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Animal utilization from Iron Age site of Elbistan Karahöyük, East Mediterranean, Turkey

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Abstract

This paper presents the result of recent zooarchaeological analyses from the excavations of Elbistan Karahöyük in Southeast Turkey. Zooarchaeological data have been evaluated into conventional methods of analysis. This has contributed to better understanding of the local diet, consumption preferences, and Iron Age subsistence strategies. In addition, animal bone studies provide information about socio politic and economic alterations. After the collapse of Hittite Empire, it is known that the social and economic changes but as yet in order to see whether there is any evidence from Karahöyük that to show a major changes or recognition of the animal economy during the Iron Ages. Excavations undertaken at Karahöyük 2017-2018-2019 have yielded 2,212 identified animal bone remains from the Iron Age levels (Early, Middle, and Late Iron Ages). The material consists mainly of domestic livestock (sheep, goat, cattle, and pig), dogs, equids (horse, donkey) and minor number of wild mammals (wolf, fox, hare, badger, and birds) presented in faunal assemblage as well. Skeletal element distribution, dental age profile and the fusion stages are generated.

Introduction

Karahöyük is situated Elbistan Plain, covers an area of about 2.547 km^2 and lies between the Taurus and anti-Taurus mountains and is crossed by the Ceyhan river and its tributaries on the way to the Mediterranean (Çiftçi and Greaves, 2010:90). It has a strategic position as it is located on the important trade routes connecting Eastern Cilicia, Northern Syria and Mesopotamia to Central Anatolia (Özgüç and Özgüç, 1949:3). Elbistan plain is surrounded by the mountains, Binboğa (2.500 m) to the west, Berit (3.054 m) to the south, Hizanlı (2.256 m) to the north, and Nurhak (3.090 m) to the east (Fig. 1). These mountains naturally divide the plain into two climatic zones: the eastern Anatolian is cold in winters and hot in summers with moderate to low rainfall; the semi-arid Mediterranean zone is cold and moist in winters and hot and dry in summers with moderate rainfall. While the western part of the plain is under the influence of the Mediterranean climate, the eastern part has more continental characteristics. The environment is diverse, while bushes cover the plain to the north, the Mediterranean climate is characterized by shrubs and herbaceous plants in the south-western highlands (Çiftçi and Greaves, 2010:90-91). The vegetation in the eastern and central parts is typical semi-arid as well (Polat, 1993:63). The plain is very well watered by the several rivers; the Hurman, Söğütlü, Göksun and Nergele. Because of the geographic features, the plain is one of the most fertile lands in Turkey, thus, suitable for intensive agriculture and husbandry activities. Cereals, pea, barley, beet sugar, legumes, various fruits, and vegetables are cultivated today. The upland areas to the east and west of the plain, where the flat areas are much more accessible, are dominated by animal husbandry (Çiftçi and Greaves, 2010:91). Since milder climate prevails in the region, cattle, sheep, goat husbandry, and poultry is the most commonly preferred in meadow pasture areas for longer periods throughout the year (Koday, 2005:190). In addition, those areas protected natural barriers were suitable for settlement of autonomous states, which is attested by the abundance of mounds dating to the 1^{st}-3^{rd} millennium BC on the Elbistan Plain (Özgüç and Özgüç, 1949:4).

Karahöyük is the largest (450 x 300 m and 21 m height), multiperiod mounded is situated on the east–west route that crosses the plain, providing it with an excellent position to dominate both the plain and its near vicinity (Çiftçi and Greaves, 2010:93). All the important trade routes mentioned above crosscut the plain pass through the mound (Özgüç and Özgüç, 1949:16). For this reason, it is understood that the mound had a significant role, especially during the Assyrian Trade Colonies and Hittite Periods (Uysal, 2017:255). Höyük is located 10 km northwest of Elbistan district of Kahramanmaraş province and in the center of Karahüyük village (Uysal and Çiftçi, 2016:35, 2021:96). It was settled on the north of the Şar Dağı and on the eastern edge of the Hurman River, a branch of the Ceyhan River.

The first archaeological research at Karahöyük was conducted by Hugo Grothe early 1900's (Uysal, 2017:255). Thereafter his study, Tahsin and Nimet Özgüç directed one season of excavation in 1947 and understood that the site was occupied from Late Bronze Age (Hittite Imperial Period) to the Iron Age (Neo-Hittite Period) and Hellenistic and Roman Periods (Çiftçi, 2019:4). The first written source Karahöyük stele was discovered by the Tahsin and Nimet Özgüç during excavation in 1947, the stele with Luwian hieroglyphic inscription has been found *in situ* in open-air sanctuary overlying the remains of the houses from the Hittite Empire periods, and accordingly dates to the first post-Hittite level (Woudhuizen, 2003:211). The local ruler of Armanani dedicated this stele to the local Storm God for King Ir-Tešub (?). Additionally, a pair of portal lion sculptures dating from the Iron Age have been discovered not far from Elbistan (approximately 15 km away). These findings are also essential in demonstrating the region's position during Iron Age (Çiftçi and Greaves, 2010:96). After a long time, the new project was started in 2015 under the direction of Bora Uysal, Sivas Cumhuriyet University. A cylinder seal made of steatite with an inscribed hieroglyphic inscription was discovered from northern plain trench N11 during the 2016 excavation season, and this is the first written document found after Karahöyük stele. The seal was dated as Early Iron Age (Layer IV) (Uysal and Çiftçi, 2017:571).

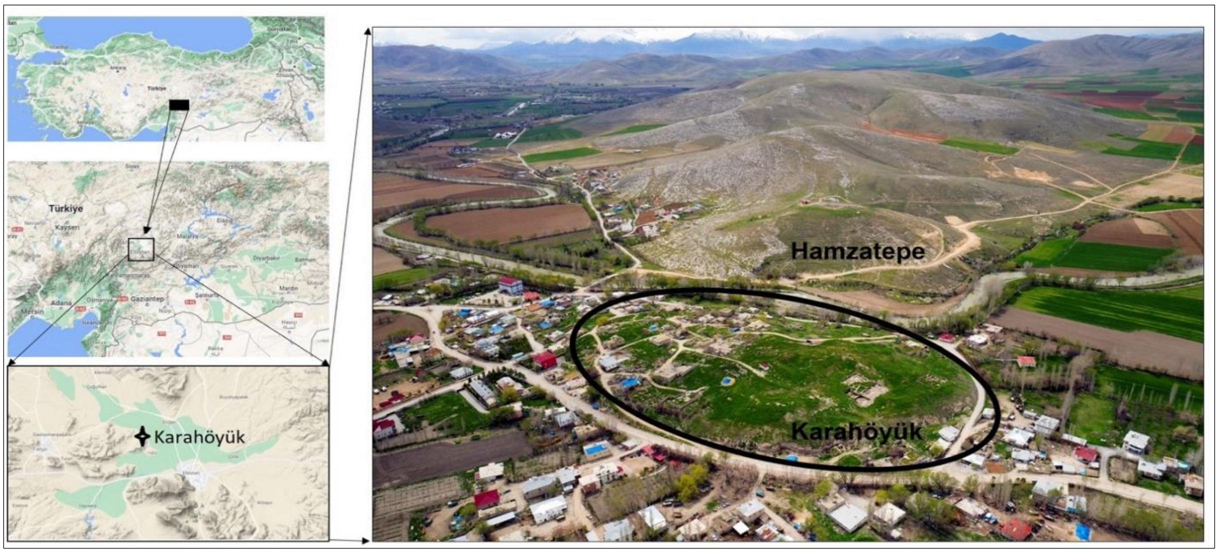

Figure 1. Map showing the location of the Karahöyük.

It was stated in the excavation report of 1947 that the south and south-west directions of the mound were heavily destroyed by the modern village's houses. Today, the destruction has spread to wider areas. Modern settlement extended in all directions on the mound, and it is surrounded by a modern asphalt road. Especially the northern part is almost completely diminished (Uysal, 2017:255; Uysal and Çiftçi, 2016:37). Despite all, since the Iron Age layer was very thick (5.5 m), older periods were able to be appropriately preserved (Uysal and Çiftçi, 2016:37). The current excavation has been conducted on one of the undestroyed areas, the northwest slope, and in two close areas, called Northwest Slope (NS) and Northern Pain (NP). Northwest Slope (NS) exposes a well stratigraphic sequence of seven occupation layers identified (Table 1), as a result of studies in five trenches (G7, H7, I7, and I8). The Late Iron Age architecture was detected just below the surface. The building consisted of a large house (at least four rooms) and an attached courtyard. In addition, many pits located outside of the rooms were also found in this layer at NS (Uysal, 2017:256). The excavation was continued at six trenches (L11, L12, M10, M11, N10, and N11) on the Northern Plain (NP), and working was prolonged on eight cultural levels. The stratigraphic sequence is presented in Table 2. While layers III and IV are referred to Late Hittite Chiefdom Period, layers V to VII are represented as Hittite Emperor Period. After cleaning layer VII, the oldest cultural deposit (layer VIII) was unearthed in the 2020 excavation season (Fig. 2). Excavation at this layer still continues, and in order to find out the exact date, it is needed to progress. Nevertheless, so far, works based on archaeological research shows that they seem probably dated to the Late Bronze Age (LBA) or the end of the Middle Bronze Age (MBA) periods (unpublished excavation report). The architecture is characterized in NP as intersecting walls, two rectangular-shaped rooms, and a cylinder seal with hieroglyphic inscriptions were found 4th layer dated to Early Iron Age (Uysal, 2017:256; Uysal and Çiftçi, 2016:39). Another hieroglyph stamp and button seal were also found from layer 7th of the LBA period in trench N10 in 2019 (Uysal and Çiftçi, 2021:101). In addition to these findings, mudbrick walls on stone foundations, sherd, hearths, and tandoors were discovered in this area. The goal of the excavation is to define the stratigraphic sequence of the settlement and find answers to some specific archaeological questions (Uysal, 2017:256; Uysal and Çiftçi, 2016:39).

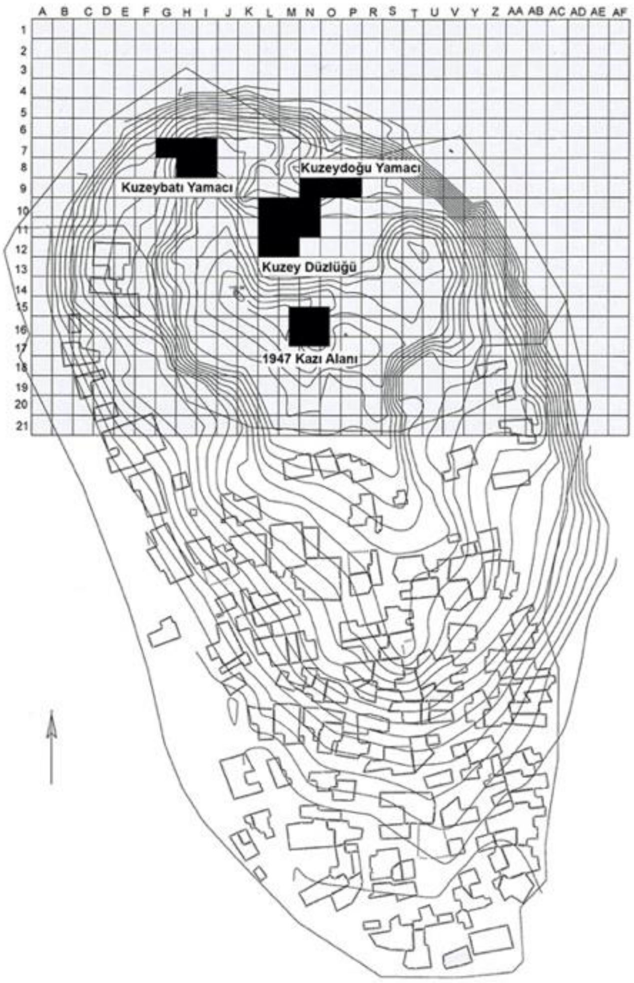

Figure 2. Topographic plan of Karahöyük and the location of the trenches.

Table 1. Stratigraphy of Northwest Slope

Northernwest Slope (NWS)	Periods
NS Layer 1	Late Iron Age
NS Layer 2	Late Iron Age
NS Layer 3	Middle Iron Age
NS Layer 4	Middle Iron Age
NS Layer 5	Early Iron Age (?)
NS Layer 6	?
NS Layer 7	?

Table 2. Chronological sequence of Northern Plain

Northern Plain (NP)	
NP Layer I	Hellenistic- Roma
NP Layer II	Late Iron Age
NP Layer III	Middle Iron Age
NP Layer IV	Early Iron Age
NP Layer V	Late Bronze Age 3
NP Layer VI	Late Bronze Age 2
NP Layer VII	Late Bronze Age 1

Since the current faunal sample is consisted to the Iron Age (Early, Middle, and Late Iron Age), zooarchaeological questions focus on understanding Iron Age animal exploitation. For the Iron Age, our understanding of the history of this area is incomplete. The region for a time came under the administration of the Assyrian governors of Plain Cilicia to the East (Baker, 2006:411). It is understood from the textual evidence that Elbistan plain was under the control of the Neo-Hittite kingdom of Malizi (Assyrian Melid and Urartian Meliteia). The boundaries of Malizian kingdom were comprised of Arslantepe (Malatya), Gurgum (Maraş) to the west, and Kummuh (Adıyaman) to the south (Çiftçi, 2019:10). Following the collapse of the Hittite Empire around 1190 BC, the period is known as the “Dark Ages,” with a general paucity of written documents found in the archaeological records. The consequence of this period cosmopolitan culture was generated in Anatolia (Yılmaz, 2012:70; Welton et al., 2019:292). The so-called Dark Age is generally accepted as a period of cultural devolution with deep social and political disruption and widespread population displacement (Welton et al., 2019:292). Despite a major political decline, the collapse of the Late Bronze Age Hittite Empire, there appears to have been political and cultural stability in eastern Anatolia (Çiftçi and Greaves, 2010:96).

The Elbistan plain served as a political and commercial link between Central Anatolia and the eastern Mediterranean. It is thought that Karahöyük played a significant role on both sides as a bridge. The aim of this zooarchaeological study is to understand the relationship with nearby Iron Age sites by comparing the faunal data. Thus, animal bone records provide a valuable opportunity to interpret regional Iron Age lifestyles. This study also presents the analysis of the zooarchaeological remains from the Iron Age periods and is the first zooarchaeological data from the site that allows us to observe the local subsistence system. Because the complex political systems have an impact on new areas, they affect not only the local polities but also components of the economy. So, it is reasonable to ask whether there is any evidence from Karahöyük to show a major change or reorganization of the animal economy during the Iron Age. Finally, zooarchaeological data give a chance to explore a number of aspects relating to food consumption, economic activities, belief systems, and environmental changes. Briefly, this article provides a general introduction to some of the zooarchaeological results from Karahöyük during the Iron Age.

Materials and methods

Three excavation (2017-2018-2019) seasons yielded a total of 2,212 fragments of animal bones weighing 76438 gr (Table 3) at Karahöyük. In addition, seven human bone fragments were found mixed within animal bones. All of the remains were meticulously collected by hand sorting of sediments with the purpose of gaining as much information as possible. Therefore, the larger animals are overrepresented, and data is biased. The smaller taxa only exist in limited numbers. This is especially true for species like birds, fish, rodents, small mammals, and other animals of similar size. Nevertheless, when comparing only larger animals and asking questions on livestock economy, it is assumed that the recovery bias has no effect on data analysis.

This study includes NS and NP areas dated to the Iron Age (Early, Middle, and Late Iron). Most of the remains recovered from Late Iron Age contexts and in the trenches at Northwest Slope. Faunal remains were cleaned with cold water and brushed, then dried, bagged, and labeled stratigraphically separated at the Karahöyük dig house (by Belgin Aslan). Those animal remains were transferred for the detailed analysis to Van Yüzüncü Yıl University. The faunal remains were examined for zooarchaeological data, including taxonomy, skeletal element, side of the body, age (tooth wear and epiphyseal fusion), sex, pathology, burning, animal gnawing, weight, and as well as cultural modifications such as tool and ornament production.

The taxonomic identification was made by comparing standard osteological atlases and other visual sources of related zooarchaeological remains and by comparison with reference collections. The discrimination between sheep and goat was employed from the publications Boessneck (1969), Payne (1985), Prummel and Frisch (1986), Schmid (1972), and Zeder and Lapham (2010). The size, morphology, and metrics criteria were used to distinguish between wild and domestic species. Measurements were taken with digital calipers according to von den Driesch (1976). It is crucial to understand how herds were maintained, for what products and the structure of supplying system, and the demographic profiles that show the age at which animals were slaughtered (Arbuckle, 2009:184).

The demographic data are obtained from two sources: the stage of fusion of the epiphyses of long bones; the eruption and wear of mandibular teeth. In order to determine epiphyseal fusion stages, Silver (1969) is followed. The recording and analysis of tooth eruption and wear follow Payne (1973) and Grant (1982) for caprine and cattle and pigs, respectively. Weighing the bone remains can be shown approximately how much each species contributes to meat consumption. The weighing method is used for measuring the estimated meat provider of an animal. Bone weight measuring also helped to understand both the economic contribution of different taxa and roughly amount of meat supply. The weighing (gr) values are presented in Table 3 for all species by each period. In order to monitor whether entire carcasses or only chosen skeletal parts were discarded, skeletal parts distributions were used.

Skeletal parts including head (horn, mandible, occipital condyle, petrosum), neck (atlas, axis, cervical), upper forelimb (humerus, scapula, thoracic, lumbar, rib, pelvis), lower and upper hindlimbs (femur, tibia, metatarsal, tarsal, fibula), and feet (1^{st} phalanx, 2^{nd} phalanx, 3^{rd} phalanx, calcaneum, astragalus) were calculated for the most abundant taxa. This technique is used to evaluate the variation in the presence of meat-non-meat bearing bones (Zeder, 1988:19). Definition of the high, medium, and low value meat is explained by Uerpmann (1973), skeletal parts associated with high value meat like scapula, humerus, femur, atlas, are usually grouped as consumption waste while low meat value parts like heads and feet are classified as butchery waste (Arbuckle, 2012:468). In addition, using this method, the intrasite and intersite exchange of animal products is the distribution of anatomical elements or body parts that can be monitored. When all parts of the body are represented at a site, it would be assumed that domestic animals were raised, slaughtered, and consumed at the same place.

However, the existence of all body parts at the site does not always imply that animals were raised there. If consumers had whole animal specialist treatments, it is possible that all body parts were consumed. However, if customers were only provided certain body parts, it is expected to find selected anatomical parts, mostly like upper limb bones that have high value meat. Where specialized butchering activities were conducted, it is predicted to a high concentration of butchery waste like feet and skull fragments (Crabtree, 1990:166). Finally, the pathological conditions, if any, were also examined by veterinarian Osman Yılmaz from Van YYU to the definition of deformation on both bones and teeth.

A few unidentified bone remains were grouped according to their size. In this study, two groups are represented as large (cattle, red deer, bear, equids) and medium (sheep, goat, pig, roe deer) sized artiodactyls. The number of identified specimens (NISP) was used as the calculation of taxonomic abundance. The NISP method can lead to counting bones from the same animal, assuming that each bone belongs to a different individual.

Distribution of the assemblage

Before presenting the archaeozoological data, it has to be noted that seven human bones were found mixed within the animal remains. These include a first carpal (trench N10, MIA), sacrum (trench H8, LIA), ischium fragment (trench H7, MIA), right ulna (trench N11, EIA), femur (trench H7, MIA), right tibia (trench H7, MIA) and left mandibular permanent isolated canine teeth (trench H7, MIA) and all the bones were fused except the bones from N10 and N11 trenches. A large number of animal bones and half of the skull of 4 years old child were recovered from a pit in those trenches in the 2017 excavation, so it is possible that these bones belong to this child (Uysal and Çiftçi, 2018:398). If the contextual information is taken into account for the other human bones, since there is no graveyard nearby, these were most likely carried by dislodging of sediments.

Turning to the animal bones, despite variety of taxa subsisted in the fauna, the assemblage consists primarily of remains from domesticated mammals. In total, 2.212 bones could be identified at least to order level (=NISP). Table 3 shows the species representation of the entire assemblage and distribution over the chronological periods and weights.

Sheep and goats (*Ovis/Capra*) (caprines) (41%) are the most abundant taxa for each period, followed by cattle (*Bos taurus*) (34.36%) and pigs (*Sus scrofa domesticus*) (9.72%) based on specimen counts. While the number of animal bones is larger in LIA in the context of taxonomic diversity, the EIA wild taxa are relatively better represented than other periods. When only the wild and domestic taxa are considered, there are few wild animals in the sample (0.96%). Although the highest number of bones is represented in LIA, the proportion of wild animals is very low in this period, and in the MIA, wild animals are found in a small sample as well. Wild mammal taxa include red, fallow, roe deer, badger, hare, wolf, and fox (Table 3). In addition, very few numbers of bird and turtle bones have been found. Equids (*Equus caballus, Equus asinus,* and *Equus sp.*) are also represented in different numbers for all periods. The number of equids is the same for EIA and MIA, but it is increased during the LIA period. Dogs and equids are represented in the same percent as 3.8%. Dogs also exist for all periods, and the highest number of *Canis familiaris* is represented in the LIA period too.

Table 3. Taxonomic distribution of animal bones by periods

	EIA			MIA			LIA		
	N	NISP %	Weight (gr)	N	NISP %	Weight (gr)	N	NISP %	Weight (gr)
Domestic mammals									
Domestic cattle; *Bos taurus*	135	31.84	11011	175	34.52	11555	450	34.94	23653
Sheep; *Ovis aries*	66	15.57	1453	63	12.43	1239	133	10.33	2415
Goat; *Capra hircus*	40	9.43	858	24	4.73	519	54	4.19	1058
Small domestic ruminants; sheep/goat	85	20.05	1158	140	27.61	1766	302	23.45	3224
Pig; *Sus scrofa dom.*	42	9.91	1447	32	6.31	1231	141	10.95	2627
Horse; *Equus caballus*	7	1.65	774	10	1.97	1132	23	1.79	1025
Donkey; *Equus asinus*	3	0.71	102	7	1.38	414	9	0.7	573
Equid; *Equus sp.*	22	5.19	720	14	2.76	554	48	3.73	2165
Dog; *Canis familiaris*	2	0.47	48	9	1.78	247	73	5.67	741
Cat; *Felis catus*	-	-	0	-	-	0	3	0.23	15
Large artiodactyls	5	1.18	194	18	3.55	653	21	1.63	584
Medium artiodactyls	4	0.94	63	5	0.99	23	15	1.16	116
Wild mammals									
Red deer; *Cervus elaphus*	5	1.18	410	4	0.79	251	1	0.08	27
Roe deer; *Capreolus capreolus*	2	0.47	29	-	-	0	-	-	0
Fallow deer; *Dama dama*	-	-	0	-	-	0	1	0.08	15
Badger; *Meles meles*	1	0.24	2	-	-	0	1	0.08	2
Hare; *Lepus europaeus*	2	0.47	2	-	-	0	1	0.08	2
Fox; *Vulpes vulpes*	1	0.24	23	-	-	0	-	-	0
Wolf; *Canis lupus*	-	-	0	2	0.39	29	-	-	0
Others									
Turtle	1	0.24	2	-	-	0	-	0	0
Mollusca	-	-		-	-		3	0.23	
Unidentified birds	-	-		-	-		7	0.54	21
Human; *Homo sapiens*	1	0.24		4	0.79		2	0.16	
Total	**424**	**100**	**18296**	**507**	**100**	**19613**	**1288**	**100**	**38263**

Main domestic taxa

Domestic sheep (Ovis aries) and domestic goat (Capra hircus)

Sheep and goats are closely related at the subfamily level, making it difficult to identify between them based on the bone remains. However, in this study, bones can be identified as sheep and goat if possible. Thus, the proportions of two genera in an assemblage can be generated. Table 3 show the numbers of sheep and goat at Karahöyük over the periods. The bones which were not able to be determined either sheep or goat were grouped as small domestic ruminants. The distribution of sheep and goats displays the predominance throughout the periods. Sheep and goat, like the Anatolian fauna during the early and middle Holocene periods, are the most abundant animals in the Karahöyük faunal assemblage, comprising 41% and more than 55% of the WR (weight) in total (Table 3). Although caprines (sheep or goat, sheep, and goat) are represented in higher than other domesticates (cattle and pig) in the Iron Age assemblage. There are slight shifts in the percentage of sheep and goats during the periods. While the proportion of sheep is lower than cattle through time, goats are fairly lower represented than cattle and pig for all periods. When we look at the ratio of each species separately (sheep, goat, and sheep/goat as small ruminants), it can be observed as those are lower than cattle in Iron Age levels.

Evidence of pathologic conditions is rare in terms of the total numbers of caprines remains from Iron Age at Karahöyük. The granulomatous disease was observed on the s/g metatarsal bone due to the improper fusion of the broken bone (personal communication with O. Yılmaz) (Fig. 15d). This condition shows itself as swelling caused by a bone infection. 8.73% (n=193) butchery marks were observed on caprines bones. Fifteen caprines have been modified as a result of the production of functional or decorative tools (Fig. 16b).

It is noteworthy that some sheep (n=7) and goat (n=8) bones were associated as wild, because they were larger than normal. The evidence of human modification in the form of chop and cut marks is displayed in wild sheep bones and goat bones. Butchery marks are apparent on three wild sheep tibia fragments and one humerus, and cut marks are also observed on one partially burned wild goat's femur bone fragment in EIA assemblage. Cut mark was observed on one neonate scapula bone.

Skeletal parts of caprines

Sheep, goat, and sheep/goat skeletal elements are sorted into six groups according to anatomical features. Although skeletal part representation for sheep and goats together has discrepancies, it is built up to understand general butchery activities and consumption habits. The representation of portions of the caprine skeleton is presented for each period in Fig. 3. Skeletal element distribution for caprines shows that all body parts exist. While upper and lower forelimbs are over-represented, necks are preserved as very few numbers (n=9). The head and upper forelimbs are observed a higher number than upper hindlimbs and neck groups for sheep. The result of skeletal elements representation is different for goats. The neck and feet are over-represented, while upper-lower hindlimbs and heads are detected in low numbers. Considering butchery waste is correlated with heads and feet, consumption waste is linked with high value meat limb bones. Thus, it is understood that high meat value bones were often preferred for caprines and related with the consumption waste. When looking at the skeletal element distribution for sheep, because high and low meat values are shown combined, it is difficult to reach a clear judgment. Taking all elements represented in various quantities into account, sheep may have been raised and slaughtered at the site or treated as carcasses. Skeletal element distribution for goats indicates butchery waste because the high number of low meat value bones are recovered. In addition, a specialized butchery activity for goats can be mentioned.

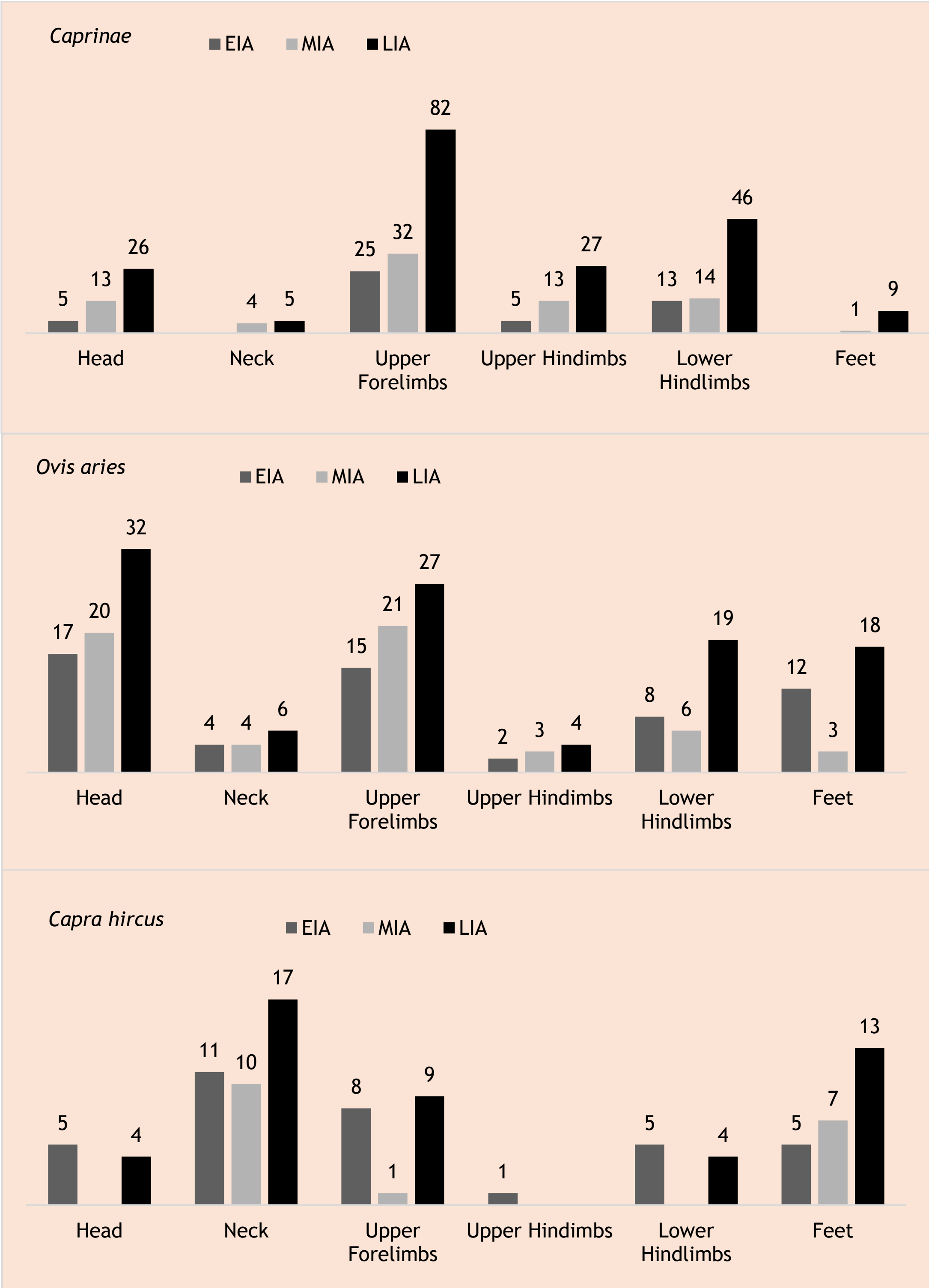

Figure 3. Skeletal element distribution for caprines each period.

Epiphyseal fusion for caprines

Fused and unfused bones are recorded following Silver (1969). Demographic data are calculated based on the state of fusion of long bones are represented in Table 4. Epiphyseal fusion data were derived for elements identified as sheep, goat, and sheep/goat and added together to produce a single fusion value for all elements within the given age range. Table 4 shows the percentage of animals surviving beyond a given age range. At Karahöyük Iron Age, sheep and goats were living beyond the first two age stages. The ratio of individuals who survived until 30 months is the highest percent of the examined population, while the number of individuals surviving between 30-36 months is lower, as shown in Table 4. A very few numbers of caprines reached 42 months of age. The majority of the animals were killed between the first and second years of age, with only a few older animals were survived beyond the third year, and those were highly likely kept for herd reproduction or secondary products. This indicates that young and juvenile sheep/goats were exploited within the herd. The epiphyseal fusion data of sheep and goats indicates that the caprines were herded primarily for meat during the Iron Age. In addition, eighteen neonate caprine remains were found from Iron Age Karahöyük. Caprine neonatal bones are, however, virtually impossible to assign to species due to the poor development of the diagnostic morphological characteristics, so neonatal bones were identified as caprines.

Table 4. The fusion stages of sheep/goat, goat, and sheep for long bones. M: Month, F: Fused, UF: Unfused

	Elements	**Sheep/Goat**		**Goat**		**Sheep**		**S/G+G+S**		
		UF	**F**	**UF**	**F**	**UF**	**F**	**UF**	**F**	**F%**
Group A (8-10 m)	Scapula	1	2	0	3	0	0	1	5	16.13
	Distal humerus	0	6	1	2	0	6	1	14	45.16
	Pelvis: acetabulum	0	2	0	0	1	3	1	5	16.13
	Proximal radius	0	1	0	0	0	3	0	4	12.90
	Total	**1**	**11**	**1**	**5**	**1**	**12**	**3**	**28**	**90.32**
Group B (12-24 m)	Proximal phalanx 1	0	0	0	4	0	4	0	8	26.67
	Proximal phalanx 2	0	0	0	0	0	1	0	1	3.33
	Distal metapodium	1	0	0	4	0	3	1	7	23.33
	Distal tibia	2	1	0	3	1	6	3	10	33.33
	Total	**3**	**1**	**0**	**11**	**1**	**14**	**4**	**26**	**86.67**
Group C (30-36 m)	Proximal ulna	1	1	0	1	0	1	2	2	18.18
	Proximal femur	1	1	1	0	1	0	3	1	9.09
	Proximal calcaneum	0	0	0	1	1	1	1	2	18.18
	Total	**2**	**2**	**1**	**2**	**2**	**2**	**6**	**5**	**45.45**
Group D (36-42 m)	Proximal humerus	0	0	0	0	0	1	0	1	16.67
	Distal radius	0	0	0	1	0	0	0	1	16.67
	Distal femur	1	1	0	0	1	0	2	1	16.67
	Proximal tibia	1	0	0	0	0	0	1	0	-
	Total	**2**	**1**	**0**	**1**	**1**	**1**	**3**	**3**	**50.00**

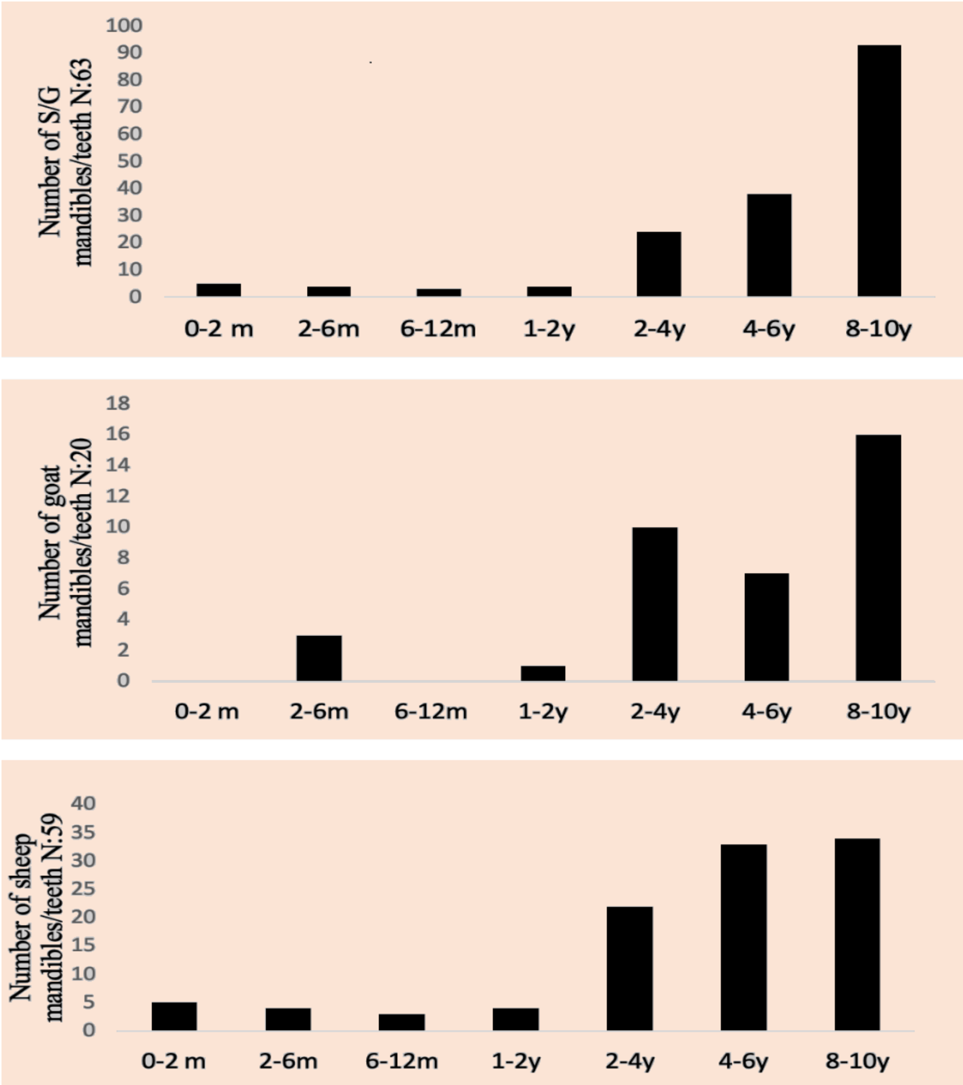

Figure 4. Dental age profile for sheep/goat, goat and sheep (M: month, Y: year).

Dental age profiles for caprines

In order to monitor culling, the age of flocks, mandibular teeth eruption, and wear of caprine (s/g, sheep, goat) is also calculated. The distribution of age stages of examined mandibular teeth is shown in Fig. 4. According to dental aging analysis, the representation of infant and young lambs is sporadic, while the numbers of adult caprines are high in the assemblage. Consumption is in a similar age range at fusion stages of long bones and dental aging.

On the contrary to epiphyseal fusion stages, analysis of dental data indicates that herd management strategies were focused overwhelmingly on adult caprines with 90.6% of s/g, 89.2% of goats, and 84.8% of sheep are survived over two years of age. According to Helmer *et al.* (2007), the slaughtering of young lambs under six months of age is thought to be due to milk exploitation, whereas very few individuals were killed in this range. In addition, the exploitation between six months and two years of age shows that these animals are being exploited for meat, and this group is represented in a lower number as well. Culling the caprines between second and fourth years emphasizes milk extraction, whereas slaughtered between the ages of four and six, who were kept alive until adulthood to generate offspring and secondary products such as milk and wool/hair. The peaks at 2-4 years are suggestive of animals kept for wool/hair, which were slaughtered before meat quality declined. The 8-10 years old group are prominent, and the presence of the adult-old group in high proportion suggests that production of milk, hair /wool, and replacement stock was ongoing in the area. It can be observed that the graph is steadily rising after 4 years old except goats. The number of slaughtered goats is decreased slightly between 4-6 years. Even so, this result clearly accords with the predicted profiles for secondary products exploitation in the form of both milk and fleece after they exceeded their optimal meat age.

Cattle (Bos taurus)

After the caprines, cattle are the second most abundant taxa representing 34.36% of the specimens identified to genus level in the whole periods' deposits and 61.92% of the WR (Table 3). Cattle frequencies in the Levant have been demonstrated to be highly connected with geographical location, which defines a site's overall rainfall and agricultural potential (Popkin, 2009;106). A large number of cattle bones were found in the site, indicating that the environmental conditions of Iron Age Karahöyük were suitable for these animals breeding, and Karahöyük is located in the fertile Elbistan plain is suitable for agricultural activities today.

The fact that an abundance of cattle has often been associated with suitability of geographical conditions, economic wealth, and intensive agricultural production. The slight changes were observed in the percentage ratio of cattle during the periods (Table 3). In addition, cattle were always the secondly preferred animal during all periods, which suggests the continuity of the economic choices of the community, aiming production and the distribution of cattle resources.

196 (7.04%) butchery marks were recorded on cattle bones, a knife or knife like tool marks were detected in 133 of the 163 cut marks, whereas 30 fragments provide evidence of chop marks (Fig. 12a). Six specimens had clearly been modified to create ornamental or tool items (Fig. 16a). An astragalus, left proximal part of the femur and distal shaft of tibia bones were polished. In addition, a high degree of polish evidence was detected on three incisive teeth (Fig. 16c). Burning also is observed on the fifty-two cattle bones. Fifty of them were carbonized as black color, while two cattle bones turned white-grey color due to exposure to a high degree of heat.

Eight cattle bones exhibit some form of pathology. Pathological conditions are observed on the first and second phalange's proximal articular surface exostoses (osteoarthritis) (Fig. 15b-c) This disease is associated with heavy traction work and constant use of animals on stiff draught (personal communication with O. Yılmaz). Traction or cartage can thus be considered as the primary cause in this specimen, but the absence of this condition in other cattle phalanges from Karahöyük could indicate that this disease was unusual among cattle used in this type of work. Arthritis is also observed on one lumbar vertebra. In addition, tooth deformation due to bridle was detected on two mandibles, and a fracture in the proximal part of metacarpal bone caused proliferation (Fig. 13a). Lastly, due to the separation of the ulna from radius bone for some reason which was caused, bone infection and growth called '*purulent osteoproliferation*' has been detected (Fig 14a).

Skeletal parts of cattle

Skeletal part distribution for cattle at Karahöyük is represented in Fig. 5. The pattern is similar to that for each period. While the most common skeletal parts are the upper forelimbs in all periods, heads and feet are the second best-represented group in the faunal assemblages. While creating the skeletal element distribution for cattle, the process of preservation and fragmentation conditions for recovered bones should take into consideration. The proportion of upper limbs in an animal's body is substantially higher than the actual proportion of these parts. In the case of large mammals, this difference comes from the fact that the meat-bearing upper limb bones were significantly fragmented, most likely as a result of consumption activities.

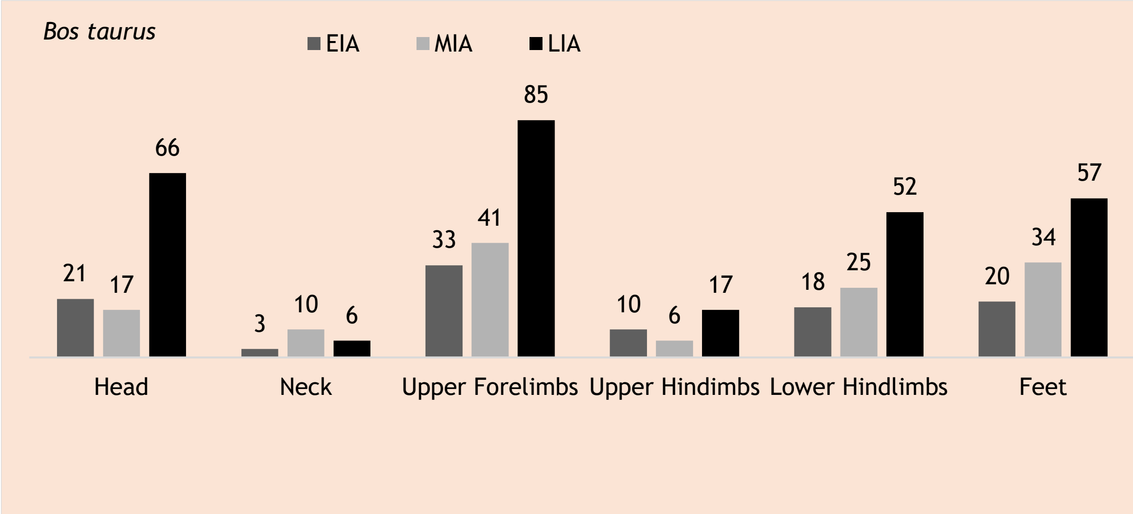

Figure 5. Skeletal element distribution for cattle.

The neck category is poorly represented for cattle at the site. In general, the frequency of skeletal elements for cattle was similar to the site during the Iron Ages. All parts of the skeleton are found comprising both high and low meat-bearing skeletal parts. In the LIA deposits, skeletal elements are better represented (n=283) than the average of other periods. While meat-bearing bones are over-represented during LIA and EIA, feet and head are better exhibited, and high meat value bones are relatively underrepresented in MIA. Looking at the overall picture in the skeletal element distribution for cattle, the inhabitants of the mound most likely processed, consumed, and disposed of the entire carcass.

Epiphyseal fusion for cattle

Mortality profiles for the cattle were constructed based on epiphyseal fusion data and mandibular remains represented by Silver (1969). These data were grouped into three age categories reflecting the fusion times of the elements concerned (Table 5). In the Iron Age levels, survivorship was generally very high the first three years (89.47-87.50%). It is shown that the population mostly survived beyond three years old. 60% of the long bones that belong to fully adult individuals were slaughtered older than four years. According to epiphyseal fusion for cattle, consumption starts as from 1.5 years old age. However, there is a decline as they become older age. Beyond 24-36 months of age, cattle were preferred compared with old individuals. As with caprine, calves are chosen very rarely (n=8). This pattern fits cattle may have been exploited to supply secondary products/traction rather than as sources of meat.

Table 5. Epiphyseal fusion stages for cattle

Cattle				
Groups	**Elements**	UF	F	F%
Group A (0-18 m)	Scapula	3	18	11.84
	Distal humerus	5	38	25.00
	Proximal radius	7	26	17.11
	Pelvis: acetabulum		8	5.26
	Proximal phalanx 1	1	30	19.74
	Proximal phalanx 2		16	10.53
	Total	**16**	**136**	**89.47**
Group B (24-36m)	Distal metapodium	1	29	51.79
	Distal tibia	6	20	35.71
	Total	**7**	**49**	**87.50**
Group C (>42 m)	Proximal humerus	2	0	0
	Femur	7	8	13.33
	Proximal tibia	7	8	13.33
	Calcaneum	8	20	33.33
	Total	**24**	**36**	**60**

Fig. 6 shows the number of cattle mandibles, mandibular sections, and individual teeth that could be assigned age stage. The profile based on mandibles specimens suggests relatively late (older than 4 years) mortality, with 53.16%. Furthermore, 22.78% of cattle display those animals in the assemblage lived beyond 3 years old. Infant and juvenile deaths are poorly represented, with only 5.06%. The pattern of cattle culling profile of adult and older ages might have been strongly associated with high intensified agriculture. This is supported by the existence of silos from archaeological findings. In addition, the prevalence of pathologies in foot bones and tooth deformation because of bridle supports this. Although older ages were mostly represented in the fauna, the tooth wears data might suggest that the use of cattle in Iron Age was not solely for traction but also for meat and milk because subadult individuals are also represented in the assemblage. Distribution of tooth wear stages and epiphyseal fusion of long bones results indicate that cattle were generally kept until adulthood. Because adult mortality is dominant, a herd strategy based on females would be the most effective for flock maintenance, with few males kept for reproduction. Adult females would have served as breeding stock and secondary products like milk and traction. In addition, the male stock would be slaughtered as optimal age between 3-4 years old so that meat production might have been ensured.

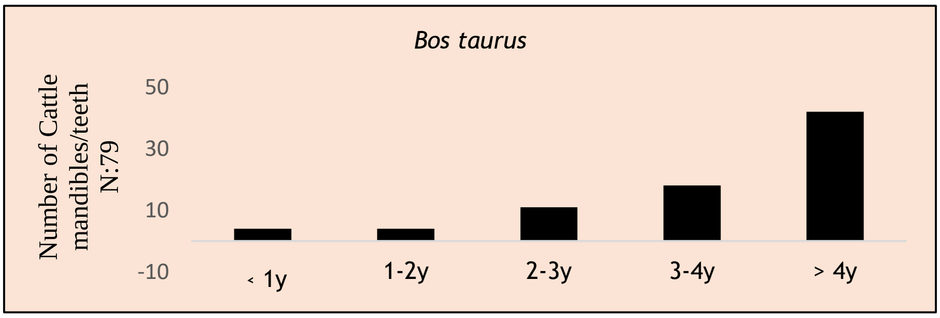

Figure 6. Dental age profile for cattle (Y: year).

Pig (Sus scrofa dom.)

The total number of identified pig remains is 215 (9.72%); pigs are thus the third best-represented animals at Karahöyük. The ratio of pig remains during the EIA 9.91%, as shown in Table 3, while this 6.31% during MIA and it reached highest proportion in the LIA 10,95%. 26 (12.09%) cut marks were observed on pig bones. A chopped mark was observed on one humerus bone, and twenty-five cut marks were detected on different parts of pigs' skeletal parts. Burning is also found in a few bones. Seventeen pig bones were carbonized as black, while one bone was as grey/white color. There were no signs of a pathological condition for the pigs at Karahöyük. All the remains are considered domestic pigs, except one part of the scapula. The rest of the pig remains seem not to be larger than the average size of the assemblage.

The primary use of pigs is as a meat supplier so, pigs play a significant and unique role in the subsistence economy of the societies. The proportion of pig remains can reflect the economic system at the settlement. Studies show that in the Near East, pigs were raised on a small scale to maintain their family's meat demand. As a result, whereas pigs are common in urban areas, they are less common in rural areas. Pigs are poorly represented in high status or cultic contexts, and if pigs are found at urban centers usually related to household refuse (Zeder, 1985:85). As the pig's omnivorous dietary habits, those have a wide choice of habitats. Those need certain water sources (near lakes or riversides) to survive and are unable to live in an arid desert climate (Gilbert, 2002:15). Therefore, the ratio of pig remains in the faunal assemblages are important in terms of reflecting on the past environmental conditions. Considering the number of pigs in the fauna, it can be supposed that the past environmental conditions at Karahöyük were suitable for pig breeding.

Skeletal parts of pigs

A view on the skeletal element distribution of pig (Fig. 7) shows that all body parts are present. The highest number of body parts were recovered in the LIA context (n=87), varying for MIA (n=30) and EIA (n=32). As Uerpmann (1973) stated, the animals were slaughtered within site, it is expected that the low meat-bearing axial skeletal elements will be deposited. However, the animals were butchered outside of the settlement the high meats of the skeletons will be carried back to the site. The overall pattern, overrepresentation of the head is visible, while hindlimbs and feet are underrepresented. Pig skulls are much more durable than other animal skulls and are better preserved, plus easily identified. Therefore, low meat/butchery waste of skeletal fragments (head) is highly represented. Nevertheless, the low representation of the more minor elements like carpals, tarsals, and some phalanges for all periods might be related with collected by hand during the excavation. Because recovery technique has important influences on the skeletal part representation for all of the species and also pigs, the high number of pig heads in the material it is difficult to assume whether entire pigs were butchered at the site or this pattern is related to the taphonomic process.

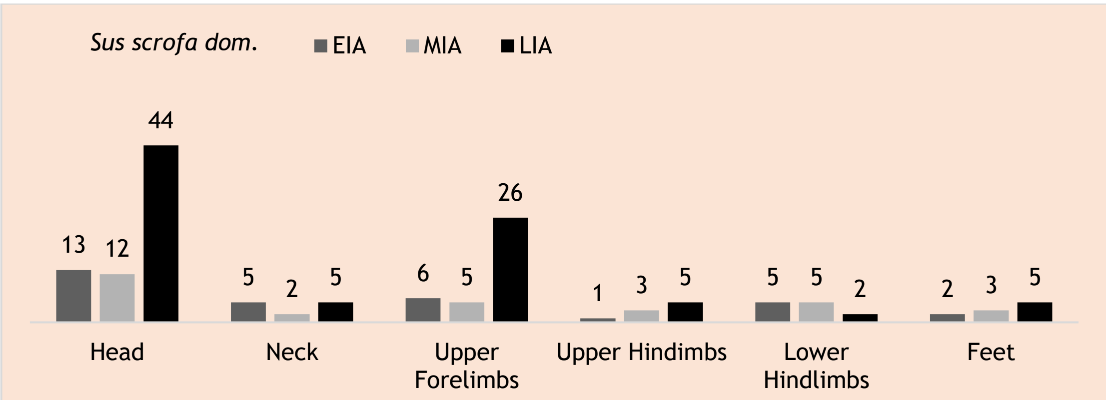

Figure 7. Skeletal element distribution for pigs.

Epiphyseal fusion for pigs

Slaughtering ages of pigs were reconstructed according to both epiphyseal fusions of long bones and tooth eruption and wear. The fusion stages are divided into three groups (Table 6). Table 6 describes the skeletal parts fusion stages of each bone. In general, Group A epiphyses fused during infantile and juvenile stages (before 12 months), Group B indicates subadult stages (before two years), and Group C epiphyses fused when the animals reached full adulthood (before 3.5 years). Before explaining in detail the culling age for the pigs, it is noteworthy to mention that the neonate skeleton was recovered in trench I8 (KH/I8.8/I/LIA), and three neonate occipital bone fragments were also discovered in the same context. Although most pigs were culled within the first year (55.10%), younger piglets were also slaughtered (44.90%). A small number of fragments belonging to the older than two years' group (68.75% of the animals) were killed before subadult years. Few adults (2.61%) were slaughtered before they reached adulthood. The mortality profiles for the pigs suggest that the inhabitants mainly preferred younger animals.

Table 6. Epiphyseal fusion stages for pigs

	Pig			
	Element	**UF**	**F**	**F%**
Group A (<12 M)	Pelvis: Acetabulum	2	4	8,16
	Scapula	5	8	16,33
	Distal Humerus	7	4	8,16
	Proximal Radius	3	3	6,12
	Proximal Phalanx 2	5	8	16,33
	Total	22	27	**55,10**
Group B (<2 Y)	Distal Metapodium	0	0	0
	Distal Tibia	0	4	80
	Calcaneum	0	1	20
	Total	0	5	**100**
Group C (<3,5 Y)	Ulna	11	5	2,17
	Femur	2	1	0,43
	Proximal Tibia	4	0	0,00
	Total	17	6	**2,61**

Another way to examine slaughter patterns is tooth eruption and wear data also used in this study. The aging stages are represented in Fig. 8. According to this, the first group indicates infantile and juvenile (up to 12 months), the second group is subadults (1-2 years). In contrast, the third group represents adult individuals (2-3 years), and 3-4 years includes adults. The final group comprises old animals. Fig. 8 indicates that 50% of the animals were killed during the first two age stages. 18.33% of adult animals were culled, and similar frequencies are observed (8.33%) for the first, fourth, and fifth age groups. The dental wear aging pattern indicates that few very young animals and few old animals were slaughtered in the assemblage. The slaughtering trend shows that animals were killed at the end of subadult stages. This is a typical pattern of animals kept for their meat.

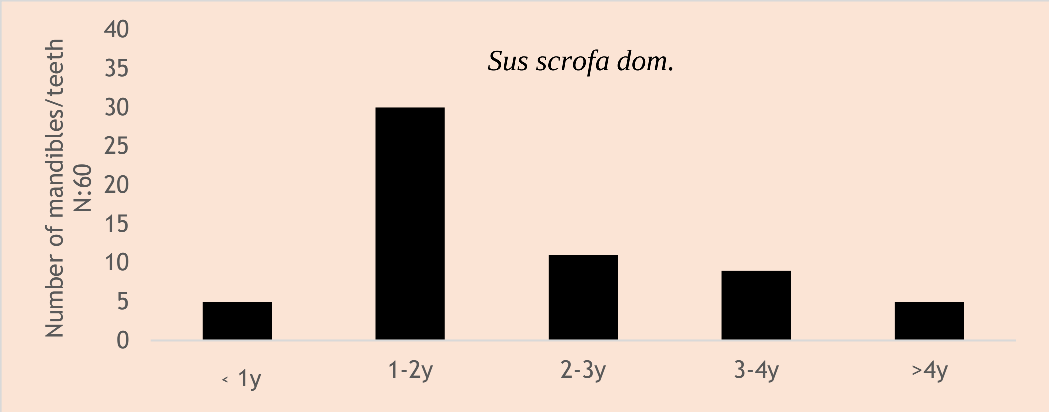

Figure 8. Dental age profile for pigs (Y: year).

Equids (Equus caballus, E. asinus, and Equus sp.)

Equids were preferred in the Levantine Iron Age. The horses were mainly used as a means of transportation. As ancient people could not travel long distances, they were primarily used for military purposes. However, donkeys were also always major animals for transportation. Donkeys were employed on a variety of tasks like plowing, transport of goods, and the supply of the motive power for the mill. Given the evidence for agricultural suitability of the Plain, the role of equids would have been crucial at Karahöyük.

143 (6.47%) equid remains were recovered from Karahöyük, 84 (3.80%) are unidentified to species, 40 (1.81%) are assigned to *E. caballus*, and 19 (0.86%) are identified as *E. asinus*. In order to make an identification of the equids, cheek teeth and postcranial skeletons were used, based on Chuang (2018), Baxter (1998), and Eisenmann (1986; 2002). The enamel pattern of the biting surface of teeth is typical for the horse and donkey (Fig. 17a-b). Isolated teeth are the most commonly found element for the equids in the fauna, and it is difficult to identify specific species from isolated teeth (37.77%). Therefore, because certainty about identification can only be acquired from complete toothrows, the ratio of *Equus sp*. is recorded highly. However, the second and third molars can be securely distinguished through their triangle forms.

Cut marks were observed on six donkeys, two horses, and fifteen equid bones; three of them had chopped marks, and two of them were gnawed. In general, cut marks do not concentrate on one skeletal element but distribute across different parts of the bones (Fig. 12 b). Although cut marks are not common among the equids, still traces may have been associated with the consumption of the equids by the Karahöyük inhabitants during Iron Age. The burning condition was rarely detected. Only three bones are carbonized with black color.

As for the pathology was observed on only one proximal femur bone, recovered from trench I7/I/LIA. This condition is diagnosed as '*hypocalcemia osteoporotic bone lesion*' by veterinarian Osman Yılmaz (personal communication with O. Yılmaz) (Fig. 15a). The condition of having a low concentration of calcium in the blood is associated with a reduction of bone tissue or vitamin D deficiency.

The mortality profile of equid species based on postcranial elements reflects that almost all of the equids died into adulthood, and only four unfused bones were found in the assemblages. According to a general picture of aging, very few equid elements were unfused, and a great majority of animals appear to have lived until adulthood. In addition, only one deciduous tooth was found and apart from this sample rest of the teeth were permanent. Considering this information, equids were kept into adulthood, indicating that their principal function was as a source of burden rather than as food animals.

Skeletal parts of equids

Skeletal elements distribution shows all body parts of equids are represented (Fig. 9). Regardless of the figure, the most frequently recovered elements were mandible, maxilla fragments, and isolated teeth (n=72). Thirty-seven of these teeth belong to equids, 27 identified as horses, and eight classified as donkeys. Few equids postcranial remains were collected from the site. Upper forelimbs and lower hindlimbs are relatively better represented, while phalanges are the least common group in the assemblages. Equid bones were recovered from the site are represented by 6.47% of the total NISP. Thus, it can be assumed that these animals are of importance to the daily lives of the inhabitants based on their NISP.

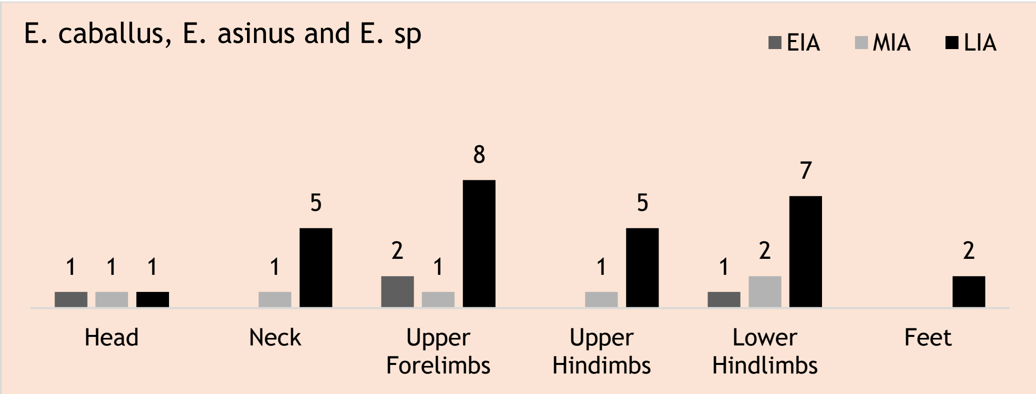

Figure 9. Skeletal distribution for E. caballus, E. asinus, and E. sp.

Dog (Canis familiaris)

A total of 84 (3.80%) dog bone fragments have been recovered from the site. One of the retrieved left humeri had cut marks (Fig. 12c). It would not be correct to say that dogs were being eaten from one cut mark sample. Therefore, dogs are presumed to have been kept as animals of companions for people or as guard animals for flock. None of the dog bones found at Karahöyük showed evidence of burning trace. One individual puppy was found in the same context (I8-8/I/LIA), and one skull, maxilla, mandible, and one scapula belong to the same individual. There was no archaeological evidence on whether this young individual was intentionally buried or not. All of the postcranial bones of dogs are fused in the fauna, except for the bones of this puppy. The majority of the dog remains are of adult animals. One pathology was detected on dog phalange, which has been described as *osteoproliferation* condition was occurred due to luxation (personal communication with O. Yılmaz).

Skeletal parts of dogs

Different elements of dogs are represented in the assemblage (Fig. 10). A very few numbers of (n=5) mandible, maxilla, and isolated teeth remains were recovered. In addition, head and neck bones were also found in a small number, while feet are better represented in the fauna. Limb bones are the most frequently recovered group from the site.

Carnivores at Karahöyük

A single red fox (*Vulpes vulpes*) left side mandible was the other Canidae bone recovered from Karahöyük. One canine tooth is preserved within the mandibular bone. Other Canidae species were found at the site described as a wolf (*Canis lupus*). One right side proximal part of the ulna and left side of pelvis fragment (ilium+ishium) are belonged to wolf (*Canis lupus*) due to both its huge size. This is also verified by comparison reference collection and atlases (Pales and Garcia, 1981). Cat (*Felis catus*) is represented with three bones; one left and one right side proximal part of humerus and right side of ilium fragments. Postcranial bones are fused stage. Interestingly, cut marks are observed on humerus bone (Fig. 12e). The last represented Carnivora is badger (*Meles meles*), left side of the mandible (without teeth), and right side of ilium fragments are identified as a badger.

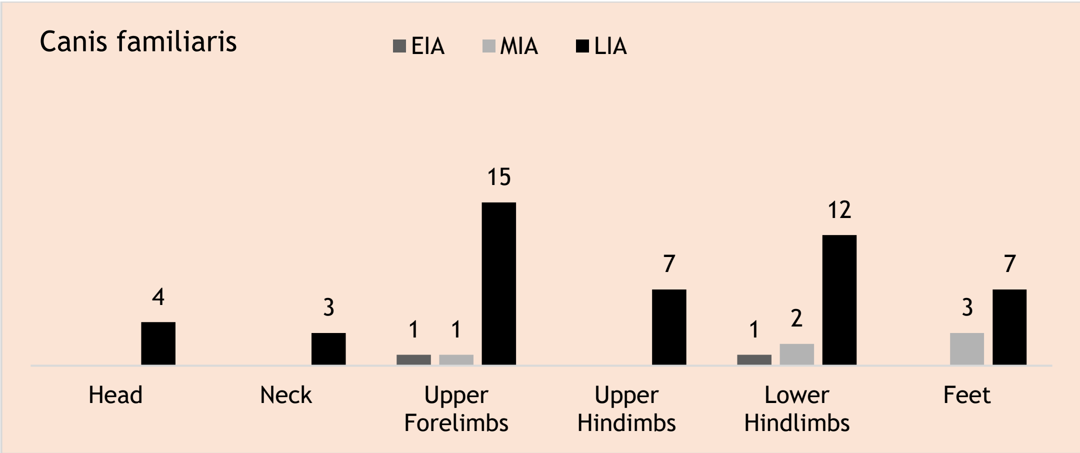

Figure 10. Skeletal element distribution for dogs.

Other taxa

Deer are present in small numbers in the Iron Age deposit and include red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), and fallow deer (*Dama dama*). The Near East is home to three deer species. The largest of the first three is the red deer (*Cervus elaphus*), which has a wide range over Eurasia and is currently found in forested areas of Turkey, the Caucasus, and northern Iran. The smallest Near Eastern cervids, roe deer (*Capreolus capreolus*), share the same habitat and geographical distribution as red deer, whereas fallow deer (*Dama dama*) are medium-sized and prefer drier conditions (Gilbert, 2002: 24).

Ten red deer bone remains were recovered from the site, cut marks were observed on four of the long bones, and one antler was used as a tool (Fig. 18). In addition, burning traces were also discovered on a red deer skull. While one right side of the distal part of humerus and left side proximal part of the ulna was found and identified as roe deer, one astragalus was identified as fallow deer. Several cut marks were also detected on both roe and fallow deer bones.

Hare (*Lepus europaeus*) remains were found in very few numbers (n=3), cut marks were observed on one of the metatarsal bones. Hares might have been hunted as a food source or hidden in the site. In addition, bird bones were identified infrequently (n=7, 0.33%) two of the bone fragments identified as a possible goose (*A. anser*). Several cut marks were observed on one of the femur bones (Fig. 12d). Only one carapace of the turtle was found from the area. Lastly, mollusks rarely appeared (n=3).

According to subsistence economy of people at Karahöyük, sheep and goat herding was the basis of the subsistence of the inhabitants. It is understood that sheep were much kept than goats in every levels of Iron Ages. The faunal remains indicate that subsistence based on herding sheep and goat for mainly wool and hair, which were also the meat producing animals (55%). On the other hand, cattle is the most important meat providers, so cattle provide high amount of meat (60%). Thus, beef and mutton was mostly preferred by the people. Pigs as animals is usually exclusively meat providers, nevertheless pigs were among other domestic animals, provided less than the half of the meat consumption (20%). At Karahöyük about 50% of the pigs were slaughtered during the first two age, these patterns confirm that domestic swine were raised for tender meat which have reached their optimum weight.

Discussion

According to archaeological records, Karahöyük had an important strategic location in the Elbistan Plain back to the Early Bronze Age. Furthermore, research has revealed that the site remained a significant center during Iron Age (Uysal and Çiftçi, 2021:96).

The faunal analysis of the materials recovered from Iron Age levels at the site suggests a pattern of the animal economy, mainly focusing on the extensive exploitation of sheep and goat herds that were raised in the adjacent area. Cattle and pigs in the second and third, respectively. Equids (ass and horse) also existed in the fauna in a different ratio. The presence of these two animals, however, may carry somewhat different socio-economic implications. The distribution of equid bones in the Middle East suggests that neither horse nor ass is a major food animal. Instead, these species seem to have been used mainly for the transportation of goods and people as well as agricultural production. Asses are traditionally seen as draft animals of burden. As the bearers of prominent people, horses are often given a higher prestige. They have also often been linked long-distance migration of nomadic groups across central Europe and Asia (Zeder and Arter, 1994:113). Cut marks were observed in the Karahöyük equids assemblage, although not common those traces may have been linked to consumption of equids yet they don't play important role in the subsistence economy of the site. The cut marks for the equids is rare so, low chance to equid meat part of a human diet. In general, it is understood that the main function of equids at Iron Age Karahöyük was a carry of the load. Dog remains are also identified at the site. Cut marks are sporadic, indicating that dogs are presumed to have been kept as guard dogs as well as companion animals.

In addition, the minor wild animals were recovered, from the site. In particular, wild animals are the primary source of information on past environments. There are three species of deer at Karahöyük, red deer (*Cervus elaphus*), fallow deer (*Dama dama.*), and a roe deer (*Capreolus capreolus*). The existence of deer is a good indication that past environmental condition was suitable for deer. The small number of deer found at Karahöyük may be related to small-scale hunting activity for meat or trade activity. Although deer were found in very few numbers, in fact, they are essential since red deer especially yield a high amount of meat per individual. In addition, antler tools were observed in a small number, which is a sign of tool making (Fig. 18). Bird and hare bones are a much less well-represented group, and those animals made either minor contributions to the diet or which is related to the recovery method is stated above.

The zooarchaeological data at Karahöyük are represented here to observe potential animal exploitation strategies from the Iron Age in the Elbistan Plain. The faunal evidence from Karahöyük suggests that the meat supply depended almost entirely on animal husbandry, which emphasized caprines, cattle, and pigs, horses, donkeys, and relatively few wild animal species additional components of the faunal assemblages. In addition, in this part evaluation comparing with the faunal data of proximate Iron Age archaeological sites.

NISP proportion comparisons with available data from the other Iron Age sites match those of Karahöyük, but the proportion is different. Caprine bones' frequencies for Karahöyük 41% and at Kilise Tepe (Baker, 2006) has 62.7%, although the small number of bones dated to Iron Age assemblage at Ziyaret Tepe (Greenfield-Jongsma and Greenfield, 2013), caprines dominant in the fauna and ratio 51%. Iron Age Çadır Höyük (Arbuckle, 2009) presents as 48.1%, Kaman-Kalehöyük (II) (Hongo,1996) 60%, Büyüktepe and Sos Höyük (Howell and Meurs, 2001) comprises 33.9% and 32% respectively. Caprine remains are also dominant at Kinet Höyük (64.4%) (Çakırlar et al., 2018:123), Oylum Höyük Iron Age assemblage (60.1%) (Silibolatlaz-Baykara and Aslan, 2019:158) and Gordion (predominance peaks at 88%) (Phase 7A-7B) (Zeder and Arter, 1994:110) (Fig. 11).

Caprines may have been chosen as the primary herded domesticated for a couple of reasons. Sheep produce a high amount of meat per individual with slightly greater caloric content, while goats produce milk for a longer length of time. Sheep and goats both generate wool and hair (Zeder and Arter, 1994:112). A focus on caprine herding provides varied quantities and types of resources as well. In addition, studying the quantities of sheep and goats across time can reveal information about environmental and economic changes. Sheep and goats have quite varied pasture and water requirements, despite being frequently herded together. Sheep are thought to be better in wetter and colder climates, but they require a higher grade of forage and more water than goats, and they are more prone to disease (Zeder and Arter, 1994:112). Based on this information, it is clear that Iron Age sites mentioned in the text and Karahöyük's environmental conditions are suitable for the herding of caprines, and it is the most preferred animal throughout the region.

The age data for sheep/goats show broad continuity in their use and the age profile emphasizes the culling of adult and older animals at Karahöyük. The younger age group is not well represented. The herd management was focused overwhelmingly on adult caprines, thus, s/g are intensively exploited for mainly secondary products, especially hair/wool. The excavator suggests that textile related remains like spindle whorls and loom weights were found during the excavation (Pers. com. with Ali Çiftçi), this evidence of woolen textile production at Karahöyük. Consumption of adult caprines may be related to textile production and trade, as well as controlled herd management strategy ensuring the longevity of herd in insecure times. Karahöyük located an important trade route and played a central role during the Assyrian Trade Colonies and Hittite Periods. Iron Age period with high numbers of adult caprines implying great emphasis upon secondary products. So, it is suggested that the significance of Karahöyük in the trade continued during the Iron Age. When compared to other Iron age sites, there is high kill off animals 3-4 years and low proportion of old animals at 8-10 years old based on dental wear in Kilise Tepe, 3-4 years are indicative of animals kept for wool/hair and animals were killed optimum age for meat (Baker, 2006). Demographic results for ovicaprines at Çadır Höyük show that during the Iron Age, 48% survived past two years, and few older yearlings were slaughtered. Similar to Kinet Höyük, the subsistence economy at Çadır Höyük focused combination of products including meat and milk and wool, indicating the mixed economy was practiced (Çakırlar et al., 2018:130; Arbuckle, 2009:190). EIA materials were very few at Ziyaret Tepe. Culling profiles similarly suggest that ovicaprines are used mostly for secondary products exploitation (Greenfield-Jongsma and Greenfield, 2013:136). This is also reported at Kaman-Kalehöyük (Subphase IId-a), where older sheep and goats suggest that the herding ovicaprines for wool and hair is increasingly important (Hongo, 1996:155). Iron Age mortality profile based on both dental and epiphyseal data from Sos Höyük and Büyüktepe Höyük shows similarity those from other sites in terms of adult mortality (Howell and Meurs, 2001:61).

The frequency of cattle bones remains for Iron Age Kaman-Kalehöyük amount to 15-20%. An exception is the assemblage from Subphase IIb (single room (R24) represents the intrusive occupation of the site by culturally diverse population) showed low proportions of cattle 11%. Similarly, cattle are the second most abundant taxa for Karahöyük (34.36%), Kilise Tepe (15.60%), Kinet Höyük (14.8%) Çadır Höyük (11.8%), Sos Höyük (21.38%), Büyüktepe Höyük (26.06%), and Oylum Höyük (16.53%). The importance of cattle increased during Iron Age Gordion. The cattle ratio for Ziyaret Tepe is represented as 44% (Fig. 11).

The cattle management system focused on adult animals. Cattle may have been exploited to supply meat as well as secondary products and traction. In addition, pathological cattle bones, mostly foot bones, suggest that there was a demand for cattle as traction animals in agricultural fields. However, Iron Age levels of Kaman-Kalehöyük (Subphase IIb-IIa) and Kinet Höyük kill-off pattern of cattle different more young animals were killed which suggests the use of cattle other than for traction of agricultural purposes possibly as a major source of meat. Because the slaughter of adult/older cattle husbandry is associated with the improvement of agricultural activity, it can be assumed that there was large-scale agricultural production and economic potential due to the settlement on the commercial road route. In addition, there are plastered silos were found in the Iron Age levels during the excavation, the surplus of agricultural products might have been storage in these silos (personal communication with Ali Çiftçi).

Environment plays a role in cattle herding, and the population of cattle is probably indicative of the gentle and relatively wetland region in Karahöyük situated. The well-watered flat land with good grazing may have favored cattle production while access to the relatively larger Iron Age settlements. According to Arbuckle (2014), after the collapse of the Late Bronze Age political system, the number of cattle declined. However, still, it is understood that the cattle were the most secondly favored animal during the Iron Age Anatolia.

The frequency of pigs at Karahöyük is 9.72% when compared to contemporary sites Kinet Höyük 12%, Çadır Höyük 10.2%, Oylum Höyük (15.5%), Kilise Tepe less than 10%, pigs are represented as significantly lower numbers in the Iron Age Ziyaret Tepe, Sos and Büyüktepe Höyük (respectively n=13, 0.18%, 3.13%). Similarly, the pig ratio at Iron Age Kaman-Kalehöyük (Phase II) is represented as 17% (Fig. 11). Without exception, pigs were slaughtered juvenile or younger age at all Iron Age sites. This is related to the economic importance of pigs was limited to household consumption of their meat.

In general, it is understood from those Iron Age animal bone remains that there are quite similar faunal remains and subsistence strategies. They are characterized by the exploitation of sheep, goats, cattle, and pigs. The faunal remains of Karahöyük and animal-based economy showed a similar pattern to the Iron Age settlements. According to zooarchaeological proves, despite the political collapse that happened in the Late Bronze Age, there was no change detected in both faunal assemblage structure and subsistence strategies.

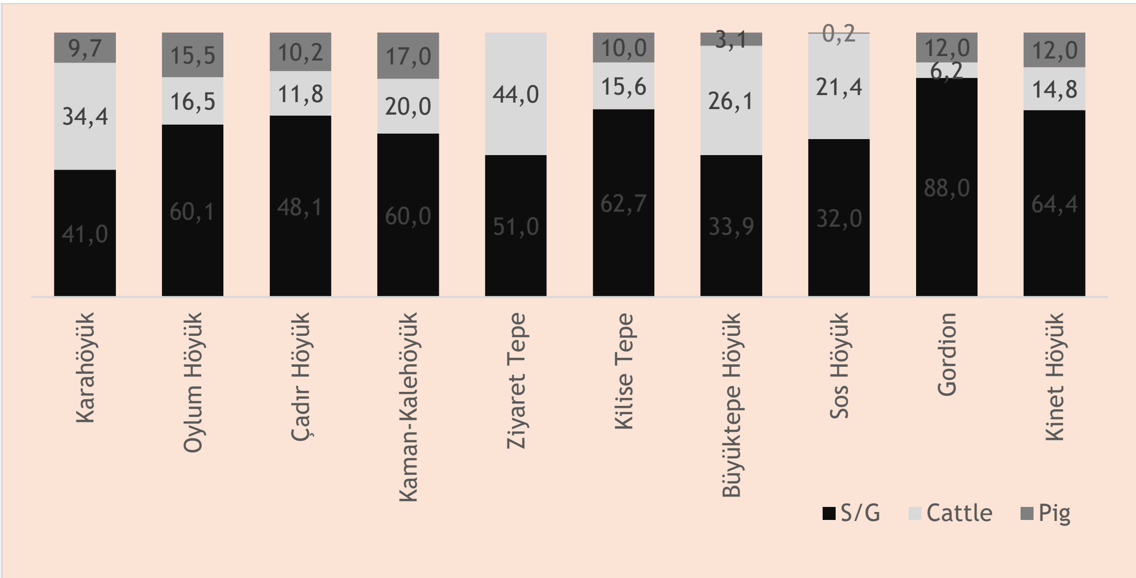

Figure 11. NISP proportions of s/g, cattle, and pigs from Iron Age sites in Anatolia.

Conclusion

The assemblage from Iron Age at Karahöyük shows an emphasis on domestic taxa, with sheep, goat, and cattle being the most abundantly represented species. These taxa were managed according to secondary products, which are very important in terms of affecting the development of societies as well as forming the basis of the animal economy. So domestic animals are most commonly represented and comprise the typical Anatolian fauna for almost every period. Similarly, sheep and goats were herding for secondary products. Cattle were used for primary power as an agricultural draught animal and milk in Anatolia during Iron Age. Pigs are also represented in the fauna, and it is understood that pigs were bred mainly for meat sources like in other Iron Age sites. Equids were valuable animals in the Levantine.

Iron Age in terms of reflecting military purpose and transportation of goods at the time (Popkin, 2009:103). The presence of equids, probably related to a distribution system of wool and other surpluses (non-animal products), were long-distance trade with horses and donkeys. As for the dogs, a nearly complete puppy individual was recovered, and that animal was probably buried intentionally. In addition, small numbers of carnivores like wolves, cats, and badgers were also detected in the assemblage. Interestingly, cut marks were observed on a single cat humerus bone. However, it is difficult to make a definite assumption about these marks. Wild taxa are poorly represented. The presence of deer suggests that some limited exploitation and hunting activities of wild species took place. However, it is unclear to what degree these taxa provided to the subsistence necessities of the settlement's inhabitants.

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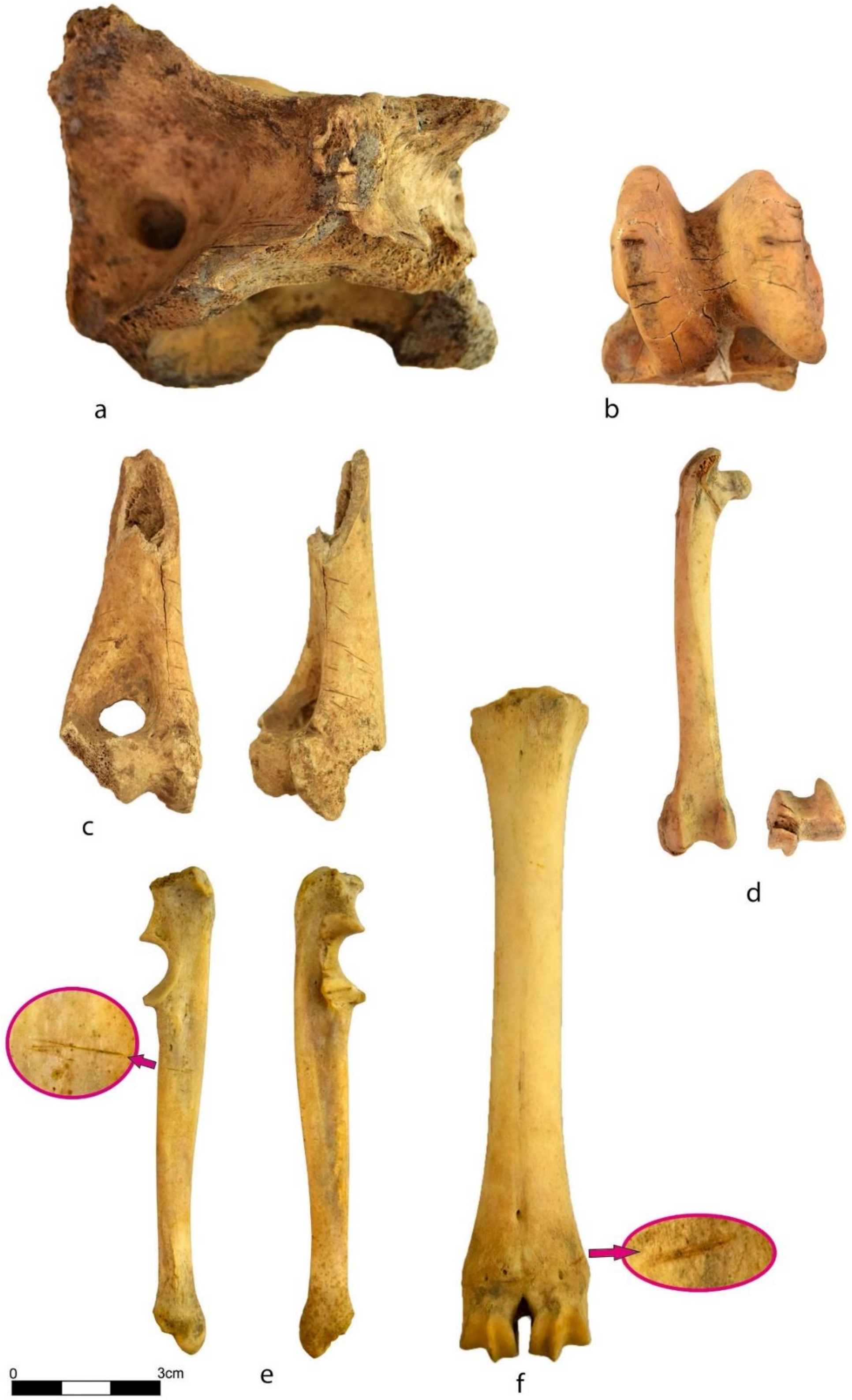

Figure 12. Some cut marks examples selected within the samples a. *Bos taurus* atlas, b. Equid left astragalus, c. *Canis familiaris* right humerus, d. Aves right femur bone, e. *Felis catus* ulna, f. *Ovis aries* metacarpal bone.

Figure 13. *Bos taurus* tooth deformation due to the bridle on right and left mandibles.

Figure 14. *Purulent osteoproliferation* disease on *Bos Taurus* right ulna.

Figure 15. a. *Hypocalcemia osteoporotic bone lesion* on Equid femur proximal, b and c. *Bos taurus* second phalange exostoses, d. *granulomatous disease* on caprine metatarsal.

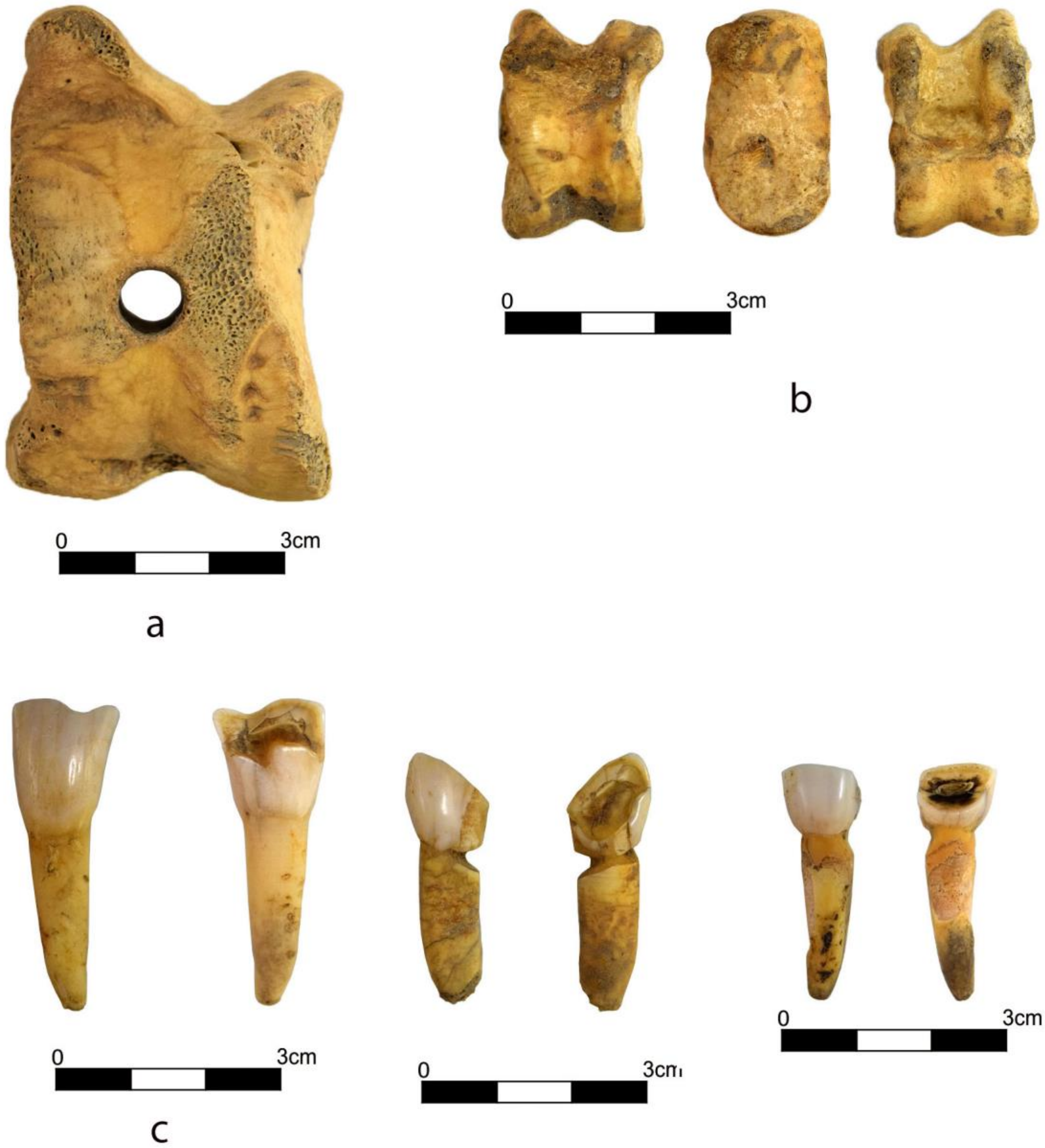

Figure 16. a. *Bos taurus* astragalus bone tool related with textile production, b. Caprine (left) astragalus bone tool, c. polished *Bos taurus* incisive teeth.

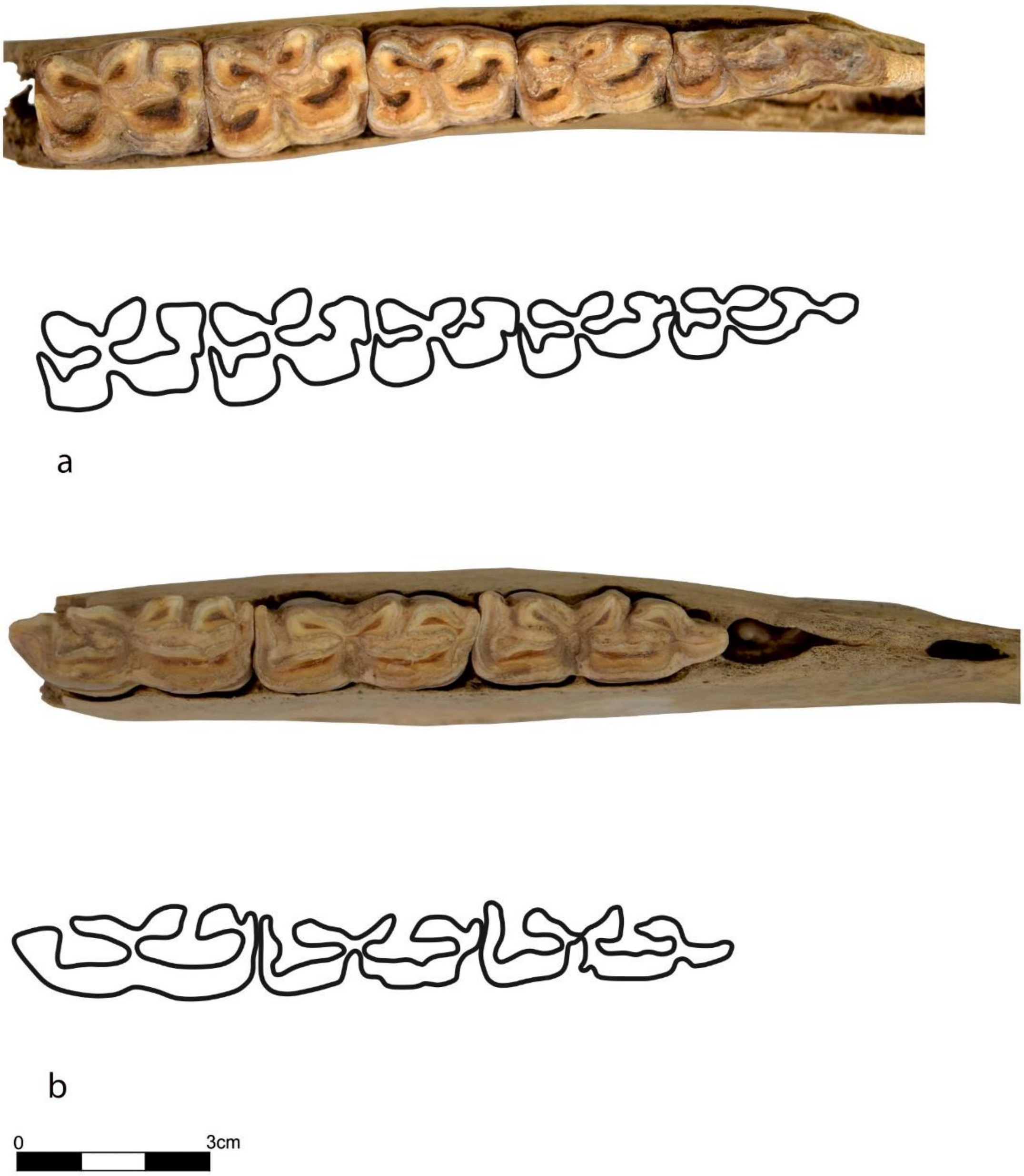

Figure 17. Left mandible of a. *Equus caballus* b. *Equus asinus*.

Figure 18. *Dama dama* polished antler.