shown in Table 11, the total frequency of Schmorl's defects in male vertebrae (25%) is more than twice as high as that recorded in female vertebrae (10%). This difference is statistically significant ($\chi^2 = 10.92$; $p < 0.0001$). Males also exhibit a significantly

	Shoulder		Elbow		Hip		Knee	
	N/T	%	N/T	%	N/T	%	N/T	%
MALE	8/61	13.1	51/110	46.4	7/88	7.9	37/96	38.5
FEMALE	11/57	19.3	30/118	25.4	10/110	9.1	22/92	23.9
TOTAL	*19/118*	*16.1*	*81/228*	*35.5*	*17/198*	*8.6*	*59/188*	*31.4*

Note: The following method of tabulation is used: N - number of affected joints T - total number of joints present in this subcategory; % - percent of joints with arthritis. A joint was scored as present if at least one joint element was completely present or if two or three elements were partially present. Arthritis was scored as present if at least one joint element showed evidence of degenerative change.

Table 9: Degenerative changes in major joints in Privlaka.

	Cervical		Thoracic		Lumbar		Total	
	N/T	%	N/T	%	N/T	%	N/T	%
MALE	11/69	16	18/58	31	34/173	20	63/300	21
FEMALE	16/116	14	14/66	21	22/149	15	52/331	16
TOTAL	*27/185*	*15*	*32/124*	*26*	*56/322*	*17*	*115/631*	*18*

Note: N - number of affected vertebrae; T - total number of vertebrae present in this subcategory; % - percent of vertebrae with degenerative change.

Table 10: Vertebral degenerative change in Privlaka.

	Thoracic vertebrae		Lumbar vertebrae		TOTAL vertebrae	
	N/T	%	N/T	%	N/T	%
MALE	20/58	34.4	38/173	22.0	58/231	25.1
FEMALE	6/66	9.1	16/149	10.7	22/215	10.2
TOTAL	*26/124*	*21.0*	*54/322*	*16.8*	*80/446*	*17.9*

Note: N - number of affected vertebrae; T - total number of vertebrae present in this subcategory; % - percent of vertebrae with Schmorl's defects.

Table 11: Frequencies of Schmorl's defects in Privlaka.

higher incidence of Schmorl's defects in thoracic vertebrae (34% versus 9%, $\chi^2 = 6.66$; $p < 0.001$) and in lumbar vertebrae (22% versus 11%, $\chi^2 = 4.54$; $p < 0.03$). Total frequencies of Schmorl's defects in the complete population are also high. Approximately 18% of all adult vertebrae exhibit a defect.

Trauma

Trauma rates are high in Privlaka. Twenty percent (14/71) of males, and sixteen percent (12/73) of females show evidence of healed trauma. In both males and females trauma was more common in the upper extremities than in the lower: in males 43% of all trauma was localized in the upper extremities versus 34% in the lower; 48% in upper extremities versus 31% in lower was recorded for females. Evidence of cranial trauma was seen only in females; two cases were recorded both involving blunt force trauma to the parietals which resulted in well healed, shallow, oval depression fractures. Not one case of trauma, cranial or post-cranial, can be characterised as peri-mortem (occuring at the time of death). No evidence of trauma was seen in subadult bones.

Only one individual exhibited more than one traumatic injury. This is an adult male, aged between 45 to 50 years, who suffered a cutting wound to the right medial clavicle which became infected and developed osteomyelitis that subsequently healed with considerable bone remodeling. This individual also exhibited traumatic myositis ossificans in the proximal right femur and two healed, shallow, oval depression fractures in the proximal joint surface of the right tibia. As grave goods found in this individuals grave include luxurious belt ornaments and a sword and knife a reasonable case can be made that this individual was a veteran of several campaigns.

DISCUSSION

As demonstrated in this paper, the accumulation of osteological evidence from skeletal samples is an important step in evaluating conclusions derived from archaeological and historical sources. Of particular interest are the physical data relating to demography, genetic change and lifeways of archaeological populations. Osteological evidence also provides information that is typically unavailable through other sources. Skeletal indicators of disease, trauma, growth interuption as evidenced by enamel hypoplasia, frequencies of anemia and infection, provide valuable data not only about the frequencies of these stress indicators but also about the ways in which different populations attempt to overcome them.

Osteological research of the Privlaka cemetery has provided data concerning cemetery demography and skeletal and dental pathological lesions. The series includes 181 individulas of which 37 were subadults (aged less than 15 years), and 144 were adults. Despite the probable under-representation of infants and children caused by differential bone preservation and differential burial techniques (infant and child burials were, as a rule, considerably shallower than adult burials) subadult mortality, as ascertained in this sample, is high. Slightly less than 20% of the complete population died before their fifteenth year. Adult mortality is highest in young adulthood, between the ages of 20 to 35 years. Paleodemographic analysis indicates significant gender differences in mortality profiles. These differences are evident in differential age-specific mortality frequencies and in mean ages at death. Females live shorter and display peak mortality frequencies earlier than males. The results of a Kruskal-Wallis One-Way analysis and a Mann-Whitney test further confirm that the difference in age at death between males and females is statistically significant.

Skeletal evidence for dietary deficiencies is abundant. The high frequencies of active cribra orbitalia in subadults and healed cribra orbitalia in adults attest to frequent childhood episodes of anemia, while the high frequencies of ectocranial porosity without concomitant vault thickening in adult crania indicate frequent episodes of chronic malnutrition in adults.

Aside from being unequivocal, the skeletal evidence for nutritional deficiency also suggests possible gender differences; adult females seem to be more exposed to malnutrition than males. This may be the reason why females show higher frequencies of active periosteal lesions. Reduced nutrition may have lowered host resistance in females making them more suspectible to infectious disease.

Significant differences in the frequencies of degenerative changes in joint surfaces and vertebrae, as well as differences in the frequencies of Schmorl's defects indicate that males, though buffered from the effects of malnutrition, were exposed to higher levels of excessive physical stress. The relatively young mean age at death for males in the Privlaka sample further suggests that the higher frequencies of degenerative changes were not simply the result of greater longevity, but more likely the result of a culturally imposed division of labor in which males were more exposed to strenuous physical activity.

The high frequencies of healed trauma in the analysed sample suggest that inter-personal violence accompanied the general deterioration of stability in the Avar state and the reduced availability of food resources. No gender differences were noticed in the frequencies of traumatic lesions. Females were affected only slightly less than males, and both sexes displayed a greater preponderance for fractures in the upper extremities which is consistant with a high frequency of defensive fractures.

In conclusion, osteological evidence from the Privlaka cemetery supports the hypothesis of high mortality and dietary deficiencies suggested by archaeological and historical data. The skeletal evidence further suggests that existing dietary deficiencies were not uniformly distributed in the complete population. Reduced access to nutritional resources may have activated specific cultural buffering mechanisms which selectively buffered adult males from the effects of malnutrition. At the same time, these same cultural systems, probably through the mechanism of a culturally imposed division of labor, exposed males to significantly higher levels of physical stress.

Acknowledgements

I wish to thank Prof. M. Šmalcelj for her kind permission to study the osteological material from Privlaka.

ABBREVIATIONS

AJPA - American Journal of Physical Anthropology, New York

AP - Arheološki Pregled, Beograd

Opusc. Archaeol. - Opuscula Archaeologica; Radovi Arheološkog zavoda Filozofskog fakulteta u Zagrebu

BIBLIOGRAPHY

Acsadi and Nemeskeri 1970 — Gy. Acsadi and J. Nemeskeri, History of human life span and mortality, Budapest, 1970

Brooks and Suchey 1990 — S. Brooks and M.J. Suchey, Skeletal age determination based on the os pubis: A comparison of the Acsadi-Nemeskeri and Suchey-Brooks methods, Human Evolution, 5, 1990, 227-238

Fazekas and Kosa 1978 — I.Gy. Fazekas and F. Kosa, Forensic fetal osteology, Budapest, 1978

Iscan et al. 1984 — M.Y. Iscan, S.R. Loth and K.K. Wright, Metamorphosis of the sternal rib: A new method to estimate age at death in males, AJPA, 65, 1984, 147-156

Krogman and Iscan 1986 — W.M. Krogman and M.Y. Iscan, The human skeleton in forensic medicine, Springfield Illinois, 1986

Liptak 1983 — P. Liptak, Avars and ancient Hungarians, Budapest, 1983

Lovejoy et al. 1985 — C.O. Lovejoy, R.S. Meindl, T.R. Pryzbeck and R.P. Mensforth, Chronological metamorphosis of the auricular surface of the ilium: A new method for determination of adult skeletal age at death, AJPA, 68, 1985, 15-28

Mann and Murphy 1990 — W.R. Mann and P.S. Murphy, Regional atlas of bone disease, Springfield Illinois, 1990

McKern and Stewart 1957 — T.W. McKern and T.D. Stewart, Skeletal age changes in young American males, analysed from the standpoint of identification, Natick, Massachusetts, 1957

Moorrees et al. 1963 — C.F.A. Moorrees, E.A. Fanning and E.E. Hunt, Age variation of formation stages for ten permanent teeth, Journal of Dental Research, 42, 1963, 1490-1502

Owsley et al. 1991 — D.W. Owsley, R.W. Mann and S.P. Murphy, Injuries, surgical care and disease, In S. Pfeiffer and R.F. Williamson (editors) Snake Hill: An investigation of a military cemetery from the War of 1812, Toronto, 1991

Phenice 1969 — T.W. Phenice, A newly developed visual method of sexing the os pubis, AJPA, 30, 1969, 297-301

Šmalcelj 1973 — M. Šmalcelj, Privlaka - "Gole Njive" (općina Vinkovci) - Nekropola VII-IX stoljeća - sistematska iskopavanja, AP, 15, 1973, 117-119

Šmalcelj 1976 — M. Šmalcelj, Privlaka - "Gole Njive", Vinkovci - nekropola VIII-IX st., AP, 18, 1976, 127-128

Šmalcelj 1981 — M. Šmalcelj, Privlaka - Gole Njive (Opć. Vinkovci) - avaroslavenska nekropola, AP, 22, 1981, 143-144

Šlaus 1993 — M. Šlaus, Cranial variation and microevolution in two early Middle Age sites from Croatia; Privlaka and Stari Jankovci, Opusc. Archaeol., 17, 1993, 273-307

SAŽETAK

DEMOGRAFIJA I BOLESTI U PRIVLACI, NALAZIŠTU RANOGA SREDNJEG VIJEKA

Paleodemografska analiza srednjovjekovne populacije iz Privlake pokazuje visoke stope mortaliteta kod djece i u razdoblju između 20. do 35. godine života. Paleodemografske analize također upućuju na statistički značajnu razliku u doživljenim starostima između muškaraca i žena. Ova razlika očituje se u različitim vrijednostima prosječnih doživljenih starosti i u različitoj razdiobi razdoblja najveće smrtnosti. Arheološka analiza groblja iz Privlake, temeljeći se na atipičnoj oskudnosti keramike i grobnih priloga hrane, upućuje na moguću ograničenost izvora hrane. Osteološke analize potvrđuju ovu hipotezu. Visoke učestalosti nepreboljene cribra orbitaliae kod djece i aktivne ektokranijalne poroznosti kod odraslih upućuju na česta razdoblja anemije i kronične neishranjenosti. Različite učestalosti ovih pokazatelja stresa kod muškaraca i žena nadalje pokazuju da pristup ograničenim izvorima hrane nije bio ravnopravan. Znakovito smanjena dostupnost izvorima hrane aktivirala je, po svemu sudeći, specifične obrambene kulturne mehanizme koji su selektivno štitjeli odrasle muškarce što se na osteološkom materijalu očituje u statistički značajno većim učestalostima ektokranijalne poroznosti i nepreboljenog periostitisa kod žena. Sinergističko djelovanje nedovoljne prehrane i nespecifičnih zaraznih bolesti glavni je uzročnik diferencijalnog mortaliteta muškaraca i žena. Naglašeni spolni dimorfizam u podjeli hrane prati i naglašeno nejednaka podjela fizičkog rada u kojoj su muškarci izloženi značajno većem stupnju fizičkog stresa. Na osteološkom materijalu ovo se očituje u statistički značajno većim učestalostima degenerativnih promjena na zglobnim pločama i Schmorlovih defekata na kralješcima kod muškaraca.