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BIOLOGICAL ANTHROPOLOGICAL ANALYSIS OF THE AVAR PERIOD SKELETAL FINDS FROM HATVAN-SPORTPÁLYA, HUNGARY

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Szeniczey, T., Tóth, Z., Hajdu, T.: *This study presents the anthropological and palaeopathological analysis of 54 individuals from the Avar Period cemetery at Hatvan-Sportpálya (Heves County, Hungary). The assemblage is dominated by adults (83.3%), while subadults are underrepresented, likely due to taphonomic and recovery biases. Metric and morphological data align with regional Avar populations, showing predominantly Western Eurasian ancestry with occasional East Asian–related traits. The observed pathological alterations are typical of archaeological populations, mainly reflecting mechanical stress and physically demanding lifestyles. Degenerative changes were frequent in load-bearing joints and the spine, consistent with habitual activity. Periosteal reactions were mostly healed, suggesting recovery from localized inflammation or trauma. Traumatic lesions were rare and predominantly represented by vertebral compression fractures likely linked to age-related bone fragility or osteoporosis; only one case of blunt-force trauma was recorded, which does not necessarily indicate interpersonal violence.*
Keywords: *Avar Period; Carpathian Basin; Bioanthropology; Paleopathology*.

Introduction

In the northern part of Hatvan, at Nagygombos – opposite the former military barracks, on the area of the former football field – the Hungarian Post ("Magyar Posta") planned to establish a logistics centre in 2022. Under the direction of lead archaeologist Zoltán Tóth, the István Dobó Castle Museum of Eger carried out an archaeological excavation at the site Nagygombos-Sportpálya (identifier 23864). The site is situated on an elevated area that, during historical times, lay along the banks of the Zagyva River. Owing to its excellent environmental conditions and elevated topography, the area was favoured in most archaeological periods.

The first, temporary occupation of the site is indicated by Mesolithic stone tools. Later, an urn cemetery from the Late Bronze Age was uncovered in the eastern part of the site. From the Iron Age, remains of a Celtic settlement were excavated, including semi-subterranean pit-houses, storage pits, and ovens. Within the Roman Imperial Period, most of the archaeological features belong to a Sarmatian village, which, similar to the Iron Age settlement, consisted of pit-houses, storage pits, ditches, and ovens.

From the Migration Period, we documented Avar graves dated to the 7th–9th centuries, totalling 62 burials. Some of these graves had already been looted within decades after burial. A few pits and several metal artefacts (coins, spurs, cannonballs, etc.) recovered through metal detecting can be dated to the Medieval Period.

Due to grave looting, few well-datable artefacts were recovered from the Avar burials. It is likely that the graves were disturbed by family members or close relatives, who deliberately dug into the head, chest, and waist regions – knowing that valuable objects and ornaments had been placed there during burial. The lower body, from the waist down, was typically left untouched, where less valuable items such as ceramic vessels, iron knives, and spindle whorls were located.

Within Heves County, this site yielded the fourth known horse burial (Grave 9; Tóth 2017). The interred individual was probably a respected leader of the community, as his grave remained undisturbed. Unfortunately, some organic material (possibly leather) placed in the grave caused acidic soil reactions, leading to severe damage to both the man's and the horse's skeletons, which became nearly unsuitable for anthropological study. The artefacts were also affected by this process.

A preliminary overview of the grave goods suggests that earliest burials were made in the last third of the 7th century, and the use of the cemetery continued into the first half of the 9th century. Based on the extent of excavation, we can estimate that approximately 80% of the Avar cemetery has been uncovered, meaning that the original number of graves likely did not exceed 100.

The burial customs and material culture show close parallels with the few known cemeteries on the eastern side of the Mátra Mountains – such as those at Gyöngyöspata (Tóth 2013, 2016, 2017), Apc (Tóth 2019), Boldog (Ács 1991) and Petőfibánya (Tóth et al. 2019). No settlement traces associated with the buried Avar community have yet been identified. It appears that the group chose an elevated area as the final resting place for their deceased. Their settlement could have been located within a 1 km radius, and its discovery remains a task for future research in the region.

The aim of the study is to evaluate the anthropological characteristics of the Avar Period community Hatvan-Sportpálya site.

Material and methods

We carried out a detailed anthropological and palaeopathological analysis of the Avar Period anthropological material from Hatvan-Sportpálya archaeological site. The skeletal collection consisted of 54 individuals. The skeletal material is curated in the collection of the Dobó István Castle Museum, Eger, Hungary.

Age estimation for foetuses and newborns was performed following the method of Fazekas and Kósa (1978). The age at death of subadult individuals was estimated using dental development (AlQahtani et al. 2010) together with measurements based on the longitudinal and cross-sectional dimensions of the limb bones (Stloukal and Hanakova 1976, Bernert et al. 2007, 2008). The skeletal age of juveniles was assessed by examining the timing of fusion of primary and secondary ossification centres, as well as age-related changes in bone size and morphology (Schaefer et al. 2008). For adult individuals, age estimation was based on macromorphological analysis of the sternal end of the ribs (Iscan et al. 1984, 1985, DiGangi et al 2001), the degree of ectocranial suture closure of the skull (Meindl and Lovejoy 1985), and age-related transformations of the symphyseal surface of the pubic bone (Brooks and Suchey 1990).

Sex estimation of adult individuals was conducted through both macromorphological and metric analyses. Sexually dimorphic features of the skull, pelvis, sacrum, and femur were evaluated following the method of Éry and colleagues (1963), while the metric traits of the coxal bones were assessed using the DSP2 method (Bruzek et al. 2017).

Craniometric and osteometric analyses followed the measurement system defined by Martin (Martin and Saller 1957). Stature estimation was performed using Sjøvold's formulae (1990), and skull indices were classified according to the categories established by Alekseev and Debec (1964). Macromorphological traits of the cranium and dentition were further examined to infer ancestry (Lipták 1967, Hefner 2009, Scott et al. 2024). The outcomes were incorporated into a web application to calculate posterior probabilities (Coelho et al. 2020).

Palaeopathological analysis was conducted through macroscopic observation, following established standards and guidelines in the literature (Buiksta 2019, Waldron 2020).

Results

Demographic analysis

A total of 54 individuals from the Avar Period were analysed (Table A1, Figure 1). Subadults (individuals under 20 years of age) comprised 16.6% (n: 9) of the assemblage (95% CI: 6.7–26.6%). Within this category, no newborns were identified, while younger children (1.0–5.9 years) were more numerous than older children (6.0–13.9 years), representing 7.4% (n: 4) and 1.8% (n: 1) of the total sample, respectively. Juveniles (14.0–19.9 years) accounted for an additional 7.4% (n: 4) of the analysed sample. For a pre-Jennerian population, this ratio appears unexpectedly low, which is likely reflecting an underrepresentation of all subadult categories, especially the newborns.

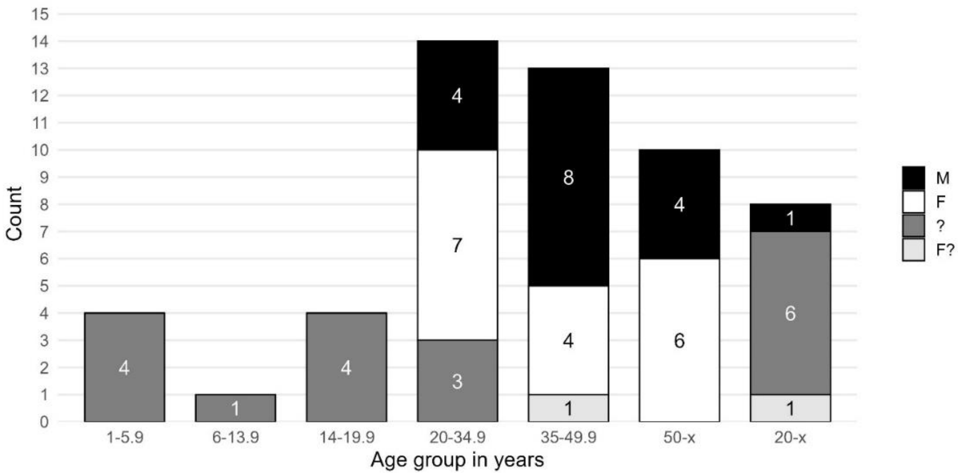

Figure 1: Sex and age distribution of the skeletal remains from Hatvan-Sportpálya (M: males, F: females, ?: unknown sex, F?: probably female).

The assemblage was dominated by adult individuals, who comprised 83.3% (95% CI: 73.4–93.3; n: 45) of the total sample. Among the adults, 17 females (37.7%), 18 males (40.0%), 2 presumably female (4.4%), 1 presumably male (2.2%), and 7 adult individuals (15.5%) of unknown sex were identified. The ratio of identified male and female individuals (M/F) shows a balanced proportion of 1.05. The proportion of young adults (20.0–34.9 years) in the entire sample is 25.9% (n: 14), similarly, the middle adult (35.0–49.9 years) is 24.07% (n: 13), while the old adults (50.0–x years) were also found in a larger portion with 18.5% (n: 10). Due to the preservation of the skeletal material, 14.8% of the individuals (n: 8) were merely categorized as adults (20.0–x years).

Metric analysis

Due to factors such as small sample size and skeletal material preservation status, the metric values obtained from cranial remains have restricted interpretive potential.

Among the major cranial characteristics, the cranial width-length ratio (M8:M1) indicated a mesocranic form in one case, while the height-length ratio (M17:M1) corresponded to chamaecranic and orthocranic types. Regarding facial morphology, the upper facial index (M48:M45) could be determined in one instance, showing a hyperleptene form. The orbital index (M52:M51) values exhibited considerable variation, ranging from hyperchamaeconch to hypsiconch categories. Similarly, the nasal index (M54:M55) values displayed a high degree of variability, encompassing forms from hyperchamaerrhine to hyperleptorrhine, without any apparent pattern in frequency distribution. Individual craniometric measurements are presented in Table A2.

Among the female individuals, the cranial width-length ratio (M8:M1) indicated a hyperdolichocranic form in one case. Examination of cranial height relative to length and width (M17:M1 and M17:M8) revealed chamaecranic and acrocranic features, respectively. In one individual, the facial indices (M47:M45 and M48:M45) indicated mesoprosopic and euryenic forms. The orbital index was most commonly classified as chamaeconchic, although hypsiconch and mesoconch categories also occurred. The nasal index displayed a level of variation similar to that observed among the males, ranging from hyperchamaerrhine to hyperleptorrhine forms.

Stature was estimated from femoral length using a formula designed to account for both sex and broad geographic variation. The mean estimated stature for males was 167.2 cm (SD = 5.9 cm), whereas for females it was 156.5 cm (SD = 3.9 cm). The individual measurements of the long bones used for stature reconstruction are presented in Table A3.

Ancestry analysis

We employed the Arizona State University Dental Anthropology System (ASUDAS; Scott et al. 2024) to estimate ancestry based on the observation of 25 key dental morphological traits. These traits are used to score 32 attributes on the dentition. The recorded attributes were entered into the rASUDAS2 web application, which applies a naïve Bayes classification algorithm to calculate ancestry probabilities. To ensure analytical reliability, only individuals with at least twelve clearly identifiable traits and 20 classified attributes were included in the dataset. This approach enabled the assignment of individuals to one of seven predefined ancestry groups, with East Asian and Western Eurasian categories considered the most relevant a priori, given the historical context of the population examined.

Altogether, the dentition of eight individuals met the criteria for classification. Based on the rASUDAS2 results, Western Eurasian ancestry was identified as the most probable in 87.5% of the cases (n: 7), with posterior probability values ranging from 0.83 to 1.00. In one instance, the posterior probability indicated a predominantly East Asian ancestry, with a value of 0.94.

Non-metric cranial traits to assess ancestry according to Hefner (2009) were involved in the analysis if 10 out of the 11 were suitable for analysis. The method classifies the cases between African, Native-American, Asian and European ancestries. Given the context of the site, African and Native American ancestry was not assumed a priori. As in the applied Bayesian classifier, these probabilities cannot be changed, if the output indicates these ancestry groups, we consider as unidentified.

According to Lipták's method (1967), the trait combinations most typical of populations with European ancestry were the most observed on the cranial remains (Figure 2).

Figure 2: Individuals with dominantly European-ancestry-related cranial traits. A: Grave No. 23; B: Grave No. 24; C: Grave No. 32; D: Grave No. 49; E: Grave No.50.

Figure 3: Individuals with mixed East Asian- and European-ancestry-related cranial traits. A: Grave No. 3; B: Grave No. 5; C: Grave No. 13.

However, in three individuals, certain features more characteristic of East Asian ancestry were also identified alongside predominantly European traits (Figure 3). Yet, in cases where dental remains were suitable for analysis, the results consistently indicated a Western Eurasian ancestry, supporting the overall European morphological pattern observed in the crania. The results of the ancestry estimations are presented in Table 1.

Joint diseases

The appendicular skeleton. The diagnosis of osteoarthrosis (OA) is established by the presence of eburnation or a combination of at least two of the following criteria: marginal osteophytes, new bone growth on the joint surface, pitting on the joint surface, and changes in joint shape (Rogers and Waldron 1995). If at least one of the bony elements forming a joint was preserved, and a minimum of three of the selected criteria could be evaluated, the specimen was included in the scoring process. No substantial differences were observed between the frequencies on the left and right sides. To increase the sample size, the unilateral presence of a lesion was considered sufficient to record osteoarthrosis as present.

Degenerative joint changes consistent with osteoarthrosis were identified in both male and female individuals, with variation in frequency and anatomical distribution (Table 2). Among males, the highest frequencies were recorded in the hand (50.0%), elbow (42.9%), and hip (30.0%) joints, followed by the knee (27.3%) and shoulder (12.5%). No degenerative changes were observed in the wrist, ankle, feet, temporomandibular, or atlantodental joints. In females, osteoarthrosis was most common in the atlantodental (40.0%) and hip (33.3%) joints, while lower frequencies were noted in the elbow (14.3%), hand (14.3%), wrist (11.1%), and knee (8.3%). No lesions were observed in the shoulder, ankle, feet, or temporomandibular joints. Due to the small sample size, frequencies were not analysed separately by age group. However, no signs of osteoarthrosis were identified among individuals aged 20–35 years. The proportions of affected individuals in the 35–50 and 50+ age groups were broadly comparable, with a slight increase observed in the oldest age category.

Table 1. Estimated ancestries with different anthropological methods. Probabilities are rounded to 2 digits (AFR: African, AME: Amerindid, ASI: Asian, EUR: European, M: males, F: females, ?: unknown sex, M?: probably male)

Grave No.	Age (ys)	Sex	Scott et al. (2024) E-Asia	W-Eurasia	Hefner (2009) AFR	AME	ASI	EUR	Lipták (1967)*
2	20–35	M	0.94	0.06	–	–	–	–	–
3	30–35	F	<0.01	>0.99	0.02	0.52	0.37	0.10	EUR+ASI
5	50–x	M	–	–	0.02	0.27	0.67	0.04	EUR+ASI
8	20–30	F	0.01	0.99	–	–	–	–	–
13	20–30	F	0.00	1.00	–	–	–	–	EUR+ASI
23	15–16	?	0.17	0.83	0.00	0.00	0.00	0.99	EUR
24	17–18	M?	<0.01	>0.99	0.05	0.00	0.00	0.95	EUR
26	40–45	M	–	–	0.69	0.08	0.18	0.04	–
32	35–50	M	–	–	–	–	–	–	EUR
43	20–35	M	<0.01	>0.99	–	–	–	–	–
44	20–30	F	<0.01	>0.99	–	–	–	–	–
49	40–45	F	–	–	0.00	0.06	0.01	0.93	EUR
50	60–x	M	–	–	0.00	0.12	0.00	0.88	EUR

Table 2. Proportion of identified OA cases among males and females at the individual level. "A" indicates the absence, while "P" indicates the presence of osteoarthrosis (OA).

Articulation	Males A	P	%	Females A	P	%
Shoulder	7	1	12.5	7	0	0.0
Elbow	4	3	42.9	6	1	14.3
Wrist	6	0	0.0	8	1	11.1
Small joints of hand	2	2	50.0	6	1	14.3
Hip	7	3	30.0	8	4	33.3
Knee	8	3	27.3	11	1	8.3
Ankle	9	0	0.0	10	0	0.0
Small joints of foot	6	0	0.0	8	0	0.0
Temporomandibular	2	0	0.0	7	0	0.0
Atlantodental	4	0	0.0	3	2	40.0

The spine. Spondylosis deformans showed a high prevalence in both sexes, particularly in the thoracal and lumbar regions. The alteration as a degenerative condition strongly correlated with age, especially beyond the 50-year threshold, and shows no major sex-biased difference. Degenerative spondylodiscitis was less frequent and more variable between sexes, with mild cervical predominance and minimal thoracic or lumbar involvement. Degenerative joint disease (spondylarthrosis) was found across all regions, but with differing intensities between males and females. Spondylarthrosis (OA of the zygapophyseal joints) appears to be more frequent in males, with strong thoracal dominance and an age-related increase (Table 3).

Table 3. Proportion of identified pathological spinal alterations among males and females at the individual level. "A" indicates the absence, while "P" indicates the presence of the lesion.

Lesion	Sex/Age (ys)	Cervical			Thoracal			Lumbar		
		A	P	%	A	P	%	A	A	%
Spondylosis deformans	Males	1	3	75.0	0	6	100.0	0	4	100.0
	20–35	0	0	0.0	0	0	0.0	0	0	0.0
	35–50	1	1	50.0	0	4	100.0	0	3	100.0
	50–x	0	2	100.0	0	2	100.0	0	1	100.0
	Females	2	5	71.4	2	6	75.0	2	7	77,8
	20–35	1	0	0.0	1	2	66.7	1	3	75.0
	35–50	1	1	50.0	1	1	50.0	1	1	50.0
	50–x	0	4	100.0	0	3	100.0	0	3	100.0
Spondylodiscitis	Males	3	1	25.0	4	1	20.0	4	1	20.0
	20–35	0	0	0.0	0	0	0.0	0	0	0.0
	35–50	2	0	0.0	2	1	33.3	3	0	0.0
	50–x	1	1	50.0	2	0	0.0	1	1	50.0
	Females	6	2	25.0	8	0	0.0	9	0	0.0
	20–35	1	0	0.0	3	0	0.0	4	0	0.0
	35–50	3	0	0.0	2	0	0.0	2	0	0.0
	50–x	2	2	50.0	3	0	0.0	3	0	0.0
Spondylarthrosis	Males	1	2	66.7	0	3	100.0	4	1	20.0
	20–35	0	0	0.0	0	0	0.0	0	0	0.0
	35–50	1	0	0.0	0	2	100.0	3	0	0.0
	50–x	0	2	100.0	0	1	100.0	1	1	50.0
	Females	6	1	14.3	5	1	16.7	6	1	14.3
	20–35	2	0	0.0	2	0	0.0	3	0	0.0
	35–50	2	0	0.0	2	0	0.0	1	1	50.0
	50–x	2	1	33.3	1	1	50.0	2	0	0.0

Periosteal alterations

Table 4 summarizes the individual level of frequency of periosteal reactions observed on long bones in males and females. Only individuals whose corresponding bones were preserved with all three diaphyseal segments (proximal, medial and distal) were included in the analysis. Periosteal reactions were most frequently observed on the tibia, affecting 50.0% of males and 36.4% of females, while other bones showed only isolated cases. Periosteal alterations on the tibia occurred on every segment, mostly on the medial site of the bone, and were predominantly healed lesions. The last row of the table is based on frequencies observed on bony elements rather than individuals. In this analysis, any tibial specimen with at least one investigable diaphyseal segment (proximal, medial or distal) was included. These data, therefore, reflect the intensity of the periosteal alteration rather than its individual-level occurrence, which outlines a similar value between the sexes.

Table 4. Individual-based frequencies of periosteal alterations. “A” indicates the absence, while “P” indicates the presence of periosteal reactions (*: frequencies belong to element-based calculation).

		Males			Females	
Bones	A	P	%	A	P	%
Humerus	5	0	0.0	6	1	14.3
Radius	6	0	0.0	8	0	0.0
Ulna	5	1	16.6	5	0	0.0
Femur	12	0	0.0	12	0	0.0
Fibula	3	1	25.0	4	0	0.0
Tibia	5	5	50.0	7	4	36.4
Tibia*	41	9	18.0	56	7	11.0

Traumatic alterations

Traumatic alterations were observed in eight of the 54 examined individuals. The majority of these lesions (n: 6) were located on the vertebral column, manifesting as compression fractures and cracked vertebral endplates. Of these six cases, five involved female individuals belonging to the 50+ age category. The lesions predominantly affected the lower thoracic and lumbar regions, most frequently around the L1/L2 and L4/L5 vertebrae. In addition, multiple compression fractures of the mid- to lower thoracic spine were documented in one male individual aged approximately 50 years. Considering the age and sex distribution of the affected individuals, these spinal traumas were likely of degenerative origin, possibly associated with osteoporosis, which may explain the higher prevalence among females. Nevertheless, the small sample size precludes drawing definitive conclusions.

On the frontal bone of a male individual aged over 50 years (Grave 5, Figure 4), a shallow, oval-shaped depression with rounded edges was observed, likely resulting from blunt-force trauma. The lesion is located on the upper portion of the frontal squama, between the frontal tubers and the bregma, slightly deviating to the left of the midsagittal plane. The depression measures approximately 13.5 mm × 4.0 mm and shows clear signs of advanced healing.

General stress markers

Although their precise cause remains debated, porotic lesions of the orbital roof (cribra orbitalia) and parietal bones (cribra cranii) are commonly associated with hematological disorders, parasitic infections, or vitamin deficiencies (Marcsik 1975, Walker et al 2009). These lesions typically develop during childhood and may persist into adulthood. They are generally understood as a biological response to physiological stress and are considered non-specific indicators of systemic disturbance. Linear enamel hypoplasia (LEH), which appears as linear grooves in dental enamel, indicates stress or disturbances during tooth development, providing vital insights into childhood health. At the individual level, only those with at least 50% of the entire dentition and 50% of the incisors and canines preserved were included in the analysis, as these teeth are the most common locations for LEH (Condon and Rose 1992).

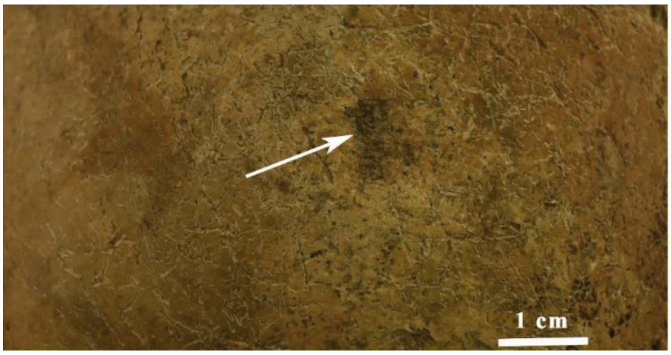

Figure 4: Oval-shaped depression on the frontal bone of a male individual aged 50–x years (Grave 5).

The limited representation and preservation of subadult remains did not permit a detailed analysis. However, cribra orbitalia was observed in one case (n=3), while cribra cranii was absent among the investigable specimens (n=2). The dentition of two juvenile individuals was suitable for analysis of LEH, but no alteration was observed.

In the adult sample, cribra orbitalia was recorded in 11.1% of males and 27.3% of females, while cribra cranii occurred only in females (16.7%) and was absent in males. Hypoplasia affects 33.3% of males and 57.1% of females. When calculated based on the total number of investigable teeth (LEH*), the frequencies were 3.9% for males and 5.9% for females. The higher frequency of LEH among female teeth is largely due to a 20–30-year-old female (Grave 8), in whom seven teeth exhibited hypoplastic defects (Table 5).

The defects were observed on both maxillary and mandibular teeth, including canines, incisors, and premolars. Estimated ages of formation for the hypoplastic lines ranged approximately from 1.5 to 5.5 years, indicating multiple episodes of physiological stress during early childhood. But most of the lines were formed between 2.5–3.5-year-old.

Table 5. Proportion of identified pathological alterations among males and females at the individual level. "A" indicates the absence, while "P" indicates the presence of the lesion (*: frequencies belong to the tooth-count-based calculation).

	Males			Females		
Pathological alteration	A	P	%	A	P	%
Cribra orbitalia	8	1	11.1	8	3	27.3
Cribra cranii	5	0	0.0	5	1	16.7
LEH	4	2	33.3	4	3	42.9
LEH*	122	5	3.9	158	10	5.9

Discussion

The assemblage is dominated by adults (83.3%), while subadults (16.6%) are markedly underrepresented. This likely reflects taphonomic loss and recovery bias. Similarly, the increased proportion of older adult individuals should be interpreted cautiously, since the cemetery has not been fully excavated. Given these circumstances, the demographic profile of the analysed material likely does not fully reflect the true composition of the original population.

The limited data on the metric characteristics of the analysed community do not differ markedly from what is generally expected based on the literature (individual skeletal data of remains from Hatvan-Sportpálya are presented in the Appendix, in Tables A1–3). However, it should be noted that published anthropological data from the immediate region remain scarce, however in the past decades the anthropological material of several small sites had been published (Hajdu 2004, Szeniczey 2016, 2019, Évinger 2016, 2019, Marcsik and Hegyi 2019). The predominantly Western Eurasian ancestry identified among the individuals also corresponds well with previously reported patterns, while the presence of East Asian–related traits is not unexpected, as similar findings have been documented at other Avar Period sites from the closer vicinity (Szeniczey 2019, Évinger 2019a, b; Marcsik and Hegyi 2019). However, it should be emphasized that further ancient DNA (aDNA) analysis is required to confirm and refine interpretations of population admixture.

Degenerative joint disease was a common pathological feature in the assemblage. Osteoarthrosis occurred more frequently in males in the upper limbs (hand and elbow joints), likely reflecting sex-specific activity patterns and labour division, however the sample size and the skewed age distribution (overrepresentation of older adults) do not allow for definitive conclusions. Degenerative vertebral changes were prevalent in both sexes. The high frequency and age correlation of these conditions suggest chronic mechanical stress and repetitive strain associated with daily activities.

Evidence of periosteal new bone formation was found on several long bones, with the tibia being the most frequently affected element in both sexes. Most of the lesions were healed or remodelling, suggesting recovery from previous inflammatory or traumatic event rather than active infection at death.

Traumatic lesions were relatively few, with most involving compression fractures of the vertebral column. These were particularly frequent among older females, suggesting a connection with age-related bone fragility and possible osteoporosis. Such degenerative compression fractures are common in skeletal populations exposed to high physical workload and nutritional deficiencies affecting bone density (Curate 2014). The single case of a healed depression fracture on the frontal bone represents a non-fatal blunt-force injury, consistent with accidental or interpersonal trauma. The well-healed nature of the lesion suggests survival long after the event.

Markers of systemic physiological stress, such as cribra orbitalia, cribra cranii, and linear enamel hypoplasia (LEH), were present but at moderate frequencies. The slightly higher prevalence among females may indicate greater exposure to nutritional or metabolic stress during development, although the small sample size limits definitive interpretation. The estimated timing of LEH formation suggests repeated stress episodes during early childhood, likely linked to nutritional instability – for example, during weaning, or due to parasitic or infectious diseases (El-Najjar et al. 1978).

Given the current state of research and the limited size and preservation of the assemblage, broader epidemiological, demographic, and population-historical conclusions cannot yet be drawn with confidence. Nonetheless, when considered alongside previously published anthropological data from nearby sites, the findings from Hatvan-Sportpálya contribute valuable information to the growing body of evidence on the Avar Period population of the region.

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On behalf of all contributors, we respectfully and affectionately dedicate this study to Dr. Antónia Marcsik on the occasion of her 85th birthday.

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References

Ács, Cs. (1991): Avar sírok Boldogon. *Az egri vár híradója 23:*77–78.

Alekszejev, V.P., Debec, G.F. (1964): *Kraniometria. Metodika anthropologitsheskih isledovanij*. Nauka, Moszkva.

AlQahtani, S.J., Hector, M.P., Liversidge, H.M. (2010): Brief communication: The London atlas of human tooth development and eruption. *American Journal of Physical Anthropology, 142(3)*: 481–490. DOI: https://doi.org/10.1002/ajpa.21258

Bernert, Zs., Évinger, S., Hajdu, T. (2007): New data on the biological age estimation of children using bone measurements based on historical populations from the Carpathian Basin. *Annales historico-naturales Musei nationalis hungarici, 99*: 199–206.

Bernert, Zs., Évinger, S., Hajdu, T. (2008): Adatok a gyermekek életkorbecsléséhez a Kárpát-medencei történeti népességek gyermekhalottainak csontméretei alapján. *Anthropologiai Közlemények, 49:* 43–50.

Brooks, S., Suchey, J. M. (1990). Skeletal age determination based on the os pubis: a comparison of the Acsádi-Nemeskéri and Suchey-Brooks methods. *Human Evolution, 5:* 227–238. DOI: https://doi.org/10.1007/BF02437238

Brůžek, J., Santos, F., Dutailly, B., Murail, P., & Cunha, E. (2017). Validation and reliability of the sex estimation of the human os coxae using freely available DSP2 software for bioarchaeology and forensic anthropology. *American Journal of Physical Anthropology, 164(2):* 440–449. DOI: https://doi.org/10.1002/ajpa.23282

Buikstra, J. (2019, Ed.): *Ortner's Identification of Pathological Conditions in Human Skeletal Remains. 3. ed*. Academic Press, London

Coelho, J.D.O., Curate, F., Navega, D. (2020): Osteomics: decision support systems for forensic anthropologists. In: Obertova, Z., Stewart, A., Cattaneo, C. (Eds): *Statistics and probability in forensic anthropology*. Academic Press, London.

Curate, F. (2014): Osteoporosis and paleopathology: A review. *Journal of Anthropological Science, 92:* 119–146. DOI: https://doi.org/10.4436/JASS.92003

DiGangi, E.A., Bethard, J.D., Kimmerle, E.H., Konigsberg, L.W. (2009): A new method for estimating age-at-death from the first rib. *American Journal of Physical Anthropology, 138(2):* 164–176. DOI: https://doi.org/10.1002/ajpa.20916

El-Najjar, M. Y., Desanti, M. V., & Ozebek, L. (1978): Prevalence and possible etiology of dental enamel hypoplasia. *American Journal of Physical Anthropology, 48(2)*: 185–192. DOI: https://doi.org/10.1002/ajpa.1330480210

Éry, K., Kralovánszky, A., Nemeskéri, J. (1963): Történeti népességek rekonstrukciójának reprezentációja. *Anthropologiai Közlemények, 7:* 41–90.

Évinger, S. (2019a): Petőfibányán feltárt avar kori temetkezések embertani vizsgálata. *Agria, 52:* 257–265.

Évinger, S. (2019b): Viszneken feltárt avar kori temetkezések embertani vizsgálata. *Agria, 52:* 233–242.

Fazekas, G., Kósa, F. (1978): *Forensic fetal osteology*. Akadémiai Kiadó, Budapest

Hajdu, T. (2009): Anthropological analysis of the Avar Age people from the Jászberény-Disznózug cemetery (Hungary). *Annales historico-naturales Musei nationalis hungarici, 101:* 147–166.

Hefner, J.T. (2009): Cranial nonmetric variation and estimating ancestry. *Journal of Forensic Sciences, 54(5):* 985–995. DOI: https://doi.org/10.1111/j.1556-4029.2009.01118.x

Iscan, M.Y., Loth, S.R., Wright, R.K. (1984): Age estimation from the rib by phase analysis: white males. *Journal of Forensic Sciences, 29:* 1094–1104. DOI: https://doi.org/10.1520/JFS11776J

Iscan, M.Y., Loth, S.R., Wright, R.K. (1985): Age estimation from the rib by phase analysis: white females. *Journal of Forensic Sciences, 30:* 853–863. DOI: https://doi.org/10.1520/JFS11018J

Lipták, P. (1965): On the taxonomic method in the paleoanthropolgy (historical anthropology). *Acta Biologia Szegediensis, 11:* 169–183.

Marcsik, A. (1975): Egy csontelváltozás feltételezett aetiológiája. *Anthrop*ologiai Közlemények*, 19*: *47–53.*

Marcsik, A., Hegyi A. (2019): Nagyréde-Ragyogópart avarkori lelőhely embertani anyagának jellegzetességei. *Agria, 52:* 243–255.

Martin, R., Saller, K. (1957): *Lehrbuch der Anthropologie, Vol. 1–2.* Fischer Verlag, Stuttgart.

Meindl, R.S., Lovejoy, C.O. (1985): Ectocranial suture closure: a revised method for the determination of skeletal age at death. *American Journal of Physical Anthropology, 68:* 57–66. DOI: https://doi.org/10.1002/ajpa.1330680106

Rogers, J., Waldron, T. (1995): *A field guide to joint disease in archaeology*. Wiley: Chichester, UK.

Schaefer, M.C., Black, S., Scheuer, L. (2008): *Juvenile Osteology: A Laboratory and Field Manual*. Academic Press, Amsterdam.

Scott, G.R., Navega, D.S., Coelho, J., Vlemincq-Mendieta, T., Kenessey, D., Irish, J.D. (2024): rASUDAS2 A New Iteration of the Application for Assessing the Population Affinity of Individuals by Tooth Crown and Root Morphology. *Forensic Anthropology, 8(1):* 1–9. DOI: https://doi.org/10.5744/fa.2024.0006

Sjøvold, T. (1990). Estimation of stature from long bones utilizing the line of organic correlation. *Journal of Human Evolution, 5:* 431–444. DOI: https://doi.org/10.1007/BF02435593

Stloukal, M., Hanakova, H. (1978): Die Lange der Langsknochen altslawischer Bevölkerungen unter besonderer Berücksichtigung von Wachstumsfragen. *Homo, 29:* 53–69.

Szeniczey, T. (2016): Kál-Csörszkavics-bánya lelőhelyen feltárt avar kori emberi maradványok embertani vizsgálata. *Agria, 49:* 243–252.

Szeniczey, T. (2019): Apcon feltárt avar kori temetkezések emberi csontanyagának antropológiai vizsgálata. *Agria, 52:* 233–242.

Tóth, Z. (2013): *A gyöngyöspatai avar temető*. Master thesis. ELTE BTK, Budapest,

Tóth, Z. (2016): Újabb adatok a késő avar kori sírkerámiákról. A Gyöngyöspata–Előmály temetőjéből származó edények temetkezési szokásban betöltött szerepe. In: Perémi, S.Á. (Ed.) *Hadak Útján XXIII*. Veszprém. pp. 145–160.

Tóth, Z. (2017): Avar kori lovastemetkezések a Mátra-vidéken. In: Merva, Sz. (Ed.) *ALTRUM CASTRUM 9.* A visegrádi Mátyás Király Múzeum füzetei. Hadak útján XXII. Visegrád. pp. 265–288.

Tóth, Z. (2019): Avar kori temető Apcon. *Agria, 52:* 220–232.

Tóth, Z., Kenéz, Á., Lisztes-Szabó, Zs., Csík, A., Pető, Á. (2019): Régészeti és archaeobotanikai adatok Heves megye (késő) népvándorláskori kutatásához Petőfibánya-Iskola utca 5. lelőhely sírjainak vizsgálata alapján. *Agria, 52*: 291–307.

Waldron, T. (2020): *Palaeopathology*. Cambridge University Press, Cambridge.

Walker, P.L., Bathurst, R.R., Richman, R., Gjerdrum, T., Andrushko, V.A. (2009): The causes of porotic hyperostosis and cribra orbitalia: A reappraisal of the iron-deficiency anaemia hypothesis. *American Journal of Physical Anthropology, 139(2):* 109–125. DOI: https://doi.org/10.1002/ajpa.21031

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APPENDIX

Table A1. Individual sex and age data of the skeletal remains from Hatvan-Sportpálya archaeological site (M: males, F: females, ?: unknown sex, F?: probably female).

Inventory No.	Object No.	Grave No.	Age (ys)	Sex
2024.3.1	83	1	20–50	?
2024.3.2	84	2	20–35	M
2024.3.3	101	3	30–35	F
2024.3.4	109	17	50–80	M
2024.3.5	113	13	35–40	F
2024.3.6	115	7	35–50	F
2024.3.7	118	4	40–50	F
2024.3.8	119	5	50–80	M
2024.3.9	121	6	20–30	F
2024.3.10	133	13	20–30	F
2024.3.11	143	8	20–30	F
2024.3.12	150	10	50–80	F
2024.3.13	153	11	50–80	F
2024.3.14	156	12	50–80	F
2024.3.15	163	14	14–16	?
2024.3.16	165	15	25–28	F
2024.3.17	166	16	19–20	M
2024.3.18	167	18	20–50	?
2024.3.19	176	26	35–50	F?
2024.3.20	182	22	1,5–2,5	?
2024.3.21	184	23	15–16	?
2024.3.22	192	50	35–50	M
2024.3.23	193	24	17–18	?
2024.3.24	197	25	60–80	F
2024.3.25	198	26	40–45	M
2024.3.26	205	27	25–30	F
2024.3.27	207	28	20–35	?
2024.3.28	208	29	20–50	?
2024.3.29	211	30	40–50	M
2024.3.30	212	31	40–50	M
2024.3.31	214	32	35–50	M
2024.3.32	215	33	50–80	M
2024.3.33	216	35	35–40	M
2024.3.34	224	37	20–80	?
2024.3.35	225	38	60–80	F
2024.3.36	227	39	3–5	?
2024.3.37	?/adult	–	50–80	F
2024.3.38	?/subadult	–	2,5–4	?
2024.3.39	228	41	20–35	M
2024.3.40	232	42	14–15	?
2024.3.41	234	43	20–35	M
2024.3.42	237	45	20–35	?
2024.3.43	260	47	3,5–4,5	?

Table A1 cont'd. (M: males, F: females, ?: unknown sex, F?: probably female).

Inventory No.	Object No.	Grave No.	Age (ys)	Sex
2024.3.44	264	48	35–50	M
2024.3.45	267	49	40–45	F
2024.3.46	236	44	20–30	F
2024.3.47	292	50	60–80	M
2024.3.48	296	51	35–50	M
2024.3.49	147	9	20–50	M
2024.3.50	168	19	20–35	?
2024.3.51	180	63	7–14	?
2024.3.52	187		20–80	?
2024.3.53		34	20–35	M
2024.3.54	303	57	20–40	F?

Table A2. Individual craniometric data based on the measurements according to Martin and Saller (1957; M: males, F: females).

Grave No.	2	5	17	26	30	50	3	4	8	13	15	42	44
Sex	M	M	M	M	M	M	F	F	F	F	F	F	F
M1	–	–	–	175	–	186	–	–	–	–	–	180	–
M5	–	–	–	95	–	106	98	–	–	–	–	97	–
M8	–	–	–	–	–	143	–	–	–	–	–	131	–
M9	–	–	–	90	–	103	90	88	–	95	–	98	93
M10	–	–	–	118	–	124	105	105	–	113	–	116	–
M11	–	–	–	–	–	129	117	–	–	113	–	115	–
M12	–	–	–	–	–	–	–	–	–	–	–	108	–
M17	–	–	–	125	–	140	126	–	–	–	–	126	–
M40	–	–	–	99	–	101	100	–	–	96	–	96	–
M43	–	101	–	100	103	108	101	98	–	101	–	105	98
M45	–	–	–	–	–	136	126	–	–	–	–	–	–
M46	–	–	–	–	–	94	91	–	–	90	–	96	–
M47	–	–	–	–	–	–	108	–	–	103	–	–	114
M48	63	–	69	62	62	80	63	–	61	63	62	73	71
M51	–	41	42	41	41	42	37	–	40	41	39	41	40
M52	–	32	33	29	34	35	29	–	32	32	32	36	34
M54	25	21	23	27	25	23	24	–	25	27	25	22	23
M55	49	51	54	47	47	54	46	–	49	46	45	54	51
M62	–	–	–	–	–	52	42	–	–	46	–	44	–
M63	–	–	–	–	–	40	37	–	–	38	–	–	–
M65	–	–	–	–	–	–	–	–	–	–	–	–	–
M66	–	–	–	–	–	–	92	–	–	–	–	–	–
M69	31	–	–	–	–	41	30	–	28	–	–	–	–
M70	–	–	–	–	–	60	50	–	–	–	–	–	–
M71	33	–	–	–	–	30	37	–	–	–	–	–	–

Table A3. Individual postcranial measurements based on Martin and Saller (1957). Only the maximum lengths (M1) are reported (L: left, R: right, M: males, F: females).

Grave No.	Sex	Clavicle		Humerus		Ulna		Radius		Femur		Tibia		Fibula	
		L	R	L	R	L	R	L	R	L	R	L	R	L	R
5	M	–	–	–	–	–	–	–	–	–	475	392	–	–	–
9	M	–	–	–	–	–	–	–	–	–	–	395	–	–	–
16	M	–	–	–	–	–	–	–	–	444	434	354	350	345	345
26	M	–	–	–	309	–	250	229	–	425	425	341	339	–	–
31	M	–	–	–	–	–	–	–	–	–	440	347	343	–	–
32	M	–	–	–	–	–	–	–	–	–	–	–	344	–	–
33	M	–	–	–	–	–	–	–	–	–	422	–	–	–	–
35	M	–	–	–	–	–	–	–	–	–	–	–	350	–	–
48	M	150	153	315	320	267	267	244	245	–	–	–	–	–	–
50	M	–	–	337	348	281	284	265	264	470	471	390	382	–	–
51	M	–	–	–	–	–	–	–	–	–	464	386	381	–	–
3	F	139	136	282	283	231	233	207	211	380	380	310	309	302	304
4	F	–	–	–	–	–	–	–	–	–	424	–	360	–	–
6	F	–	–	–	–	–	–	–	–	–	–	328	–	–	–
8	F	–	–	–	–	–	–	–	–	411	408	–	328	–	–
10	F	–	–	–	–	–	–	–	–	–	399	–	–	–	–
11	F	–	130	–	307	–	–	–	–	–	419	–	–	–	–
12	F	–	–	–	–	–	–	–	–	–	–	369	–	–	–
15	F	–	–	–	–	–	–	–	–	398	403	339	339	–	–
23	F	–	–	–	–	–	–	–	–	–	–	321	321	–	–
25	F	–	–	–	–	–	–	–	–	414	–	330	–	–	–
27	F	–	–	–	–	–	–	–	–	395	400	322	326	–	–
38	F	–	–	–	–	–	–	–	237	–	428	350	346	–	–
49	F	124	127	291	–	–	245	219	222	413	410	329	–	–	–
?_adult	F	–	–	–	–	–	–	229	–	–	–	–	–	–	–