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HARRIS LINES IN A SKELETAL SAMPLE OF THE NEOLITHIC AND OF THE EARLY BRONZE AGE, ŻERNIKI GÓRNE (POLAND)

Abstract. The prevalence and chronological distribution of Harris lines have been assessed in a skeletal sample of the Neolithic and the early Bronze Age of Żerniki Górne (Poland, Kielce voivodship) in order to estimate the living conditions of studied groups. Harris lines were counted on roentgenograms of femora and tibiae of children and adults. In the latter, the ages the occurred at were assessed by the Byers method. General pattern of bones susceptibility to lines formation was supported in the present paper: more Harris lines were found in the tibia, particularly at the distal end. The frequency of lines in the Neolithic group is comparable with the average of other European Neolithic populations. Differences in Harris lines prevalence and chronology were found between the Neolithic and early Bronze Age groups. The process of lines resorption was observed in both studied populations.

Harris lines (also called: lines of arrested growth, transverse sclerotic lines, radiopaque lines) are formed in epiphyseal parts of long bones as a result of numerous metabolic insults of nutritional and/or disease character. Harris lines occur when a period of arrested growth, indicated by increased density of bone trabeculae, is followed by a period of growth recovery (Arnay et al.,1994).

There is a wide variety of etiological factors causing Harris lines: severe diseases (scarlet fever, measles, pneumonia), nutritional deficiencies, inadequate diet (lack of proteins and/or vitamins), intoxication (e.g. by heavy metals), perinatal trauma, accelerated growth in two first years of life (*int. al.* Goodman & Clark, 1981). Taking into account the multiplicity of causal factors, Harris lines are considered to be a nonspecific indicator of morphological stress widely used in paleoecological studies of past human populations. Therefore, a research

on skeletal samples is not usually focused on estimating exact etiology of this condition. Authors attempt at revealing the pattern of disturbances in a given population and its response to stress factors in a broader ecological context, e.g. studies of response to stress in males and females (Wells, 1967), interpopulation considerations (Goodman & Clark, 1988), research on seasonality of stress episodes and the stress chronology during the growth and development (Clarke,1978).

The possibility of assessing the age Harris lines formed at, provides the basis for above mentioned surreys. When the sequence of bone increments during the process of growth is known, it is possible to use measurements of the distance of a transverse line from the adequate end of a bone in order to determine the time at line formation.

However, there are some interpretative limitations which should be taken into account while analysing the condition, e.g. Harris lines may resorb and disappear after few years since the time of their formation (Goodman et al, 1984); they may be also formed in a different number in analogous bones.

In spite of above mentioned difficulties, Harris lines remain a signifcant and widely applied nonspecific stress indicator, since they bring valuable information about prehistoric living conditions:

- the number of Harris lines reflects the level of individual stress,
- the number of lines in long bones of a representative sample of a cemetery population indicates living conditions of the whole population,
- transverse lines reflect health status of an individual through several years of life,
- structural differences between particular lines correspond to the level of disturbances: fine lines indicate at slight stress which only slows down the growth process and thick lines, running across the bone shaft, correspond to the severe stress with a probable growth arrest,
- small distances between particular lines in one individual may reflect several causal factors, occuring during a single year (Kuhl, 1980, after Jerszyńska, 1988).

Harris lines are visible both in longitudinal sections and roentgenograms of long bones. Macroscopic radiography of the tibia is most widely applied.

The present paper aims at an estimation of the prevalence and chronological distribution of Harris lines in a skeletal sample of the Neolithic and the early Bronze Age of Żerniki Górne (Poland, Kielce

voivodship) in order to determine the level of stress and living conditions of the studied population.

Materials and methods

Skeletal material used in the analysis came from a barrow found in Żerniki Górne (Poland, Kielce voivodeship). Space under the mound was used as a cemetery until the close of the Neolithic and in first two periods of the Bronze Age. Neolithic sample is represented by the Corded Ware culture (2300–1900 BC, 10 adults and 5 children) as well as Chłopice Vesele and Mierzanowice culture (1300–1800 BC, 5 adults and one child). Trzciniec culture (1300–1500 BC, 38 adults and 7 children) represents the Bronze Age phase. Due to an insufficient number of individuals no division was made between the Neolithic cultures and they were treated jointly.

During the final stage of the described cemetery a barrow was erected which covered burials from all periods of the cemetery.

The studied sample consists of 39 femora and 35 tibiae of 31 adults as well as 21 femora and 12 tibiae of 7 children deriving from the Neolithic. Early Bronze Age is represented by 48 femora and 23 tibiae of 38 adults as well as 8 femora and 3 tibiae of 7 children.

Estimation of age and sex was made according to the recommendations of the Workshop of European Anthropologists (1980) and Buikstra & L. Ubelaker (1994). Sex was determined on the basis of standard skull and pelvis features. Age of adults was assessed according to cranial closure and changes in the morphology of pubic symphysis and auricular surface as well as tooth attrition. Age of children was determined on the basis of tooth formation and eruption as well as according to epiphyseal and ossification center fusion.

The number of children in the studied samples turned out too small to allow a more exact analysis of e.g. age of formation of Harris lines. Therefore, only the number of Harris lines in long bones of investigated immature individuals was assessed.

The analysis of Harris lines in adults was performed for the whole population without dividing the sample into the sex groups on account of limited number of studied bones. There is no concordance in stating sex differences in HL frequency – some authors do not find any such

differences (McHenry 1968), which allows us to treat the sample of adults as a single group.

Measurements of the total bone lenghth were made according to the technique and instrumentation of Martin & Saler and were available in a form of documentation of the graves which was kindly provided by A. Wierciñska.

The analysis of Harris lines was performed on roentgenograms of studied bones. Anteroposterior views were obtained using Fotopan X-S1 films. The exposures were taken for 0.1 seconds at 1 meter. The voltage was 45 – 50 mV and the power was 17 mAs.

Harns lines were recorded at both ends of all bones studied only when they were transverse to the long axis of the bone. Then the distance of particular lines from the proximal or distal end was measured following the method of Byers (1991). These measurements were used to calculate the percentage of mature bone lenghth at the time of radiopaque lines formation. Then the specific ages of HL occurence were stated using the tables presenting the chronology of limb bone growth in males and females published by Byers.

Abbreviations used in the paper are: HL – Harris lines, F – female, M – male, PE – proximal end, DE – distal end.

Results

In the Neolithic group which consisted of 24 adults, 15 individuals proved to be affected by Harns lines which makes 62.5%. Among children, 5 out of 7 individuals had the condition which constitutes 71.4%. In the whole Neolithic group the percent of affected individuals was 64.5%. The tibia was much more affected than the femur: out of 39 femora, only 1 bone showed HL (2.6%) at the distal end; among 35 tibiae, 25 revealed HL (71.4%) 14 proximal and 24 distal ends bore the condition. In children out of 21 femora, 5 was affected at the distal end and out of 12 tibiae, 9 was af fected – 5 at the proximal and 6 at the distal end.

The early Bronze group, represented by the Trzciniec culture people, included 45 individuals, 38 adults and 7 children. 11 adults showed HL and there was no bones marked by HL in children. The share of affected individuals was 24.4%. As in the Neolithic group, the tibia was much more affected than the femur: out of 48 femora, 3 revealed HL (6.3%) at

the distal end; out of 23 tibiae, 11 had the transverse lines (47.8%), 6 at the proximal and 8 at the distal end.

More informative than the proportions of affected individuals might be the number of HL in the studied sample, showing the severity and number of stress episodes. Such a calculation was made only for tibiae on account of small number of femora with HL. There were in general 161 lines in the Neolithic tibiae: 89 in right bones and 72 in left bones. At the proximal ends there were totally 48 HL (29.8%) and at the distal ends – 113 HL (70.2%). In the Bronze Age tibiae, we found 53 lines in total: 33 in the right bones and 20 in the left bones. At the proximal ends there were generally 12 lines (22.6%) and at the distal ends there were 41 lines (77.4%).

Measurements of bone lenghts and other distances required by the Byers method are presented in table 1 for Neolithic adult tibiae. Table 2 shows measurements of an adult femur from the same time period. Table 3 presents the number of HL in immature femora and tibiae of the Neolithic. Measurements of adults and calculations of the Byers method for adults of the early Bronze Age are presented in table 4 for the tibia and table 5 for the femur.

On the basis of the Byers method, ages of HL formation were determined for adults of both periods: table 6 presents the results for the Neolithic and table 7 for the early Bronze Age. Table 8 contains the counts and frequencies of HL at the time of their formation in Neolithic, adult tibiae with the division into the proximal and distal end. Low number of HL in infancy and early childhood is apparent. The highest frequency of HL is falls between 6 and 13 year of age. Similar procedure was done for the early Bronze Age, without dividing the lines into the proximal and distal end, on account of insufficient number of HL; this is presented in table 9. It is striking that no lines were observed before the 5^{th} year of age in the studied group. The highest frequency of HL is between 7 year of age. The results shown in table 8 are also depicted in figure 2: the distribution shows the peak of HL frequency at the age of 9 at the distal end of tibiae. It is evident that the number of HL at te proximal end of the bones is much lower than at the distal end. Figure 3 shows the chronological distribution of HL for the Bronze Age with two peaks of HL frequency occurring between 7–9 and 10–12 year of age. The comparison of the chronology of HL for both groups is presented in figure 4, where abovementioned relations are easily visible. There is a regularity

in HL formation in the following years of growth and development. In the most of the cases the lines were formed in annual sequencies.

The frequency of Harris lines in the Neolithic sample (64%) was compared with other European Neolithic populations: the results are presented in figure 1. It is evident that the sample from Żerniki Górne does not differ from other analogous populations in terms of the respective frequency.

Discussion

The frequency of affected individuals in the sample of Żerniki Górne proved different in two groups separated from each other: Neolithic and early Bronze Age. In the Neolithic people the condition was much more frequent: 64.5% as compared with early Bronze group: 24.4%. This supports widely reported pattern that the Neolithic is characterized by increased level of stress caused by sedentism, the increase of population density and less diversified diet. Such relation was also found for other stress indicators, as enamel hypoplasia (Hutchinson 1988, Goodman 1989), *cribra orbitalia* (Norr 1984, Martin et al. 1984 after Gleń-Haduch 1995). Moreover, 71.4% of the studied Neolithic children had HL, compared with absence of affected children in the early Bronze Age group. However, a possibilie bias related to low number of investigated Bronze Age individuals should be taken into account. The general frequency of HL in the Neolithic group (64.5%) turned out to be similar to other European Neolithic populations. Drenhaus (1991) noted that the prevalence of transverse lines in European populations ranges from 34% to 100%. Therefore, it may be assumed that the studied sample was exposed to the average number of stress episodes.

The pattern of different HL occurence depending on investigated bones was supported in the present paper. The tibia is much more susceptible than the femur (71.4% vs 2.6% in the Neolithic group; 47.8% vs 6.3% in the Early Bronze Age group) and shows the highest number of transverse lines at the distal end (Neolithic: 70.2% of HL at the distal end, 29.8% at the proximal end; Bronze Age: 77.4% and 22.6% respectively). The femur, if affected, shows HL at the distal rather than the proximal end. There is no difference in the prevalence of the condition between the right and left bone.

The chronological distribution of HL in the Neolithic group is marked by one peak of stress between the age of 9 and 12, while there is a low frequency of the condition in infancy and in early childhood. In the process of ontogeny, authors distinguish periods of fast and of decelerated growth in height. Accelerated growth occurs between 3–6 and 11–12 year of age (Bogdanowicz 1966, after Nowak 1995). In these periods, on account of intensive growth, long bones are particulary susceptible to any disturbances caused by nutritional factors or disease. Therefore, HL are usually the most frequent in these age intervals. Presumably, the second peak of stress in the Neolithic group (9–12 year of age) corresponds to the second period of rapid growth in the ontogeny of studied individuals. The first period of accelerated growth is not accentuated in the studied group, supposedly as a result of resorption of the lines. It has been commonly observed that the lines deriving from the earliest ontogenetic phases may disappear as a consequence of dynamic bone remodeling in subsequent life periods (Nowak, 1995). Endosteal resorption would remove cortical bone containing radiopaque lines, while subperiosteal apposition continuing throughout life would add new, line-free cortical bone tissue (Garn, Schwager 1967). Therefore, presumably in the studied group the most of transverse lines formed in infancy and early childhood resorbed and disappeared. In the early Bronze group, however, there are two peaks of stress: 7–9 and 10–12 year of age, while the latter corresponds to the second period of rapid growth. The first peak may reflect an increased level of stress in the investigated group or, maybe, is biased by a low number of tibiae subject to analysis. Moreover, there are no lines before age of 5, which probably reflects the process of resorption.

In most cases of both age groups, regular occurence of HL is observed in the form of annual sequences. This supports the observation that the transverse lines are a susceptible indicator of metabolic disturbances occuring in the process of growth and development.

Conclusions

1. The frequency of HL in the studied Neolithic sample of Żerniki Górne (64.5%) proved to be comparable with the average of other European populations, which supports the assumption of mean level of stress in childhood and adolescence ofthe studied individuals.

2. Harris lines in the Neolithic group are more prevalent than in the Early Bronze Age group.
3. The tibia turned out more susceptible to the condition than the femur.
4. More HL were found at the distal end of bones than at the proximal and.
5. In the Neolithic group the peak of stress was observed in the period of 9–12 year of age, while in the early Bronze Age sample the chronological distribution was bimodal: one peak occured between 7–9 and the second between 10–12 year of age.
6. Peaks of stress 9–12 and 10–12 in the Neolithic and early Bronze Age group respectively, apparently correspond to the period of rapid growth in the process of human ontogeny.
7. Lines formed in infancy and early childhood resorbed partly in the Neolithic group and totally in the early Bronze Age group.
8. In most cases we found annual sequences of occurences of HL.

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Summary

The skeletal sample from Żerniki Górne (Poland, Kielce voivodeship), divided into the Neolithic and early Bronze Age groups, was considered in relation to Harris lines prevalence, observed on the roentgenograms of long bones, and chronological distribution by Byers method.

The Neolithic group consists of 24 adults (39 femora and 35 tibiae) and 7 children (21 femora and 12 tibiae) and the frequency of HL is 64.5%, which is comparable with the average of other European Neolithic populations and is an evidence of a mean level of stress experienced by the studied group in their childhood and adolescence. The early Bronze Age group consists of 38 adults (48 femora an 3 tibiae) and 7 children (8 femora and 3 tibiae) and the frequency of HL is 24.4%. In both groups the tibia, particularly its distal end, proved to be much more affected than the femur.

The chronological distribution of the Neolithic group shows one peak of stress in the interval of 9–12 years of age, while the distribution of the Bronze Age group is marked by two peaks in intervals 7-9 and 10-12 years of age. It was presumed that the peaks in 9-12 and 10-12 years of age correspond to the period of rapid growth in the process of human ontogeny.

It was observed that the lines formed in infancy and early childhood resorbed partly in the Neolithic and totally in the early Bronze Age sample.

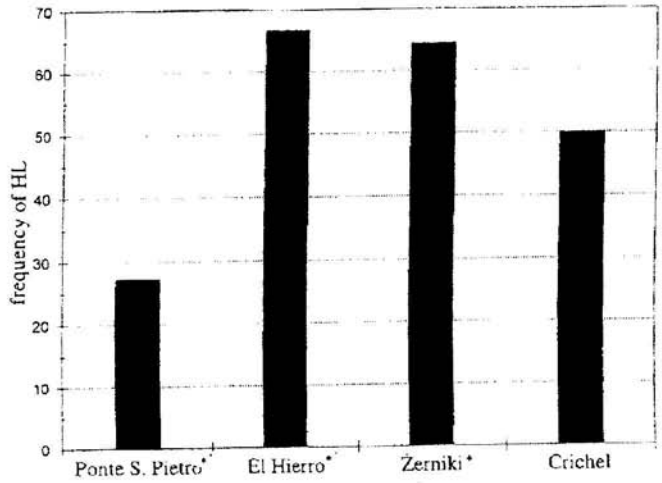

Fig. 1. Frequency of Harris lines in different European populations of Neolithic Ponte S. Pietro – after V. Formicola, a. Garulli (1988), El. Hierro – after M. Arnay-dela Rosa i in. (1994), Crichel – after C. Wells (1967)

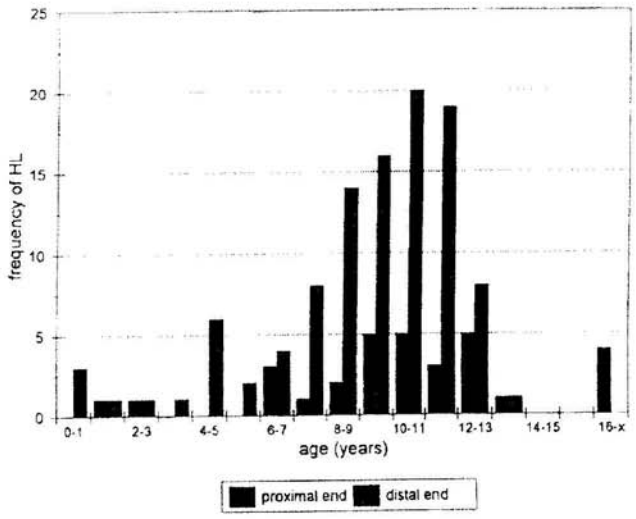

Fig. 2. Number of Harris lines in tibiae at the age of their formation in adults of the Neolithic period

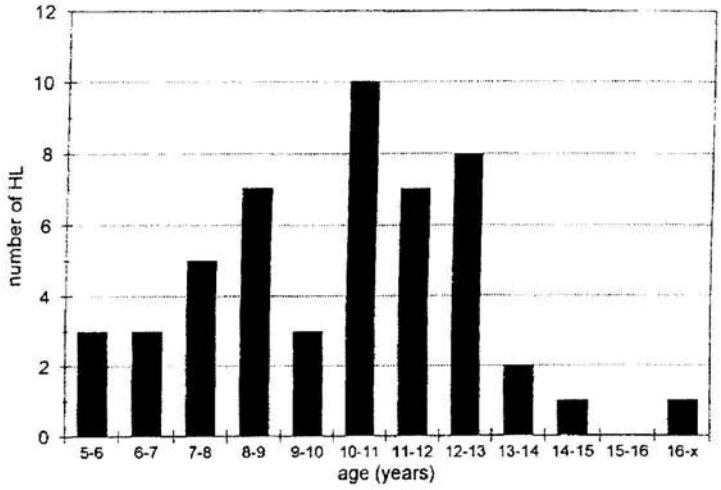

Fig. 3. Number of Harris lines in tibiae at the age of their formation in adults of the Early Bronze Age

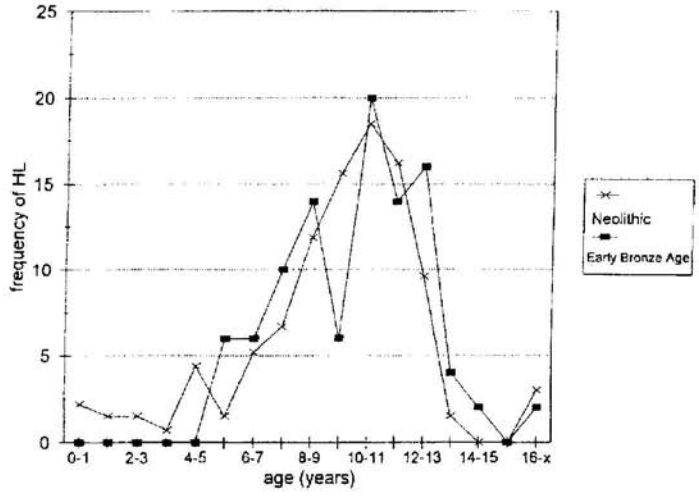

Fig. 4. Frequency of Harris lines in tibiae at age of their formation in adults of the Neolithic and the Early Bronze Age

Tab. 1. Measurements of tibiae and calculations according to the Byers methods for Neolithic adults

No	Grave	Sex	Age	RIGHT						LEFT					
				Proximal end			Distal end			Proximal end			Distal end		
				T*	P*	Pct*	T*	P*	Pct*	T	P	Pct	T	P	Pct
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	116	F	?				350	26	95.2	348	34	95.2	348	24	96.4
							350	33	89.8				348	30	91.8
							350	36	87.5				348	33	89.5
							350	44	81.4				348		
2	43	F	50-60	353	26	100.1	353	22	98.2	353	18	104.8			
				353	32	96.7	353	27	94.4	353	26	100.1			
							353	30	92.1	353	33	96.1			
							353	32	90.6						
							353	24	89.1						
							353	38	86.1						
3	52	F	25-35	387	42	93.0	387	43	85.1	390	42	93.2	390	34	91.5
				387	46	90.9	387	47	82.3	390	98	64.3	390	37	89.4
				387	52	87.8	387	49	81.0	390	105	42.8	390	40	87.4
							387	52	78.9				390	42	86.0
							387	75	63.0				390	46	83.3
							387	79	60.2				390	49	81.2
							387	83	57.4				390	55	77.1
							387	85	56.1				390	62	72.3
							387	89	53.3				390	127	27.7
							387	100	45.7				390	137	20.8
														144	16.0

cont. tab. 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
4	26	F	30-40	361	20	103.9	361	29	93.5						
				361	36	94.9	361	33	90.5						
							361	48	79.4						
5	112	F	40-50	362	56	83.8	362	34	88.9	361	55	84.4	361	34	89.8
							362	36	88.3	361	61	81.0	361	40	85.3
							362	39	86.1				361	44	82.3
							362	45	81.6				361	52	76.4
							362	51	77.2						
							362	55	75.2						
6	95	F	30-40										381	32	92.3
													381	34	90.9
													381	51	79.0
													381	56	75.5
													381	70	65.7
7	39	M	35-45				426	55	80.5				422	57	78.8
							426	67	722.9				422	111	44.5
							426	105	49.0				422	132	31.2
							426	126	35.8						
8	33	F	50-60				350						353	36	87.6
							350						353	44	81.5
							350						353	49	77.1
													353	59	70.1
9	78a	F	25-35	357	38	93.5				357	50	86.8	357	35	88.7
				357	49	87.3				357	55	84.0	357	42	83.4
				357	54	84.5				357	72	74.4	357	61	69.2
				357	70	75.5									

cont. tab. 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
				357	76	72.1									
				357	82	68.8									
				357	85	67.1									
10	32	F	30-40							350	44	89.8	350	26	95.2
										350	51	85.5	350	32	90.6
										350	55	83.5			
										350	59	81.2			
										350	62	79.4			
										350	65	77.7			
11	67a	M	40-50				391	43	85.6				388	47	82.6
							391	45	84.2				388	51	79.9
							391	54	78.1				388	57	75.7
							391	58	75.3				388	67	68.8
							391	63	71.9				388	70	66.7
							391	67	69.2				388	77	61.9
							391	73	65.0				388	80	59.8
							391	80	60.2				388	90	52.9
													388	97	48.1
12	17	F	50-60				378	30	93.9				380	37	88.9
							378	46	89.2				380	39	87.5
							378	45	83.2				380	44	83.9
													380	48	81.1
													380	60	72.2

* T – bone length, P – distance of Harris line from proximal end, D – distance of Harris line from distal end, Pct – percent of mature bone length at time of Harris line formation

Table 2. Measurements of femur and calculations according to the Byers method for Neolithic adults

No	Grave	Sex	Age	RIGHT						LEFT					
				Proximal end			Distal end			Proximal end			Distal end		
				T*	P*	Pct*	T*	D*	Pct	T	P	Pct	T	D	Pct
1	66	M	35-45										422	79	82.0
													422	85	79.8
													422	92	77.1
													422	95	76.0
													422	107	71.4
													422	111	69.9
													422	122	65.7

* T – bone length, P – distance of Harris line from proximal end, D – distance of Harris line from distal end, Pct – percent of mature bone length at time of Harris line formation

Tab. 3. Number of Harris lines in femora and tibiae of Neolithic children

No	Grave	Age	FEMUR				TIBIA			
			RIGHT		LEFT		RIGHT		LEFT	
			PE	DE	PE	DE	PE	DE	PE	DE
1	34	12-14					4		3	13
2	130	7-10		6			3			
3	14/1	10-11		3		4	4	13	2	4
4	103	15-18					5	11	3	8
5	14/2	6-12		3		3		7		6

Tab. 4. Measurements of tibiae and calculations according to the Byers method for adults of the Early Bronze Age

No	Grave	Sex	Age	RIGHT						LEFT					
				Proximal end			Distal end			Proximal end			Distal end		
				T*	P*	Pct*	T*	D*	Pct	T	P	Pct	T	D	Pct
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	69a	F	?							324	20	102.7	324	26	93.4
													324	28	93.0
													324	30	90.3
													324	33	87.8
2	54a	F	30-40				351	25	96.0						
3	54e	F	30-40	362	36	94.4									
				362	47	88.1									
				362	52	85.2									
				362	79	69.7									
4	86c	M	25-35	398	47	91.1	398	44	85.3						
							398	51	80.6						
5	62	M	30-40				363	37	87.5						
							363	43	83.1						
							363	48	79.4						
							363	54	75.0						
							363	61	69.9						
							363	66	66.2						
							363	72	61.7						

cont. tab. 4

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
							363	83	53.6						
6	12a	M	40-50	382	62	82.4									
				382	66	80.3									
7	6sB	M	50-60										352	39	83.5
													352	40	84.5
													352	44	81.5
													352	49	77.7
													352	55	73.1
													352	58	70.8
													352	62	67.8
													352	66	64.2
													352	72	60.2

* T – bone length, P – distance of Harris line from proximal end, D – distance of Harris line from distal end, Pct – percent of mature bone length at time of Harris line formation

Tab. 5. Measurements of femora and calculations according to the Byers method for adults of the Early Bronze Age

No	Grave	Sex	Age	RIGHT						LEFT					
				Proximal end			Distal end			Proximal end			Distal end		
				T*	P*	Pct*	T	D*	Pct*	T	P	Pct	T	D	Pct
1	69b	F	?										395	50	91.7
													395	60	87.6
													395	67	84.8
													395	69	84.0
													395	74	82.0
													395	86	77.1
													395	93	74.2
													395	98	72.2
													395	100	71.4
2	54a	F	30-40				427	63	88.3						
							427	87	79.3						
							427	97	75.6						
							427	115	68.8						
							427	127	64.3						
							427	137	60.6						
3	5	M	?										451	52	93.7
													451	60	90.8

* T – bone length, P – distance of Harris line from proximal end, D – distance of Harris line from distal end, Pct – percent of mature bone length at time of Harris line formation

Table 6. Age of formation of Harris lines in Neolithic adults

No	Grave	Sex	Age	FEMUR				TIBIA			
				RIGHT		LEFT		RIGHT		LEFT	
				PE	DE	PE	DE	PE	DE	PE	DE
1	2	3	4	5	6	7	8	9	10	11	12
1	116	F	?						10	12-13	11-12
									9-10		11-12
									10-11		12-13
2	43	F	50-60					13-14	10-11	1-13	
								16-x	11-12	16-x	
									11-12	16-x	
									11-12		
									12-13		
									13-14		
3	66	M	35-45				7-8				
							8-9				
							8-9				
							9-10				
							10-11				
							10-11				
							11-12				
4	26	F	30-40					12-13	9-10		

cont. tab. 6

1	2	3	4	5	6	7	8	9	10	11	12
								16-x	11-12		
									12-13		
5	52	F	25-35					10-11	2-3	2-3	0-1
								11-12	4-5	6-7	0-1
								12-13	4-5	12-13	0-1
									4-5		7-8
									5-6		8-9
									5-6		9-10
									8-9		9-10
									9-10		10-11
									9-10		10-11
									10-11		11-12
											11-12
6	112	F	40-50					9-10	8-9	9-10	8-89
									8-9	10-11	9-10
									9-10		10-11
									10-11		11-12
									10-11		
									11-12		
7	95	F	30-40								6-7
											8-9
											8-9
											11-12
											11-12

cont. tab. 6

1	2	3	4	5	6	7	8	9	10	11	12
8	389	M	35-45						1-2		1-2
									4-5		33-4
									9-10		10-11
									11-12		
9	33	F	50-60						7-8		7-8
									8-9		8-9
									10-11		9-10
											10-11
10	78a	F	25-35					6-7		8-9	7-8
								6-7		9-10	9-10
								7-8		10-11	10-11
								8-9			
								10-11			
								10-11			
								12-13			
11	32	F	30-40							8-9	11-12
										9-10	12-13
										9-10	
										9-10	
										10-11	
										11-12	

cont. tab. 6

1	2	3	4	5	6	7	8	9	10	11	12
12	67a	M	40-50						6-7		4-5
									7-8		4-5
									8-9		6-7
									9-10		6-7
									9-10		7-8
									10-11		8-9
									12-13		10-11
									12-13		11-12
											11-12
13	17	F	50-60						9-10		7-8
									11-12		9-10
									12-13		10-11
											10-11
											11-12

Tab. 7. Age of formation of Harris lines in adults of the Early Bronze Age

No	Grave	Sex	Age	FEMUR				TIBIA			
				RIGHT		LEFT		RIGHT		LEFT	
				PE	DE	PE	DE	PE	DE	PE	DE
1	2	3	4	5	6	7	8	9	10	11	12
1	69a	F	?							16-x	10-11
											11-12
											12-13
											12-13
2	69b	F	?				7-8				
							7-8				
							8-9				
							8-9				
							9-10				
							10-11				
							10-11				
							10-11				
							11-12				
3	54a	F	30-40		5-6						
					5-6						
					6-7						
					8-9						
					8-9						
					10-11						
4	54e	F	30-40					7-8			
								10-11			

cont. tab. 7

1	2	3	4	5	6	7	8	9	10	11	12
								10-11			
								12-13			
5	86c	M	25-35					13-14	11-12		
									12-13		
6	62	M	30-40						5-6		
									6-7		
									7-8		
									8-9		
									8-10		
									10-11		
									11-12		
									12-13		
7	12a	M	40-50					11-12	10-11		
								11-12			
8	5	M	?								13-14
											14-15
9	62B	M	50-60								6-7
											7-8
											7-9×2
											9-10
											11-12
											1-13×2

Tab. 8. Number and frequency of Harris and age of their formation in tibiae of Neolithic adults

Age at formation of HL (years)	Proximal end number	Proximal end frequency (%)	Distal end number	Distal end frequency (%)	No of HL both ends	Frequency of HL both ends (%)
0-1	-	-	3	2.9	3	2.2
1-2	1	3.2	1	1.0	2	1.5
2-3	1	3.2	1	1.0	2	1.5
3-4	-	-	1	1.0	1	0.7
4-5	-	-	6	5.8	6	4.4
5-6	-	-	2	1.9	2	1.5
6-7	3	9.7	4	3.8	7	5.2
7-8	1	3.2	8	7.7	9	6.7
8-9	2	6.5	14	13.5	16	11.9
9-10	5	16.1	16	15.4	21	15.6
10-11	5	16.1	20	19.2	25	18.5
11-12	3	9.7	19	18.3	22	16.2
12-13	5	16.1	8	7.7	13	9.6
13-14	1	3.2	1	1.0	2	1.6
14-15	-	-	-	-	-	-
15-16	-	-	-	-	-	-
16-x	4	12.9	-	-	4	3.0

Tab. 9. Number and frequency of Harris lines and age of their formation in tibiae of adults of the early Bronze Age

Age at formation of HL (years)	No of HL	Frequency of HL (%)
5-6	3	6.0
6-7	3	6.0
7-8	5	10.0
8-9	7	14.0
9-10	3	6.0
10-11	10	20.0
11-12	7	14.0
12-13	8	16.0
13-14	2	4.0
14-15	1	2.0
15-16	-	-
16-x	1	2.0

* T – bone length, P – distance of Harris line from proximal end, D – distance of Harris line from distal end, Pct – percent of mature bone length at time of Harris line formation