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Animal Economies and Islamic Conversion in Eastern Ethiopia: Zooarchaeological Analyses from Harlaa, Harar and Ganda Harla

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Abstract

Excavations at three urban sites, Harlaa, Harar, and Ganda Harla, in eastern Ethiopia have recovered substantial assemblages of faunal remains. These, the first to be analysed from Islamic contexts in the country, were studied to reconstruct animal economies, and to assess if it was possible to identify Islamic conversion or the presence of Muslims in archaeological contexts through examining butchery practices and diet via the species present. Differences in animal economies between the sites in, for example, management strategies, use of animals for traction, and presence of imported marine fish, infers the development of different traditions. However, conversion to Islam was evident, and although issues of non-observance, mixed communities, and dietary eclecticism have to be acknowledged, the appearance of a similar range of butchery techniques suggests these were linked with the appearance of Muslim traders, and subsequent spread of Islam.

Keywords

Islam – Ethiopia – zooarchaeology – Harar – Harlaa – butchery – religious conversion – diet

Introduction

Excavations completed as part of the Becoming Muslim project (694254 ERC-2015-Adg) have recovered substantial assemblages of faunal remains from sites in Harlaa (2017-2019), Harar (2014, 2018), and Ganda Harla (2014). These are the first to be published from Islamic sites in Ethiopia, and one of only a few assemblages to have been analysed from sites that are contemporaneous with the better-studied Aksumite (c. 1st-7th centuries AD) and post-Aksumite contexts in the north of Ethiopia and neighboring Eritrea (e.g. Cain 2000; Lesur et al. 2007; Chaix 2013; González-Ruibal et al. 2014; Woldekiros & D'Andrea 2017). The zooarchaeological analyses were completed with the aim of reconstructing animal economies (herd management strategies, sex proportions of domesticates, body portion distributions, and pathological bone modifications), and assessing if it was possible to identify Islamic conversion or the presence of Muslims in archaeological contexts through examining butchery practices and diet via the species present. Both indicators were useful in recognizing Islam, but non-observance is a factor which has to be acknowledged. Moreover, significant differences were evident between the three sites illustrating variability in animal economies and the development of different traditions over time within eastern Ethiopia.

Answering the questions posed was facilitated by the fact that the faunal material from all three sites demonstrates excellent preservation of both dense and less dense elements. Costal cartilage was recorded in a majority of excavated contexts and foetal, neonatal and infant remains were also recovered from across the sites (Supplementary Tables S1–S28). A reasonably low degree of pre- and post-depositional fragmentation of material was also evident. The systematic dry-sieving of all contexts that was employed allowed the recovery of both small elements and remains of small animals, including birds, fish, and rodents.

The Sites and their Faunal Assemblages

Harlaa (9°29′10.22″N, 41°54′36.96″E)

The archaeological site of Harlaa is located at 1700 m ASL on the edge of the main fault escarpment of the southern

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FIGURE 1 The location of the sites in Ethiopia and the Horn of Africa (prepared by N. Khalaf).

Afar margin underneath the modern Oromo village of Ganda Biyo on the Dire Dawa to Dengego road. The accepted name for the archaeological site is Harlaa which is related to the common appellation 'Harla' given to ruined stone-built towns and funerary monuments in the region, whose origins are ascribed by the Oromo to a legendary ancient people of giant status (Chekroun et al. 2011: 79), and who occupied the region before the Oromo arrived (Joussaume & Joussaume 1972: 22), beginning in the mid-16th century (all dates are AD unless otherwise specified). Harlaa is situated approximately 40 km north-west of Harar and 15 km southeast of Dire Dawa (Fig. 1). Prior to the start of the current investigation of the site, previous research had consisted of limited survey and surface collections (e.g. Patassini 2006). Harlaa is a large urban centre (Fig. 2) covering a maximum area of approximately 500 m east to west by 900 m north to south, excluding outlying cemeteries (Khalaf & Insoll 2019). It is composed of several elements including a central settlement area, workshops, at least three early mosques, wells, lengths of fortification wall, and cemeteries to the north, east, and west.

Since 2015, excavations have been completed in a mosque (Area A), workshop complex (Area B, except labelled A in 2016), cemeteries (Areas C and D), a house with associated industrial/kitchen facility (Area E), and part of an extensive building complex, which included a defensive wall, and what may have been a reception hall (Area F). Faunal assemblages were recovered from areas B, E, and F. The chronology at Harlaa predates both Harar and Ganda Harlaa. Area B has provided the longest

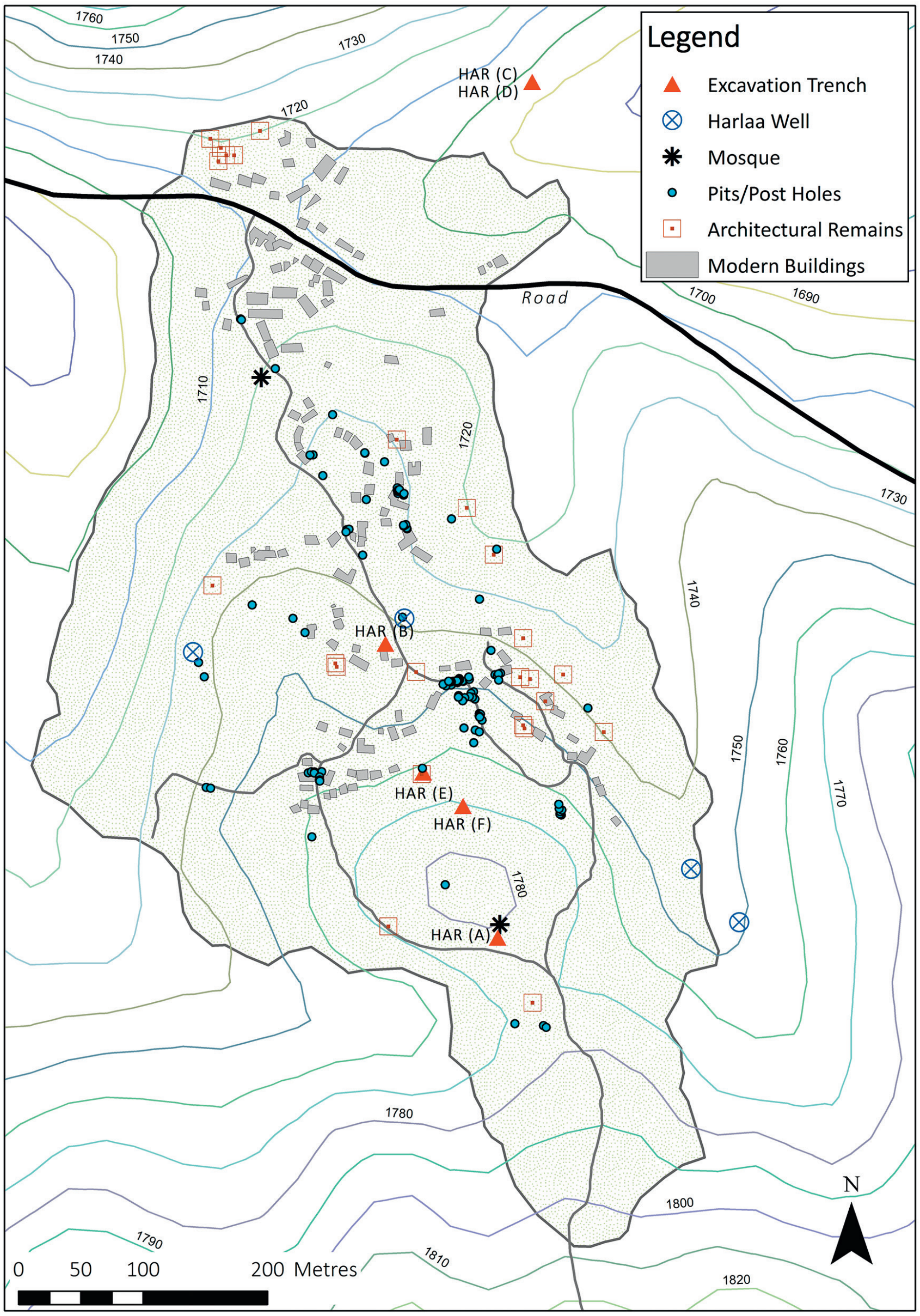

FIGURE 2 The location of the different areas in Harlaa (prepared by N. Khalaf).

chronology with 14 AMS dates obtained spanning the period between the mid-6th and early 15th centuries (Table 1). From these, five phases of occupation and use of the workshop complex can be reconstructed (Table 2). Three AMS dates were obtained from Area E of between the mid-11th and mid-13th centuries, and two AMS dates from area F of between the mid-12th and mid-13th centuries (Table 1).

Significant evidence for manufacturing and participation in international Red Sea and western Indian Ocean trade networks, as well as regionally focused ones, has been recovered from Harlaa. Luxury materials, mostly imported, and to a lesser extent manufacturing debris, were distributed across all three areas. Work on provenancing and identifying these materials is ongoing but the most significant concentrations came from the workshop site (Table 3). Imported ceramics included black-on-yellow and other glazed wares of Yemeni/southern Red Sea provenance, Iranian lustre glazed frit, and Chinese celadon and white wares. AMS dates from the mosque and one single and one double Muslim burial in the cemeteries attest the presence of a Muslim community at Harlaa by the mid-12th century (Insoll in press) (Table 1).

TABLE 1 AMS radiocarbon dates from the Harlaa excavations

Context number	Date and laboratory number
HAR 15 (A) 10	Cal AD 1155-1255 (2 sigma calibration; Beta – 419525)
HAR 15 (B) 6	Cal AD 1155-1260 (2 sigma calibration; Beta – 419526)
HAR 15 (B) 10	Cal AD 1165-1265 (2 sigma calibration; Beta – 419527)
HAR 16 (A) 6	Cal AD 1290 to 1410 (2 sigma calibration; Beta – 451581)
HAR 16 (A) 7	Cal AD 1255 to 1290 (2 sigma calibration; Beta – 451582)
HAR 16 (A) 9	Cal AD 1190 to 1275 (2 sigma calibration; Beta – 451583)
HAR 17 (B) 6 – Hearth	Cal AD 1220 to 1285 (2 sigma calibration; Beta – 461299)
HAR 17 (B) 10	Cal AD 1035 to 1215 (2 sigma calibration; Beta – 461300)
HAR 17 (B) 15	Cal AD 535 to 620 (2 sigma calibration; Beta – 461301)
HAR 17 (B) 24 – Hearth	Cal AD 775 to 975 (2 sigma calibration; Beta – 461302)
HAR 17 (B) 24 – Under Wall	Cal AD 1015 to 1050 and Cal AD 1080 to 1150 (2 sigma calibration; Beta – 461303)
HAR 18 (B) 6	Cal AD 1256 to 1306 (2 sigma calibration; Beta – 490904)
HAR 18 (B) 13	Cal AD 1152 to 1260 (2 sigma calibration; Beta – 490905)
HAR 18 (B) 24	Cal AD 776 to 971 (2 sigma calibration; Beta – 490906)
HAR 18 (B) 26	Cal AD 684 to 780 (2 sigma calibration; Beta – 490907)
HAR 17 (C) Burial 1 – Upper	Cal AD 1330 to 1340 and Cal AD 1395 to 1440 (2 sigma calibration; Beta – 461292)
HAR 17 (C) Burial 2 – Lower	Cal AD 1220 to 1285 (2 sigma calibration; Beta – 461293)
HAR 17 (D) 1	Cal AD 1165 to 1265 (2 sigma calibration; Beta – 461294)
HAR 18 (E) 8	Cal AD 1039 to 1210 (2 sigma calibration; Beta – 490908)
HAR 18 (E) 9	Cal AD 1154 to 1264 (2 sigma calibration; Beta – 490909)
HAR 19 (E) 30	Cal AD 1028 to 1184 (2 sigma calibration; Beta – 522144)
HAR 19 (F) 6	Cal AD 1169 to 1270 (2 sigma calibration; Beta – 522142)
HAR 19 (F) – (Cut Section) Below Plaster Floor (2)	Cal AD 1165 to 1265 (2 sigma calibration; Beta – 522143)

TABLE 2 The occupation phases in Harlaa, Area B

Phase	Date
1	7th to 10th centuries AD
2	11th to mid-13th centuries AD
3	Late 12th to late 13th centuries AD
4	Mid/late 13th to early 14th centuries AD
5	Late 13th to 14th centuries AD

TABLE 3 Distribution of examples of luxury materials from Harlaa (beads can be both locally made and imported, all other materials listed are imported)

Site	Beads	Middle Eastern glazed ceramic sherds	Chinese ceramic sherds	Southeast Asian/ Chinese martaban jar sherds	Glass vessel fragments
HAR (B)	1968	114	88	4	353
HAR (E)	338	27	13	50	207
HAR (F)	151	4	2	0	38

The 2017 to 2019 excavations in Area B recovered 33,184 faunal remains totaling 90,422.5 g, of which 8063 (24.3%, by weight 63323.8g or 70.0%) were identifiable. Of these, 2655 (32.9%, by weight 38599.1 g or 61.0%) were identifiable to genus level. A further 3897 (48.3%, by weight 20070.6 g or 31.7%) fragments were identifiable to family level and an additional 1450 (17.9%, by weight 4625.0 g or 7.3%) identifiable only to element. The 2018 and 2019 excavations of Area E recovered 13,155 faunal remains totaling 23060.6 g. Of these, 612 were identifiable to genus level (4.6%, by weight 7369.4 g or 31.9%), 1079 identifiable to family level (8.2%, by weight 4956.6 g or 21.5%) and 399 (3.0%, by weight 895.5 g or 3.9%) to element and animal size class. The 2019 excavations in Area F recovered 1847 fragments totaling 2533.0 g. From this sample 93 fragments were identifiable to genus level (5.0%, by weight 952.7 g or 37.6%), 125 (6.8%, by weight 425.4 g or 16.8%) were identifiable to family level and 49 (2.6%, by weight 74.8 g or 3.0%) were identifiable only to element and animal size class.

Unidentifiable material from these excavations included small fragments of cranium or long bone shaft which could not be further identified to element. In comparison to the identifiable elements, the 25,121 unidentifiable fragments from Area B averaged 1.08 g (compared with

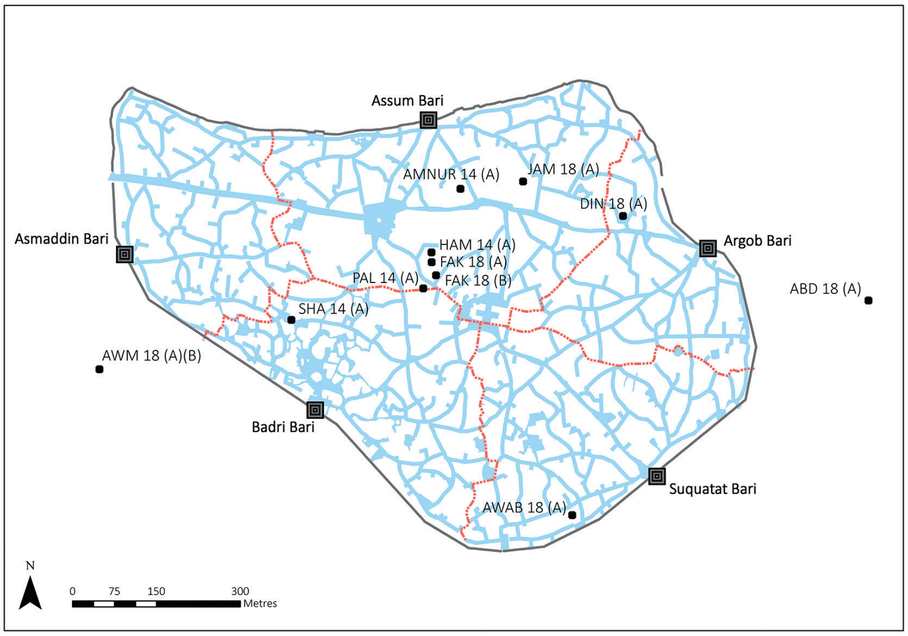

FIGURE 3 The location of the excavations in Harar (prepared by N. Khalaf).

7.85 g for identifiable material), the 11,037 unidentifiable fragments from Area E averaged 0.89 g (compared with 6.34 g for identifiable fragments) and the 1580 unidentifiable fragments from Area F averaged 0.68g (compared with 5.44g for identifiable remains). In the majority, these comprised fragments of appendicular cortical bone (shaft fragments), although the remainder of the skeleton (fragments from the cranium and axial portions) were also well represented. Discussions of fragments identifiable to the level of element, family and genus are hereafter discussed in NISP (Number of Identified Specimens) unless otherwise stated. Further detail as to the distribution of unidentifiable fragments by fragment type and animal size class is available in the Supplementary Table S1.

Harar (*9°18′33.21″N, 42°8′15.84″E*)

Harar is also situated in the Somali Plateau, at 1900 m ASL, but in a more heavily vegetated landscape (Khalaf & Insoll 2019). At the core of Harar is a historic city, surrounded by a wall, the *djugel*. This is built of locally quarried calcareous tuff (Hashi stone) mortared with mud and wooden reinforcements (Ahmed 1990: 321). It encompasses an area of c. 1000 × 800 m and is accessed by five gates, with corresponding quarters (Horton 1994: 195). The walled city contains within it approximately 2000 houses, 82 mosques, and numerous saints' tombs and shrines (CIRPS & Harari People National Regional State 2003), the result of important urban development over many centuries (Insoll 2017).

Excavations at nine locations in and immediately adjacent to the walled city (five mosques, one shrine, two settlement areas, one blacksmithing location) (Fig. 3), have provided eight AMS radiocarbon dates of between the 15th and 19th/early 20th centuries (cf. Insoll 2017; Insoll and Zekaria 2019). The excavations indicate that occupation in Harar post-dates the late 15th century, and until evidence to the contrary is found, it is suggested that the city and its mosques date from this era and were linked with the establishment of Harar as the capital of the Sultanate of Adal (c. 1415 to 1577) (Insoll 2017; Insoll and Zekaria 2019). Prior to this the Harari, likely in the form of the 'Harla', were elsewhere, possibly at Harlaa or one or more of the largely uninvestigated abandoned stone town sites, such as Ganda Harla, that are found across the eastern Harar Plateau and the Chercher Mountains (cf. Insoll 2017: 209-210). Although Harar functioned as a trade centre that connected the eastern Ethiopian highlands, arid lowlands, and the Gulf of Aden, the situation was very different to Harlaa as few luxury materials have been recovered. These comprise four glazed ceramic sherds of probable Middle Eastern Origin, one sherd of Chinese blue and white ware of 18th or 19th century date and a single fragment from a green glass bottle or flask neck (Insoll 2017: 207; Insoll and Zekaria 2019).

For the purposes of this discussion, the faunal remains from all the units in Harar are combined rather than presented as separate assemblages. This does not bias the analysis as there were no meaningful disparities in the quantities found or species present. The excavations at Harar recovered 887 bone fragments totaling 4974.8g. Of these, 173 (19.5%, by weight 1859.3 g or 37.4%) were identifiable to genus level, 142 (16.0%, by weight 1326.4 g or

26.7%) were identifiable to family level, and 60 (6.8%, by weight 472.4 g or 9.5%) only to element and animal body size class.

Ganda Harla (*9°25′81.5″N, 42°14′35.3″E*)

This abandoned settlement is located 12.5 km southeast of Harar on a hill west of the village of Sofi. It is also linked with the Harla in local tradition (Tesfaye et al. 2013: 3). Numerous structures and enclosures built of dry stone were recorded on the upper part of the site and delimited to their north by a large defensive wall, also built of dry stone, running down the hill. A test excavation of 120 × 220 cm was completed inside one of these buildings which provided a radiocarbon date of cal AD 1466 to 1645 (2 sigma calibration; GX-33811). The function of the building, whether military, civic, storeroom, or residential, was unclear, but fragments of plaster and worked masonry suggested it had been of some importance (Insoll et al. 2014: 103-104). Unfortunately, the security situation has precluded further work, but based on the C14 date it is suggested that Ganda Harla was founded at or just prior to the establishment of Harar as part of an expansion of settlement accompanying increased Islamisation.

The excavations at Ganda Harla recovered 141 fragments totaling 2191.3 g. Of these, 61 (43.4%, by weight 1269.1 g or 57.9%) were identifiable to genus level, 43 (30.5%, by weight 720.4 g or 32.9%) were identifiable to the level of family and 2 (1.4%, by weight 39.6 g or 1.8%) identifiable only to element and animal body size class. As at Harar, unidentifiable fragments comprised predominately small fragments of cortical bone but represented fragments from across the animal skeleton. These were also somewhat larger compared with those from Harlaa, averaging 2.4g/5.8 g compared with 9.7g/18.7 g for identifiable material from Harar and Ganda Harla.

Taxonomic Distributions

Identified faunal remains were categorised according to genus and species, where possible. Where specific taxonomic identification was not possible, elements were classified according to the most precise possible broader taxonomic category, such as small bovid, bird (aves), small carnivore, or medium mammal. Taxonomic identifications were made using Boessneck et al. (1963), Olsen (1960), Walker (1986), Zeder & Lapham (2010), and Zeder & Pilaar (2010) as well as a digital reference collection. Each element was identified either to taxon or taxonomic category with further information recorded as to element side, percentage of completeness, age or sex information where present, breakage patterns, burning, weathering, gnawing, butchery evidence (such as cutmarks), and other taphonomic information. Identified elements are given here as NISP (Number of Identified Specimens). Comparisons of the representation of elements for the most common mammals in each faunal sample indicates no significant differences in the representation of bodily portions either through time or between the sites (see Supplementary Table S1). In all cases, the distribution of elements suggests the presence of animals as complete carcasses.

The majority of fauna from all three sites come from domestic taxa (Table 4). For those remains which could be identified to genus level, domesticates represent between 59-100% of NISP with the majority of samples containing c. 60-77% domestic fauna (Table 5). At Harlaa, the most common domesticate is the goat (*Capra hircus*) at c. 35-40% whereas at Harar and Ganda Harla it is cattle (*Bos taurus/indicus*) at 45-64% (Tables 4 and 5). The sole exception is the very small sample from Phase 1 of Area B at Harlaa, where the camel is the most common domesticate (26.3%). The second most common domesticate is either cattle (Harlaa) or goat (Harar and Ganda Harla). Sheep at Harlaa (excepting the small sample from Phase 1) are the third most common domesticate followed by transport animals. This situation is reversed at Harar and Ganda Harlaa where transport livestock (camel, donkey and horse) combined are more common than either sheep or goats (Tables 5 and 6). The representation of transport animals in different areas of Harlaa is uneven, with an overall decline in Area B through time and a greatly reduced representation in Areas E and F (6.3% and 7.5%) compared with the contemporaneous Phase 2 sample from Area B (14.9%). Transport animals across all contexts are dominated by equids (donkey and horse), with the decrease in transport animals in Area B largely due to the decreasing presence of camels in later phases (Table 6).

Remains of domestic chicken (*Gallus gallus domesticus*) were recovered from Harlaa and Harar but are absent from Ganda Harla (as are all bird bones). These are systematically present across all contexts at Harlaa except the small sample from phase 1, Area B, and their representation is fairly consistent at c. 3-7% at Harlaa and 2.3% at Harar. Males appear to be infrequent as adults but are represented as subadult individuals, suggesting that extraneous roosters were culled prior to adulthood. Domestic guinea fowl (*Numida meleagris*) is present only at Harlaa, and is seen only in Areas E and F and phases 2 and 3 of Area B. It appears that guinea fowl were not kept in later periods.

The divergence in consumption of small vs. large domestic bovids between Harlaa and Harar/Ganda Harla

TABLE 4 Identified fauna from Harlaa, Harar and Ganda Harla. Animal size classes follow Brain (1974) with small mammals (including small canid, small carnivore and small primate) equivalent to animal size class 1 (0-23 kg), small wild bovid, small bovid and medium mammal equivalent to animal size class 2 (23-84 kg) and large wild bovid, large bovid and large mammal equivalent to animal size class 3 (84-296 kg). No remains were recovered from animal size classes 4 (296-900 kg) or 5 (over 900 kg)

	Harlaa B										Harlaa E		Harlaa F		Harar		Ganda Harla	
	Phase 1		Phase 2		Phase 3		Phase 4		Phase 5									
Taxon	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
Bos taurus/ indicus	3	6.3%	205	17.7%	9	12.0%	36	13.8%	100	20.4%	140	18.8%	23	21.3%	40	30.3%	23	37.7%
Ovis aries	2	4.2%	121	10.5%	10	13.3%	33	12.6%	68	13.9%	82	11.0%	11	10.2%	8	6.1%	1	1.6%
Capra hircus	3	6.3%	346	29.9%	18	24.0%	92	35.2%	141	28.8%	174	23.4%	31	28.7%	16	12.1%	7	11.5%
Camellus	5	10.4%	60	5.2%	1	1.3%	7	2.7%	4	0.8%	-		-		3	2.3%	-	
Equus asinus	3	6.3%	19	1.6%	1	1.3%	8	3.1%	9	1.8%	15	2.0%	1	0.9%	7	5.3%	2	3.3%
Equus caballus	2	4.2%	24	2.1%	-		3	1.1%	8	1.6%	6	0.8%	2	1.9%	6	4.5%	3	4.9%
Equus sp.	1	2.1%	23	2.0%	2	2.7%	10	3.8%	19	3.9%	11	1.5%	3	2.8%	4	3.0%	-	
Canis familiaris	-	-	3	0.3%	1	1.3%	1	0.4%	-		3	0.4%	1	0.9%	-		-	
Felis catus	-	-	3	0.3%	-		1	0.4%	3	0.6%	4	0.5%	-		1	0.8%	-	
Kobus sp.	-	-	3	0.3%	-		1	0.4 %	1	0.2%	5	0.7%	2	1.9%	2	1.5%	1	1.6%
Oryx sp.	-	-	8	0.4%	1		2		5	0.2%	2	0.3%	2	1.9%	6	4.5%	2	3.3%
Tragelaphus sp.	-	-	9	0.8%	1	1.3%	2	0.8%	5	1.2%	18	2.4%	1	0.9%	5	3.8%	7	10.4%
large wild bovid	-	-	16	1.4%	4	5.3%	4	1.5%	13	2.7%	-		-		2	1.5%	-	
Litocranius sp.	-	-	5	0.4%	-		4	1.5%	2	0.4%	-		-		1	0.8%	-	
Redunca sp.	-	-	21	1.8%	3	4.0%	2	0.8%	7	1.4%	13	1.7%	1	0.9%	2	1.5%	-	
Nanger sp.	-	-	17	1.5%	2	2.7%	5	1.9%	3	0.6%	7	0.9%	1	0.9%	-		-	
Sylvicapra sp.	-	-	-		1	1.3%	-		-		-		-		-		-	
Dorcatragus sp.	-	-	23	2.0%	1	1.3%	5	1.9%	11	2.2%	9	1.2%	1	0.9%	1	0.8%	-	
Gazella sp.	-	-	10	0.9%	1	1.3%	2	0.8%	3	0.6%	2	0.3%	-		2	1.5%	1	1.6%
Ourebi sp.	-	-	3	0.3%	-		1	0.4%	2	0.4%	2	0.3%	1	0.9%	2	1.5%	1	1.6%
Madoqua sp.	-	-	2	0.2%	-		-		3	0.6%	2	0.3%	3	2.8%	-		-	
Oreotragus sp.	-	-	1	0.1%	-		-		-		-		-		-		-	
small wild bovid	-	-	43	3.7%	8	10.7%	9	3.4%	12	2.4%	38	5.1%	3	2.8%	3	2.3%	-	
Potamochoerus sp.	-	-	3	0.3%	-		-		1	0.2%	1	0.1%	-		-		1	1.6%
Phacochoerus sp.	-	-	2	0.2%	-		1	0.4%	-		-		-		-		-	
Suid indet.	-	-	3	0.3%	-		1	0.4%	-		3	0.4%	-		-		1	1.6%
Orycteropus sp.	-	-	3	0.3%	-		-		-		-		-		-		-	
Histrix sp.	-	-	-	-	-		1	0.4%	-		-		-		-		-	
Lepus sp.	-	-	1	0.1%	-		1	0.4%	-		-		-		-		-	
Genetta sp.	-	-	1	0.1%	-		-		-		1	0.1%	-		-		-	
Mungos sp.	-	-	-	-	-		-		-		1	0.1%	-		-		-	
Pantera pardus	-	-	-	-	-		-		-		-		-		2	1.5%	-	
small canid	-	-	2	0.2%	-		-		1	0.2%	1	0.1%	-		-		-	
small carnivore	-	-	14	1.2%	1	1.3%	6	2.3%	4	0.8%	10	1.3%	-		1	0.8%	-	
small primate	-	-	1	0.1%	-		-		-		-		-		-		-	
small bovid	17		1090		60		290		442		734		81		43		9	
large bovid	9		311		15		57		153		293		36		99		34	
small mammal	-	-	8		-	-	1		1		6		-	-	-	-	-	-
medium mammal	1		286		11		68		125		189		28		6		2	
large mammal	2		159		8		27		74		92		11		49			
Pisces indet.	-	-	4	0.3%	-	-	3	0.4%	-	-	8		-	-	-	-	-	-
Mugilidae	-	-	19	1.6%	2	1.1%	10	1.4%	5	0.04%	3		1		-	-	-	-
Scombridae	-	-	2	0.2%	3	1.7%	-	-	1	0.01%	2		2		-	-	-	-

TABLE 4 Identified fauna from Harlaa, Harar and Ganda Harla (*cont.*)

	Harlaa B										Harlaa E		Harlaa F		Harar		Ganda Harla	
	Phase 1		Phase 2		Phase 3		Phase 4		Phase 5									
Taxon	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
Pleuronectiform	-	-	-	-	-	-	1	0.1%	-	-	-	-	-	-	-	-	-	-
Aves indet.	-	-	86	7.4%	11	2.7%	43	5.4%	47	7.3%	103	13.8%	10	9.3%	5	3.8%	-	-
Anatidae	-	-	2	0.2%	-	-	-	-	-	-	1	0.1%	-	-	-	-	-	-
Columbidae	-	-	-	-	-	-	1	0.4%	-	-	1	0.1%	1	0.9%	-	-	-	-
Gallform	-	-	8	0.7%	3	0.4%	-	-	3	0.6%	10	1.3%	2	1.9%	-	-	-	-
Anseriform	-	-	-	-	-	-	-	-	1	0.2%	2	0.3%	-	-	-	-	-	-
Passerine	-	-	-	-	-	-	-	-	-	-	-	-	1	0.9%	-	-	-	-
Gallus gallus domesticus	-	-	39	3.4%	20	4.0%	68	3.1%	43	4.5%	51	6.8%	5	4.6%	3	2.3%	-	-
Numida meleagris	-	-	4	0.3%	1	1.3%	-	-	-	-	14	1.9%	1	0.9%	-	-	-	-
Eggshell (c.f. Struthionidae)	-	-	2		-	-	-	-	-	-	3		1		1		-	-
Rodentia	-	-	3		-	-	14		23		22		5		1		-	-
Testudine	-	-	1	0.1%	-	-	-	-	-	-	-	-	-	-	1	0.8%	-	-
Stigmochelys	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	6.8%	11	18%
Total	48		3014		172		727		1307		2084		270		330		106	

TABLE 5 Proportional representation of domestic taxa from Harlaa, Harar and Ganda Harla. Given here are both the counts (N) and percentage (%) of NISP for each domesticate

Taxon	**Harlaa B**										**Harlaa E**		**Harlaa F**		**Harar**		**Ganda Harla**	
	Phase 1		**Phase 2**		**Phase 3**		**Phase 4**		**Phase 5**									
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Cattle	3	15.8%	205	24.0%	9	18.4%	36	18.1%	100	28.4%	140	27.5%	23	28.8%	40	45.5%	23	63.9%
Sheep + goat	5	26.3%	467	54.7%	28	57.1%	125	62.8%	209	55.4%	256	50.2%	42	52.6%	24	27.3%	8	22.2%
[of which sheep]	[2]	[40%]	[121]	[25.9%]	[10]	[35.7%]	[33]	[26.4%]	[68]	[32.5%]	[82]	[32%]	[11]	[26.2%]	[8]	[33.3%]	[1]	[12.5%]
[of which goat]	[3]	[60%]	[346]	[74.1%]	[18]	[64.3%]	[92]	[73.6%]	[141]	[67.5%]	[174]	[68%]	[31]	[73.8%]	[16]	[66.7%]	[7]	[87.5%]
Horse + donkey	6	31.6%	66	7.7%	3	6.1%	21	10.5%	36	9.5%	32	6.5%	6	7.6%	17	19.3%	5	13.9%
[of which horse]	[2]	[40%]	[24]	[55.8%]			[3]	[72.7%]	[8]	[53%]	[6]	[71.4%]	[2]	[66.7%]	[6]	[46.2%]	[3]	[60%]
[of which donkey]	[3]	[60%]	[19]	[44.2%]	[1]	[100%]	[8]	[27.3%]	[9]	[47%]	[15]	[28.6%]	[1]	[33.3%]	[7]	[53.8%]	[2]	[40%]
Camel	5	26.3%	60	7.0%	1	2.0%	7	3.5%	4	1.1%					3	34%		
Dog			3	0.4%			1	0.5%			3	0.6%	1	1.3%				
Cat			3	0.4%			1	0.5%	3	0.8%	4	0.8%			1	1.1%		
Domestic fowl			43	6.0%	21	14.2%	68	5.8%	43	6.6%	65	14.7%	6	10.1%	3	3.4%		
[of which chicken]			[39]	[90.7%]	[20]	[95.2%]	[68]	[100%]	[43]	[100%]	[51]	[78.5%]	[5]	[83.3%]	[3]	[100%]		
[of which guinea fowl]			[4]	[9.3%]	[1]	[4.8%]					[14]	[21.5%]	[1]	[16.7%]				

TABLE 6 Additional comparisons of taxa between Harlaa, Harar and Ganda Harla. In this table, domesticates includes both domestic mammals as well as birds. The category 'pack animals' includes both domestic equids as well as camels

Taxon	Harlaa B										Harlaa E		Harlaa F		Harar		Ganda Harla	
	Phase 1		Phase 2		Phase 3		Phase 4		Phase 5									
Domesticates	48	100%	847	73.9%	63	65.3%	259	76.2%	395	76.9%	500	68.5%	78	74.1%	89	66.7%	36	59.0%
Pack animals (all)	11	57.9%	126	14.7%	4	8.2%	28	14.1%	40	10.6%	32	6.3%	6	7.5%	20	22.7%	5	13.9%
Suids (all)	-		8	0.8%	-		2	0.8%	1	0.2%	4	0.5%	-		-		2	3.2%
Small bovid (all)	22	65.4%	1682	77.8%	104	80%	432	83.6%	694	71.5%	1063	69.8%	133	69.2%	78	33.6%	19	31.1%
Large bovid (all)	12	34.6%	552	22.2%	30	20%	102	16.4%	277	28.5%	458	30.2%	64	30.8%	154	66.4%	42	68.9%
Small bovid (genus)	5	62.5%	549	70.9%	36	75.9%	133	77%	240	67.8%	291	69%	42	65%	32	40%	10	23.2%
Large bovid (genus)	3	37.5%	225	29.1%	11	24.1%	41	23%	111	32.2%	165	31%	28	35%	53	60%	33	76.8%

changes when the representation of wild taxa is compared. Both Harar and Ganda Harla show a bias towards the hunting of small bovids in common with samples from Harlaa (Table 4). Where these sites differ is in access to imported animal products, predominately fish, which are absent from both Harar and Ganda Harla, and in the hunting of tortoises which are very rare at Harlaa but frequent at both Harar and Ganda Harla. A second common feature between the hunted fauna of these sites is the representation of suids. While there is no conclusive evidence for the keeping of domestic pigs, both Ganda Harla and Harlaa yielded suid remains. Those which can be identified to genus come from either warthog (*Phacochoerus sp.*) or bushpig (*Potamochoerus sp.*) and show no clear chronological trend in their consumption.

Wild animals recovered from Harlaa indicate the presence around the site of a fairly open and dry landscape. The most commonly hunted large bovids recovered from Harlaa, Harar and Ganda Harla all favour open terrain and scrub hillsides with the exception of *Kobus kob/ellipsiprymnus* which are more commonly found at lower elevations such as in valleys and riverine grasslands (Bekele & Yalden 2013). The hunted small bovids from all three sites favour drier open terrain with a combination of scrub environments, hillsides and grasslands. The non-bovid hunted animals (warthog, bushpig, aardvark, porcupine, hare, gennet, mongoose and leopard) range in habitat from open to scrub habitats. In general, none of the wild taxa recovered from these sites indicates the need for long-distance hunting trips as all share a common overlap in habitats of open and fairly dry grassland or hillsides.

Fish bones recovered from Harlaa (see Table 4) indicate exclusively the presence of oceanic/Red Sea/Gulf of Aden fish on the basis of those elements which could be identified to family or genus. Given the inland location of Harlaa, the fish remains recovered most likely arrived in the form of preserved fish (i.e. salted or dried). Fish remains from phases 1-4 of Area B contain entirely post-cranial elements with cranial elements appearing only in phase 5 from this area. Fish remains from Areas E and F likewise contain only post-cranial elements. The appearance of some cranial elements in phase 5 of Area B may indicate a change in the preservation techniques of fish imported to Harlaa.

Herd Management Strategies

The age structure of domestic stock was calculated through assessments of both epiphyseal (post-cranial) fusion as well as from patterns of tooth eruption and wear. The numbers of neonatal (0-2 months) and infant/juvenile (under c. 6-9 months) elements were recorded for each taxon as well as the numbers of fused and unfused proximal and distal epiphyses of each element recovered from Harlaa, Harar, and Ganda Harla. Elements with multiple fusion centres (e.g. radius) were in the main recovered only as incomplete bone fragments. For those elements where a complete unfused diaphysis was recovered, only the earlier-fusing epiphysis was recorded as providing the minimum age for the individual (Jones & Sadler2012a, b; Pummel 1987a, b; Zeder 2006).

From both a bulk assessment of fusion and age group survivorship it is apparent that in all contexts the majority of cattle survived into adulthood (c. 80-100%) (Fig. 4; Supplementary Tables S1 to S7). No remains were recovered from neonatal or infant cattle and only a very small proportion were culled as juveniles (c. 0-5%). This pattern

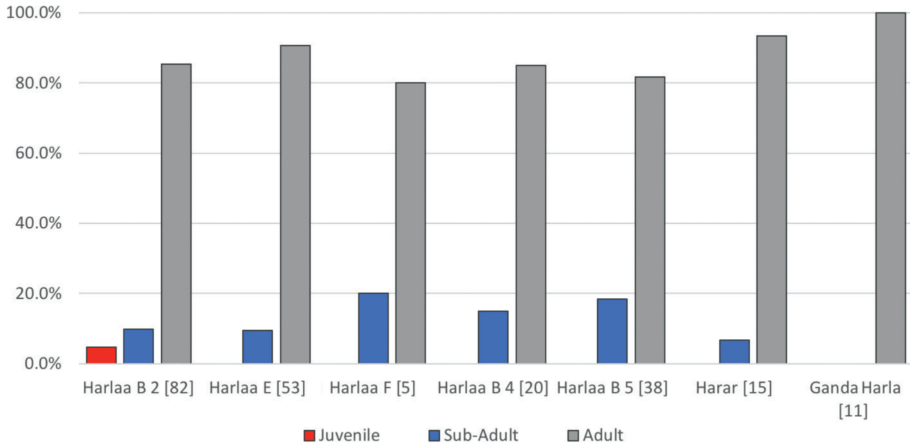

FIGURE 4 Age groups of cattle based on post-cranial fusion data. The NISP of ageable elements for cattle in each sample is given in brackets.

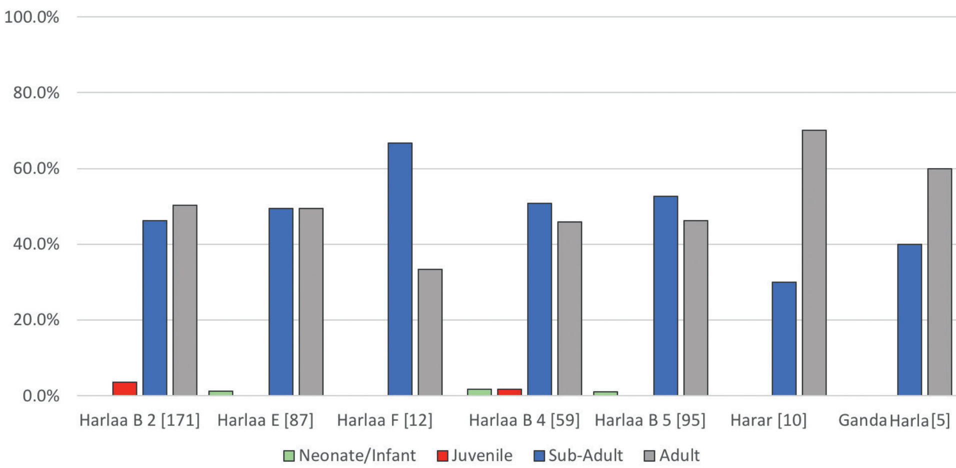

FIGURE 5 Age groups of goats based on post-cranial fusion data. The NISP of ageable goat remains in each sample is given in brackets.

of high adult survivorship suggests that cattle at all three sites were either kept as animals of labour, status, or other secondary products.

Age data on the basis of epiphyseal fusion indicates a different pattern in the management of goats (*Capra hircus*). Whereas cattle across all three sites and their phases were predominately retained into adulthood, a significant proportion of goats were slaughtered as sub-adults (Fig. 5; Supplementary Tables S8 to S14). These data indicate a strong bias in the management of goats for their meat, in particular at Harlaa. This can be seen in the high number of sub-adult animal remains, particularly between 18 months and three years of age. At Harlaa c. 50% of goats were slaughtered prior to three years of age, with c. 15-30% slaughtered specifically within this 1.5-3 year age window. By contrast, fewer goats from Harar and Ganda Harlaa were slaughtered as subadults with c. 60-70% of animals surviving into adulthood. While fewer ageable remains were recovered from these sites compared with Harlaa, those present are sufficient to indicate a more cautious management profile with a greater interest in the perpetuation or increase of livestock numbers.

Too few remains of sheep were recovered from Harar or Ganda Harla to conduct a robust assessment of age. The distribution of sheep from Harlaa by age category (Fig. 6) demonstrates a greater focus in earlier contexts (Phase 2, Area B, Area E and Area F) on the retention of adult animals, while those sub-adult animals that were slaughtered were also kept until very late in their subadult development (Supplementary Tables S15 to S19). In samples from later phases (Phases 4 and 5 of Area B), by contrast, the management of sheep indicates a less cautious management with a greater focus on meat production. In these samples, c. 54-58% of sheep survive into adulthood with a slaughter profile more consistent with that seen from goats at Harlaa than for sheep from earlier contexts.

In comparison with survivorship profiles derived from fusion of post-cranial remains, age profiles were also

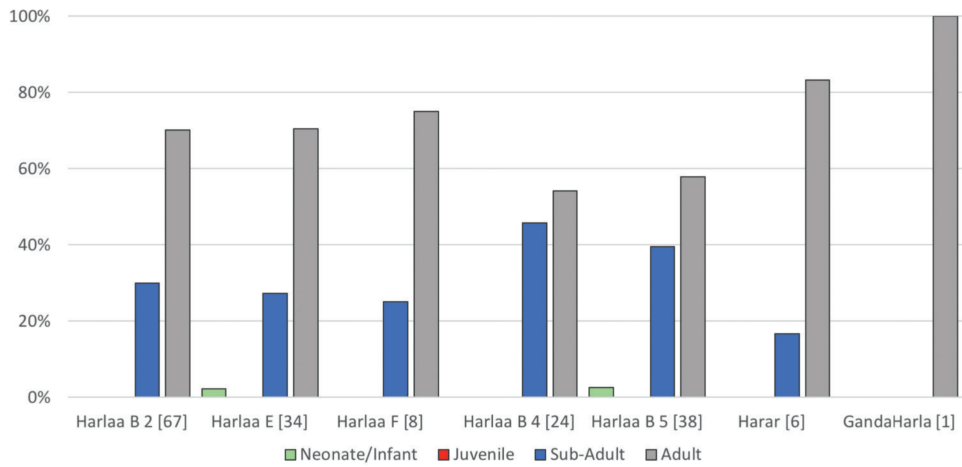

FIGURE 6 Age groups of sheep based on post-cranial fusion data. The NISP of ageable sheep remains in each sample is given in brackets.

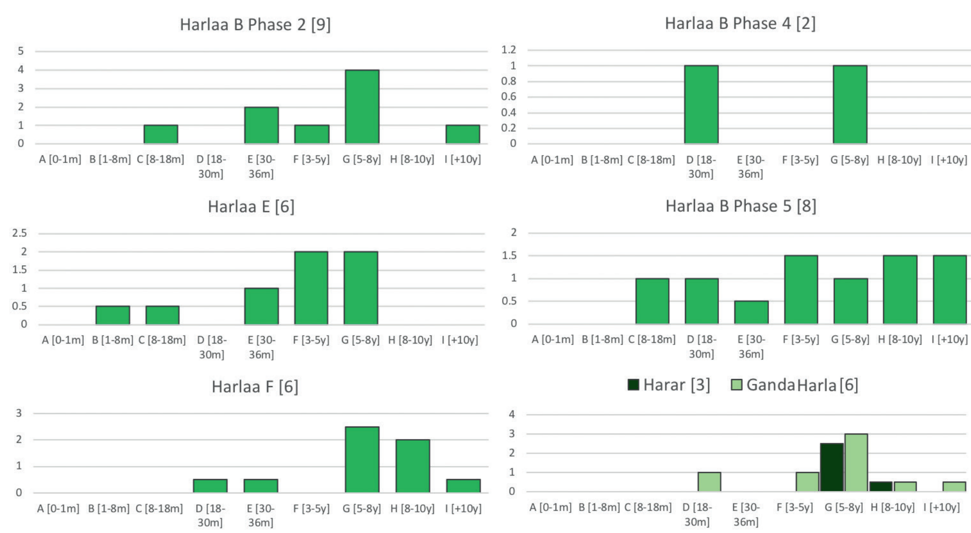

FIGURE 7 Age distribution of cattle on the basis of dental eruption and wear. Teeth have been grouped into age brackets following Halstead (1985). The NISP of ageable remains from each sample is given in brackets.

compiled for cattle, goats and sheep from Harlaa, Harar and Ganda Harla on the basis of dental eruption and wear. Age estimates from tooth wear were made using a variation of the quadratic crown height method (QCHM) modified for bovids by Gaastra (2016) as well as visual tooth-wear ageing (Grant 1982). This form of age profile provides a much narrower estimate of age-at-death for individuals in comparison to post-cranial fusion, as it determines age to within a few months. In keeping with standard practice, teeth have been placed into age groups following Payne (1973) and Halstead (1985).

Comparison of cattle survivorship on the basis of dental eruption and wear (Fig. 7) demonstrates a slightly higher culling of sub-adult animals than was indicated by post-cranial fusion. While survivorship on the basis of fusion indicated c. 80-90% of cattle from Harlaa surviving beyond 40 months of age, from dental survivorship this is reduced to 50-83%. Most interestingly, dental survivorship indicates the slaughter of c. 11-17% (vs. 4.8% post-cranial representation of this age group from Harlaa Area B, Phase 2 and absent in all other samples) of cattle within the first year of life from two early contexts at Harlaa (Area B, Phase 2 and Area E). These young animals are not found at Harlaa from the contemporaneous Area F sample, which shows a bias towards the retention of cattle beyond age three (83% compared with 66.6% from both Area B, phase 2 and Area E) compared with any other sample from Harlaa.

Age profile information obtained from dental eruption and wear for goats corresponds well with that seen from post-cranial fusion, while providing additional detail (Fig. 8). The bias towards the slaughter of sub-adult

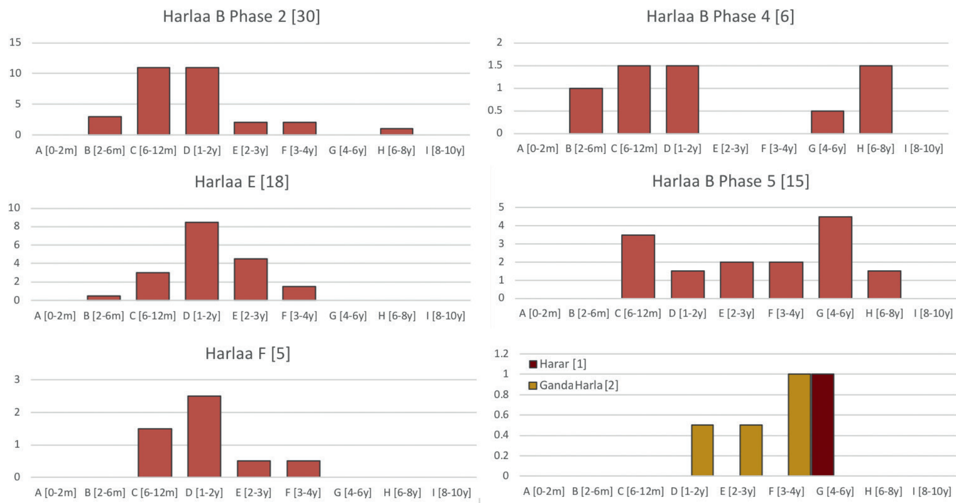

FIGURE 8 Age distribution of goats on the basis of dental eruption and wear. Teeth have been grouped into age brackets following Payne (1973). The NISP of ageable remains from each sample is given in brackets.

animals seen from post-cranial fusion data is also apparent in data from dental eruption and wear, but also indicates that this bias is stronger than was apparent from post-cranial fusion data, with only c. 10-30% of animals surviving into adulthood at Harlaa compared with c. 50-100% from Harar and Ganda Harla. While not discernible from post-cranial fusion data, it can be seen from dental age data that there is a chronological difference in the exploitation of goats at Harlaa. Circa 30-50% of goats from Phases 4 and 5, Area B can be seen to survive into adulthood, but the adult proportion from earlier contexts at Harlaa (Area B, Phase 2, Area E and Area F) is less than 10% with only 3% surviving beyond four years of age in phase 2, Area B, and no animals above four years of age in the other two early samples. This suggests strongly that, while a proportion of goats at Harlaa survived into adulthood (up to c. 40 months), very few individuals survived long after this point. Too few mandibles and teeth from sheep were recovered from Harlaa (and none from either Harar or Ganda Harla) to allow for further information on the management of this taxon to be gleaned from analysis of dental eruption and wear.

Sex Proportions of Domesticates

No sexable pelvic elements of cattle were recovered from either Harar or Ganda Harla (Table 7), and those from Harlaa all come from adult animals (Grigson 1982). With the exception of Phase 2, Area B, male and female animals are equally represented amongst those animals which can be sexed. As with cattle, no sexable pelvic elements of goats were recovered from Harar or Ganda Harla. At Harlaa, both sub-adult (by fusion status and muscle attachment development) and adult pelvic elements were recovered which could be sexed. In all phases and areas of Harlaa, all recovered female pelvic elements came from young adult or adult animals. Pelvic bones from male goats came from both subadult and adult animals, though in the majority these come from subadult animals. These data, taken together with that from both dental and post-cranial age distributions, suggests that extraneous male animals at Harlaa were preferentially culled as subadults with female animals left to survive to a slightly greater age. This is consistent with the age data indications of the management of goats for meat production.

TABLE 7 Sex proportions of cattle (*Bos taurus/indicus*) and goat (*Capra hircus*) pelvic girdles for subadult (SA) and adult (A) animals

Sex	Harlaa B 2		Harlaa E		Harlaa B 4		Harlaa B 5		Harlaa F		Harar		Ganda Harla	
	SA	A	SA	A	SA	A	SA	A	SA	A	SA	A	SA	A
Bos taurus/indicus														
Male				1		1				1				
Female		5		1		1				1				
Capra hircus														
Male	14	3	5	7	4	1	3	1	1					
Female		13		1		3		6		1				

FIGURE 9 Examples of sub-pathological changes to cattle foot bones from Harlaa: (A) phalanx 1 from Area B, phase 5; (B) phalanx 2 from Area E; and (C) distal metatarsal from Area F. Shown here are examples from Harlaa 2018 B(3) [top left], Harlaa 2019 E(25) [right].

Pathological Bone Modifications

Muscle attachment development, pathological alterations, and sub-pathological re-modelling were all recorded. Muscle attachment development could be determined for 13% of identified elements and was graded from light (indicative of subadult individuals) to heavy (indicative of adult or older adult individuals) on a scale of one to five. Pathological alterations to bones were infrequent (2 bones or 0.02% of NISP). The distribution of sub-pathological developments for metacarpals, metatarsals, first phalanges and second phalanges in response to the strain of pulling, or changes to foot bones in response to traction (Fig. 9) were scored following the criteria of the pathological index (PI) as detailed by Bartosiewicz et al. (1997; Bartosieicz 2008). Measurements of the distal ends of metacarpals and metatarsals were also taken where possible.

Foot bones which produced a positive PI score for traction (2.5 or greater) were infrequent (Table 8 and 9). While the diagnostic foot bones for traction identification were present at both Harar and Ganda Harla, none scored a PI greater than 2.0 and no measurable distal metapodials were recovered from either site. There were no indications of the use of cattle for traction. At Harlaa, samples from Area B (phases 2, 4 and 5) and from Areas E and F all indicate the presence of cattle used for traction (Table 8). However, the presence of these sub-pathological alterations does not permit distinguishing between the potential forms of traction which may have been in use. In general, the repeated practice of pulling excess weight behind the animal can be said to have caused the foot bone alterations present, and may have taken one or more forms, including pulling of carts, or ards or ploughs, or the circular pulling motion to rotate the stone for a stationary grinding apparatus.

Butchery

Cut marks are relatively infrequent at Harlaa (311 elements, or 3.9%) at Harar (11 elements, 3.3%), and Ganda Harla (1 element, 0.9%). The scarcity of butchery marks is unsurprising, as with the exception of butchery using heavy knives to sever and portion bones, cut marks produced during the processing of carcasses are generally infrequent as the aim of the butcher is to avoid direct contact with bones which will dull butchery tools (Seetah 2007). Therefore, the majority of butchery marks can be considered as 'accidental' indicators of the process of carcass skinning, disarticulation and defleshing. These marks relate to three stages in the processing of carcasses. The first stage is skinning and evisceration, in which the skin and internal organs of the animal are removed

TABLE 8 Distribution of PI values from cattle foot bones

Anterior limb						Posterior limb					
PI Value	1	1.5	2	2.5	3	PI Value	1	1.5	2	2.5	3
Area B Phase 1	1	-	-	-	-	Area B Phase 1	-	-	1	-	-
Area B Phase 2	9	1	3	2	1	Area B Phase 2	8	1	5	1	2
Area E	3	1	1	1	-	Area E	6	-	4	3	2
Area F	-	-	-	-	-	Area F	-	-	-	-	1
Area B Phase 3	1	-	-	-	-	Area B Phase 3	-	-	-	-	-
Area B Phase 4	1	2	2	-	-	Area B Phase 4	1	-	-	1	-
Area B Phase 5	3	1	1	2	-	Area B Phase 5	2	-	3	-	-
Harar	2	1	-	-	-	Harar	2	2	1	-	-
Ganda Harla	1	-	-	-	-	Ganda Harla	1	-	-	-	-

TABLE 9 Osteometric data for distal metapodials recovered from Harlaa. Those metapodials which demonstrated a positive traction index (e/D1) following Lin et al. (2016) are given in bold. The measurement (mm) of the distal breadth of the metapodial following von den Driesch (1976) is given here in as it has been used to determine the probable sex of the animal

Anterior limb: Metacarpal				**Posterior limb: Metatarsal**			
Area	**Distal breadth (Bd)**	**Sex**	**e/D1**	**Area**	**Distal breadth (Bd)**	**Sex**	**e/D1**
Area B Phase 2	51.5	F	0.637	Area B Phase 2	51.9	F	0.760
Area B Phase 2	50.4	F	0.636	Area B Phase 2	55.0	M	0.709
Area B Phase 2	56.3	M	0.611	Area B Phase 2	53.2	?	0.706
Area B Phase 2	56.8	M	0.717	Area B Phase 2	48.9	F	0.648
Area B Phase 2	56.8	M	0.604	Area E	58.9	M	0.716
Area E	50.7	F	0.619	Area E	55.7	M	0.638
				Area E	53.5	?	0.757
				Area F	54.8	M	0.783
Area B Phase 4	50.9	F	0.622	Area B Phase 4	-	-	0.749
Area B Phase 5	52.4	?	0.641	Area B Phase 5	50.7	F	0.594
Area B Phase 5	55.3	M	0.747	Area B Phase 5	54.4	M	0.701

(Figs. 10 and 11). The second stage is disarticulation of the carcass into either individual elements or a set of butchery units. The third stage is the removal of meat from bones. This is known as 'defleshing' or "filleting' and can occur either before or after cooking (Fig. 12). The identification of which stage in carcass processing is represented by a particular butchery mark (or marks) has been determined in reference to experimental butchery studies by Binford (1981), Nilssen (2000) and Seetah (2007). Butchery marks observed on animal ones from Harlaa, Harar and Ganda Harla was recorded as to the location, direction and type of butchering mark. These were categorized according to the three main stages of butchery. In comparisons of butchery practices between sites (and site phases) the most diagnostic stage was carcass disarticulation. An overview of disarticulation marks identified from Harlaa, Harar and Ganda Harla can be seen in Tables 10 to 13.

A common pattern of segmenting carcasses can be seen. Following the removal of entrails and the skinning of carcasses, the head was removed primarily through slices to free it from the first cervical vertebra (atlas). This was in the majority accessed from the dorsal side of the animal for both small and large animals. Less commonly, and primarily with small bovids, the head was removed by chopping through the cervical vertebrae (Fig. 13). The anterior limb shows two areas of segmentation – from division of the shoulder through the removal of the humerus from the scapula or from the division of the carcass at the elbow by separating the distal humerus from the radius and ulna (Figs. 14 and 15). The hind limb indicates only the separation of this limb at the hip by the removal of the femur from the pelvis. In some cases, however, this appears to have been achieved by chopping the pelvic girdle through the pubis (in large and small bovids) or through the illial and ischial shafts to remove the acetabulum along with the posterior limb (Fig. 16).

Butchery was conducted using both small and large knives, with large knives appearing to be more common in the butchery of larger animals. However, the segmentation of the axial skeleton in both small bovids and large animals follows a mix of approaches and the use of both larger knives for chopping as well as smaller slicing methods. Moreover, skinning can be seen to take place at different portions of the foot regardless of the body size of the animal, with small bovids indicating skinning marks on the first or second phalange either from the anterior or posterior limb. This is also seen with large bovids and large mammals (equids and camels) albeit with a smaller sample size. The overall impression given by butchery marks is of a pattern of individualized rather than professional butchery, with different individuals having different methods and different choices in or access to butchery equipment.

Only one butchered element was recovered from Ganda Harla, a cattle calcaneus which was disarticulated by fine slices. 11 elements from Harar contexts had traces of butchery, of these 3 were traces of filleting (both small and large bovids). The remaining 8 elements were from both small and large bovids and predominately indicated disarticulation by fine slices with the exception of one sheep illial wing which was chopped through in order to remove the sacrum and one cattle illial wing which was likewise chopped through for the removal of the sacrum (Fig. 16). This pattern of disarticulation of the hindlimb and the removal of the sacrum (to divide the pelvis) was also seen at Harlaa, although alternative methods of carcass dismemberment were also indicated at Harlaa (chopping through the pelvis around the acetabulum, removal of the sacrum

FIGURE 10 Examples of marks associated with skinning found on foot bones from Harlaa, Harar and Ganda Harla. Shown here are examples from Harlaa 2017 (B)14 [left] and Harlaa 2018 B(22) [right].

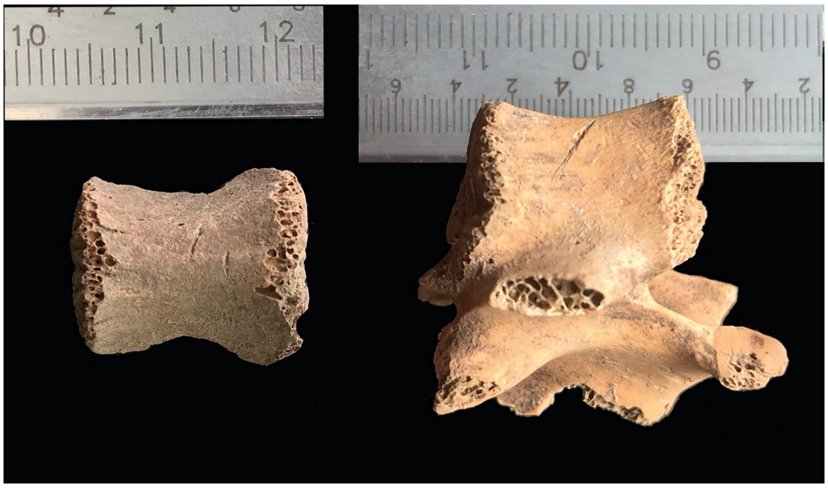

FIGURE 11 Examples of butchery marks left by the evisceration process on vertebrae from Harlaa, Harar and Ganda Harla. Shown here are examples from Harlaa 2017 B(7) [left] and Harlaa 2019 E(29) [right].

FIGURE 12 Examples of filleting marks found on material from Harlaa, Harar and Ganda Harla. Given the faint nature of filleting marks, these have been highlighted with arrows. Shown here are examples from (from top left) Harlaa 2018 B(10), 2018 B(10), 2018 (B)9, 2019 E(24), 2019 E(7) and 2019 E(25).

FIGURE 13 Examples of the multiple approaches to decapitation of bovids on the material from Harlaa illustrating disarticulation of the atlas from the skull by means of fine slices (top) and chops through the other cervical vertebrae further down the neck (bottom). Shown here are examples from (from top left) Harlaa 2018 B(7), 2017 B(4), 2017 B(4) and 2018 B(5).

FIGURE 14 Examples of the severing of the shoulder with chops through the neck of the scapula (left) and the head of the humerus (right). Shown here are examples from Harlaa 2018 B(9) [left] and Harlaa 2018 B(11) [right].

TABLE 10 Details of butchery evidence for carcass disarticulation on material recovered from phases 1 and 2 of Area B at Harlaa. In addition to these were recovered one bones with traces of filleting from phase 1 and from phase 2 four elements with traces of evisceration (the removal of entrails), 8 with evidence of skinning and 32 with evidence of filleting

Sample	Process	Taxon	Element	Portion	Location	Mark type
B/1	Disarticulation	*Ovis aries*	Metatarsal	Proximal	Anterior face	Fine slices
B/1	Disarticulation	*Camellus sp.*	Humerus	Distal	Lateral faces	Chopped through
B/1	Filleting	Small bovid	Lumbar	Centrum	Ventral face	Fine slices
B/2	Severing throat	Small bovid	Hyoid	Stylohyoid	Posterior	Thick slice
B/2	Disarticulation	*Capra hircus*	Humerus	Proximal	Capitus	Chopped through
B/2	Disarticulation	Small bovid	Humerus	Proximal	Capitus	Chopped through
B/2	Disarticulation	*Nanger granti*	Axis	Centrum	Medial	Chopped through
B/2	Disarticulation	Small bovid	Sacrum	Centrum	Medial	Chopped through
B/2	Rib removal	Small bovid	Thoraxic	Centrum	Lateral	Chopped through
B/2	Rib removal	Small bovid	Rib	Shaft	Neck margins	Chopped through
B/2	Tongue removal	Small bovid	Mandible	Ramus	Medial	Fine slices
B/2	Tongue removal	Small bovid	Mandible	Ramus	Medial	Fine slices
B/2	Tongue removal	Small bovid	Hyoid	Stylohyoid	Medial face	Fine slices
B/2	Tongue removal	Small bovid	Hyoid	Stylohyoid	Medial face	Fine slices
B/2	Tongue removal	Small bovid	Hyoid	Stylohyoid	Medial face	Fine slices
B/2	Disarticulation	*Bos sp.*	Humerus	Distal	Posterior face	Fine slices
B/2	Disarticulation	*Bos sp.*	Tibia	Distal	Anterior face	Fine slices
B/2	Disarticulation	Large bovid	Ulna	Proximal	Anterior margin	Fine slices
B/2	Disarticulation	*Bos sp.*	Metacarpal	Proximal	Anterior face	Fine slices
B/2	Disarticulation	*Bos sp.*	Astragalus	Distal	Lateral	Chopped through
B/2	Disarticulation	*Bos sp.*	Humerus	Proximal	Capitus	Chopped through
B/2	Disarticulation	*Bos sp.*	Humerus	Distal	Trochlea	Chopped through
B/2	Disarticulation	*Kobus sp.*	Humerus	Distal	Trochlea	Chopped through
B/2	Disarticulation	*Bos sp.*	Innominate	Shaft	Ischium, Pubis	Chopped through
B/2	Disarticulation	*Bos sp.*	Scapula	Neck	Dorsal	Chopped through
B/2	Disarticulation	*Bos sp.*	Femur	Proximal	Capitus	Chopped through
B/2	Disarticulation	*Bos sp.*	Femur	Proximal	Capitus	Chopped through
B/2	Rib removal	Large bovid	Rib	Shaft	Neck margins	Chopped through
B/2	Rib removal	Large bovid	Rib	Shaft	Neck margins	Chopped through
B/2	Rib removal	Large bovid	Rib	Shaft	Neck margins	Chopped through
B/2	Rib removal	Large bovid	Rib	Shaft	Neck margins	Chopped through
B/2	Rib removal	Large bovid	Rib	Shaft	Neck margins	Chopped through
B/2	Disarticulation	Large bovid	Cervical	Centrum	Dorsal	Chopped through
B/2	Disarticulation	*Equus caballus*	Cervical	Centrum	Dorsal	Chopped through
B/2	Disarticulation	*Camellus sp.*	Atlas	Centrum	Anterior	Fine slices
B/2	Tongue removal	Large bovid	Hyoid	Stylohyoid	Medial face	Fine slices
B/2	Tongue removal	*Camellus sp.*	Mandible	Ramus	Medial	Fine slices
B/2	Disarticulation	Galliform	Humerus	Distal	Lateral	Fine slices

TABLE 11 Details of butchery evidence for carcass disarticulation on material recovered from Areas E and F at Harlaa. In addition to these were recovered two bones with traces of evisceration, 12 with traces of skinning and 37 with traces of filleting from Area E. From Area F were additionally five elements with traces of filleting

Sample	Process	Taxon	Element	Portion	Location	Mark type
E	Disarticulation	*Capra hircus*	Innominate	Illium	Wing	Chopped through
E	Disarticulation	Small bovid	Innominate	Illium	Wing	Chopped through
E	Disarticulation	*Capra hircus*	Scapula	Neck	Anterior	Fine slices
E	Disarticulation	*Capra hircus*	Scapula	Neck	Ventral	Fine slices
E	Disarticulation	*Capra hircus*	Scapula	Neck	Ventral	Fine slices
E	Disarticulation	*Ovis aries*	Humerus	Distal	Anterior face	Fine slices
E	Disarticulation	*Capra hircus*	Humerus	Distal	Posterior face	Fine slices
E	Disarticulation	*Ovis aries*	Humerus	Distal	Posterior face	Fine slices
E	Disarticulation	*Ovis aries*	Radius	Proximal	Anterior face	Fine slices
E	Disarticulation	*Ovis aries*	Radius	Proximal	Anterior face	Fine slices
E	Disarticulation	Small bovid	Femur	Shaft	Anterior	Fine slices
E	Disarticulation	*Dorcatragus*	Femur	Proximal	Anterior	Fine slices
E	Disarticulation	*Capra hircus*	Atlas	Centrum	Ventral face	Fine slices
E	Disarticulation	Small bovid	Cervical	Centrum	Dorsal	Chopped through
E	Disarticulation	Small bovid	Thoraxic	Centrum	Ventral	Chopped through
E	Rib removal	Small bovid	Thoraxic	Centrum	Ventral, lateral	Chopped through
E	Rib removal	Small bovid	Thoraxic	Centrum	Ventral, lateral	Chopped through
E	Disarticulation	Small bovid	Lumbar	Centrum	Ventral	Chopped through
E	Disarticulation	Small bovid	Lumbar	Centrum	Ventral	Chopped through
E	Rib removal	Small bovid	Rib	Shaft	Neck margins	Chopped through
E	Rib removal	Small bovid	Rib	Shaft	Neck margins	Chopped through
E	Severing throat	Small bovid	Hyoid	Stylohyoid	Posterior	Thick slice
E	Disarticulation	*Bos sp.*	Humerus	Distal	Trochlea	Chopped through
E	Disarticulation	*Bos sp.*	Humerus	Distal	Trochlea	Chopped through
E	Disarticulation	*Bos sp.*	Humerus	Distal	Anterior	Fine slices
E	Disarticulation	*Bos sp.*	Humerus	Distal	Anterior	Fine slices
E	Disarticulation	*Bos sp.*	Tibia	Proximal	Lateral	Fine slices
E	Disarticulation	*Bos sp.*	Metatarsal	Distal	Lateral	Fine slices
E	Disarticulation	*Bos sp.*	Astragalus	Distal	Posterior face	Fine slices
E	Disarticulation	*Bos sp.*	Calcaneus	Proximal	Lateral face	Fine slices
E	Disarticulation	Large bovid	Cervical	Centrum	Ventral	Chopped through
E	Rib removal	Large bovid	Rib	Shaft	Neck margins	Chopped through
E	Rib removal	Large bovid	Rib	Shaft	Neck margins	Chopped through
E	Rib removal	Large bovid	Rib	Shaft	Neck margins	Chopped through
E	Rib removal	Large bovid	Rib	Shaft	Neck margins	Chopped through
F	Tongue removal	*Equus sp.*	Hyoid	Stylohyoid	Medial face	Fine slices
F	Disarticulation	*Capra hircus*	Atlas	Centrum	Ventral face	Fine slices
F	Disarticulation	*Capra hircus*	Tibia	Distal	Lateral, anterior	Fine slices

TABLE 12 Details of butchery evidence for carcass disarticulation on material recovered from phases 3 and 4 of Area B at Harlaa. In addition to these were recovered three elements with traces of filleting from phase 3 and from phase 4 two elements with traces of skinning and 14 with traces of filleting

Sample	Process	Taxon	Element	Portion	Location	Mark type
B/3	Disarticulation	*Gallus gallus*	Tibiotarsus	Distal	Lateral	Fine slices
B/3	Disarticulation	*Capra hircus*	Humerus	Distal	Posterior face	Fine slices
B/3	Disarticulation	*Gazella dorcas*	Radius	Proximal	Medial face	Fine slices
B/3	Disarticulation	*Ovis aries*	Femur	Proximal	Medial	Chopped through
B/3	Disarticulation	Small bovid	Tibia	Distal	Shaft	Chopped through
B/3	Disarticulation	Small bovid	Lumbar	Centrum	Anterior	Chopped through
B/3	Rib removal	Small bovid	Rib	Neck	Anterior	Fine slices
B/3	Rib removal	Small bovid	Rib	Neck	Anterior	Thick slices
B/4	Disarticulation	*Nanger granti*	Humerus	Distal	Trochlea	Chopped through
B/4	Disarticulation	*Ovis aries*	Humerus	Distal	Anterior	Fine slices
B/4	Disarticulation	*Capra hircus*	Humerus	Distal	Lateral	Fine slices
B/4	Disarticulation	*Ovis aries*	Humerus	Distal	All faces	Fine slices
B/4	Disarticulation	Small bovid	Innominate	Illium	Wing	Chopped through
B/4	Disarticulation	*Ovis aries*	Innominate	Ischium+ Illium	Shafts	Chopped through
B/4	Disarticulation	Small bovid	Axis	Centrum	Anterior	Chopped through
B/4	Disarticulation	Small bovid	Lumbar	Centrum	Ventral	Chopped through
B/4	Disarticulation	*Bos sp.*	Innominate	Pubis	Symphysis	Chopped through
B/4	Disarticulation	*Bos sp.*	Tibia	Distal	Shaft	Chopped through
B/4	Disarticulation	Large bovid	Tibia	Proximal	Tibial crest	Chopped through
B/4	Disarticulation	Large bovid	Thoraxic	Centrum	Ventral	Chopped through
B/4	Disarticulation	Large mammal	Thoraxic	Centrum	Ventral	Chopped through
B/4	Rib removal	Large bovid	Rib	Neck	Anterior	Thick slices
B/4	Rib removal	Large bovid	Rib	Neck	Neck margins	Chopped through
B/4	Disarticulation	*Gallus gallus*	Humerus	Distal	Lateral	Fine slices

TABLE 13 Details of butchery evidence for carcass disarticulation on material recovered from phases 5 of Area B at Harlaa. In addition to these were recovered one bone with traces of evisceration, 7 with traces of skinning and 23 with traces of filleting

Sample	Process	Taxon	Element	Portion	Location	Mark Type
B/5	Disarticulation	*Capra hircus*	Scapula	Proximal	Ventral	Fine slices
B/5	Disarticulation	*Capra hircus*	Humerus	Distal	Anterior	Fine slices
B/5	Disarticulation	Small bovid	Humerus	Proximal	Anterior	Fine slices
B/5	Disarticulation	*Ovis aries*	Radius	Proximal	Anterior	Fine slices
B/5	Disarticulation	Small bovid	Radius	Proximal	Anterior	Fine slices
B/5	Disarticulation	*Capra hircus*	Ulna	Proximal	Anterior	Fine slices
B/5	Disarticulation	*Capra hircus*	Metacarpal	Proximal	Posterior	Fine slices
B/5	Disarticulation	*Ovis aries*	Astragalus	Distal	Posterior	Fine slices
B/5	Disarticulation	*Ovis aries*	Calcaneus	Proximal	Malleolar	Chopped through
B/5	Disarticulation	*Ovis aries*	Atlas	Centrum	Ventral	Fine slices
B/5	Disarticulation	*Ovis aries*	Atlas	Centrum	Ventral	Deep slice
B/5	Disarticulation	*Ovis aries*	Atlas	Centrum	Dorsal	Fine slices
B/5	Disarticulation	Small bovid	Axis	Dens	Ventral	Fine slices

TABLE 13 Details of butchery evidence for carcass disarticulation on material recovered from phases 5 of Area B at Harlaa (*cont.*)

Sample	Process	Taxon	Element	Portion	Location	Mark Type
B/5	Disarticulation	Small bovid	Lumbar	Centrum	Ventral	Chopped through
B/5	Disarticulation	Small bovid	Lumbar	Centrum	Ventral	Chopped through
B/5	Disarticulation	Small bovid	Lumbar	Centrum	Ventral	Chopped through
B/5	Disarticulation	Small bovid	Lumbar	Centrum	Ventral	Depp slice
B/5	Rib removal	Small bovid	Rib	Neck	Anterior	Fine slices
B/5	Throat Slicing	Small bovid	Hyoid	Stylohyoid	Posterior	Deep slice
B/5	Tongue Removal	Small bovid	Hyoid	Stylohyoid	Medial face	Fine slices
B/5	Disarticulation	Large bovid	Humerus	Distal	Trochlea	Chopped through
B/5	Disarticulation	*Bos sp.*	Humerus	Distal	Trochlea	Chopped through
B/5	Disarticulation	*Bos sp.*	Humerus	Distal	Trochlea	Chopped through
B/5	Disarticulation	*Bos sp.*	Radius	Proximal	Anterior	Chopped through
B/5	Disarticulation	Large bovid	Innominate	Illium	Wing	Deep slices
B/5	Disarticulation	*Bos sp.*	Innominate	Pubis	Acetabulum	Chopped through
B/5	Disarticulation	*Bos sp.*	Femur	Proximal	Capitus	Chopped through
B/5	Disarticulation	Large mammal	Tibia	Proximal	Tibial crest	Chopped through
B/5	Disarticulation	*Bos sp.*	Astragalus	Distal	Posterior	Fine slices
B/5	Disarticulation	Large bovid	Cervical	Centrum	Ventral	Chopped through
B/5	Disarticulation	Large bovid	Cervical	Centrum	Ventral	Chopped through
B/5	Disarticulation	Large bovid	Thoraxic	Centrum	Ventral	Chopped through
B/5	Disarticulation	Large bovid	Thoraxic	Centrum	Ventral	Chopped through
B/5	Disarticulation	Large bovid	Lumbar	Centrum	Ventral	Chopped through
B/5	Rib removal	*Equus asinus*	Rib	Neck	Anterior	Deep slices

with fine slices, chopping through the femoral capitus) which are not represented in the small sample of butchered bones recovered from either Ganda Harla or Harar.

Identifying Islamic Butchery Practices and Diet in the Faunal Assemblages

Halal butchery practices are specific only in the practice of slaughtering the animal, which is done via the severing of the throat to rapidly exsanguinate the animal (Francesca 2014; Kocturk 2002). This is achieved primarily through one of two approaches – a rapid and deep severing of the trachea, oesophagus and blood vessels with a knife from across the ventral surfaces of the throat (this being the primary technique) or the decapitation of the animal with a large implement (knife, cleaver, etc.) (Francesca 2014; Kocturk 2002). Of the 25 hyoid bones recovered from Harlaa (none were recovered from either Harar or Ganda Harla), eight have evidence of butchery. Of these, three bones bear cutmarks consistent with the slicing of the throat (one each from Area E, Area B, Phase 2, and Area B, Phase 5, Fig. 17). More specific guidance for the skinning or dismemberment of butchered animals is not given in the Qur'an or Hadith but can be reconstructed by comparison with other Islamic period faunal assemblages outside Ethiopia and the few proto-historic assemblages published from within Ethiopia. Analysis of butchery from late Aksumite and post-Aksumite phases of Bieta Guyorgis (Aksum) show some common traits with butchery evidence from Harlaa. The severing of the head and neck at the cranium-atlas junction using small slices can be seen at both sites. The severing of the elbow joint through fine slices to the proximal radius and the posterior margins of the distal humerus, as well as fine slices to the body of the hyoid bone from the removal of the tongue is also seen at both sites.

Several butchery practices evident in the Harlaa material are, however, not seen in the Bieta Guyorgis assemblage, but are found across multiple Islamic period sites in Arabia (e.g. Barbar), Anatolia (e.g. Gözlükule, Kaman-Kalehöuük), Mesopotamia (e.g. Tell Tuneinir), the Levant (e.g. Ḥorbat 'Ofrat, Shallale, Tall al-Fukkar,), and Iberia (e.g. Alartos, Núcleo Arqueológico da Rua dos Correeiros) (Bangsgaard 2001, 2015; Estaca-Gómez et al 2019; Hongo 1997; Horwitz 2009; Loyet 1999; Moreno-Garcia & Gabriel 2001; Omar 2017). Generally, detailed discussions of butchery evidence are not common in

FIGURE 15 Examples of division of the carcass at the elbow by separating the distal humerus from the radius and ulna. Shown here are examples from (from left) Harlaa 2018 B(6), 2018 B(12), 2017 B(4) and 2019 E(23).

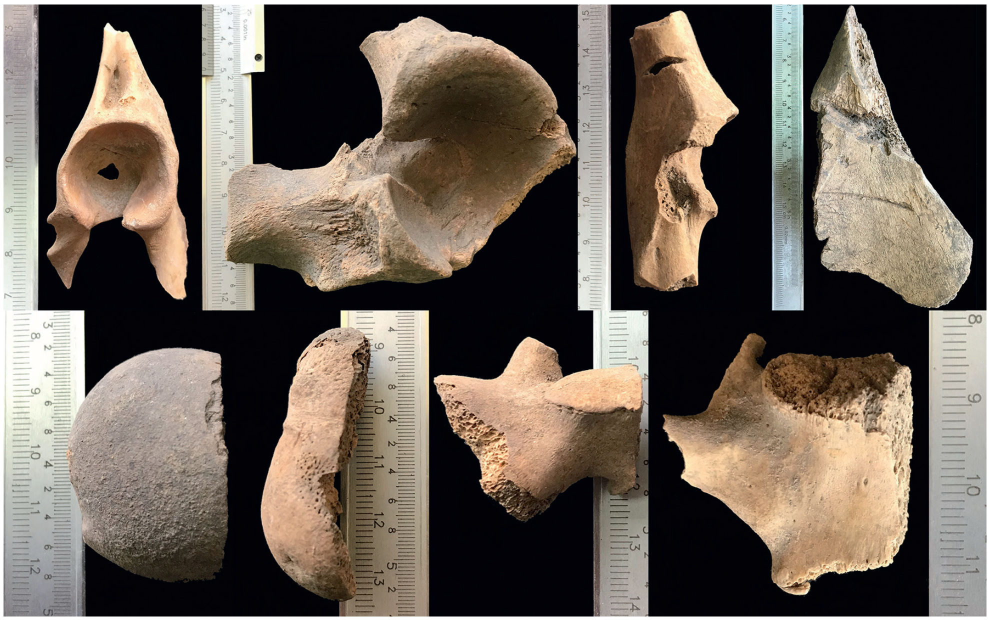

FIGURE 16 Examples of pelvic bones dismembered by chopping through the sacrum (lower right) and pubis (upper left), chopping free the femur through the head (lower left) and chopping the acetabulum free together with the femur (upper right). Shown here are examples from (from top left) Harlaa 2017 B(13), 2018 B(7), 2018 B(5), Harar 2014 SHA(A2c), Harlaa 2017 B(7), 2017 B(7), 2018 B(11) and 2018 B(6).

zooarchaeological literature from Islamic periods (cf. Insoll 1999: 95-99). Regardless, there are sufficient comparative examples to allow for the identification of particular key common practices. These involve butchery through the use of heavy knives, including the severing of the elbow joint by chopping through the distal trochlea of the humerus (Fig. 15), severing of the shoulder joint by chopping through the neck of the scapula or the humeral capitus (Fig. 14), the severing of the pelvic girdle either by chopping off the femoral capitus or by chopping free the acetabulum (Fig. 16), chopping through the distal tibia (Fig. 18), and lateral sectioning of the axial skeleton either in the removal of ribs (Fig. 19) or for the division of loins and tenderloins from the vertebral column (Fig. 20).

While it is difficult to conclusively determine that these forms of carcass dismemberment derive from cultural commonalities of the Islamic world given the infrequency of butchery discussions in zooarchaeological literature, the presence of so many common features across a range of sites which are all absent from Bieta Guyorgis suggests that the use of these butchery techniques are likely an identifiable part of Islamic cultural expansion into this region of Ethiopia. Although some of the butchery marks predate by several centuries the first evidence for Islam

FIGURE 17 Examples of butchery marks found on hyoids from Harlaa. These are found on the medial surface and indicative of the removal of the tongue, and on the ventral margins of the hyoid indicating the slicing of the throat. Shown here are examples from (from left) Harlaa 2018 B(11), 2017 B(4), 2018 B(15), 2018 B(14) and 2017 B(4).

FIGURE 18 Examples of butchery of the lower hind limb at Harlaa. Removal of the tibia from the ankle joint by fine slices (left) and chopping through the distal tibia to segment out the leg joint (middle and right). Shown here are examples from (from left) Harlaa 2018 B(8), 2018 B(5) and 2017 B(20).

at Harlaa in the form of mosques or burials, the butchery techniques may have arisen initially with the movement of Muslim traders otherwise archaeologically unrecognised, and subsequently with the spread of Islamization to Harar, and, potentially, Ganda Harla, along with the adoption of new techniques with the spread of heavier butchery knives, or a combination of such factors.

It is noteworthy that Harlaa, Harar, and Ganda Harla share a predominance of ovicaprines, in particular goats, with various contemporary sites in the Islamic World (e.g. Bangsgaard 2015; Brown 2016; Hongo 1997; Horwitz 2009; Loyet 1999; Studer et al. 2013; Taxel et al. 2017; von den Driesch & Docker 2002). Similarly, in these comparative sites, goats were also mainly culled for their meat as older subadults while cattle were more commonly retained into adulthood, as were horses, donkeys and camels (Bangsgaard 2001, 2015; Hongo 1997; Horwitz 2009; Loyet 1999).

Dietary prohibitions of varying degrees of severity also exist within different sects of Islam (Francesca 2014; Kocturk 2002; Rodinson 2012; Wheeler 2014). These include, for example, those specifically outlawed by the Qur'an – carrion, blood and pork – as well as those forbidden by Hadith and jurists within individual sects. These include cats, dogs, marine mammals, domestic equids (donkeys, horses or mules), predatory birds, carnivorous mammals, reptiles and most insects (Francesca 2014; Kocturk 2002; Wheeler 2014). Some animals are allowed within different sects (e.g. marine mammals for must Sunnī sects), thus variations in the presence or absence of prohibited animals may be indicative of Islamic dietary practices, as well sectarian traditions. However,

FIGURE 19 Examples of rib removal butchery traces from Harlaa. Shown here are examples from (from left) Harlaa 2017 B(20), 2018 B(7), 2017 B(20), 2019 E(6), 2017 B(4) and 2019 E(25).

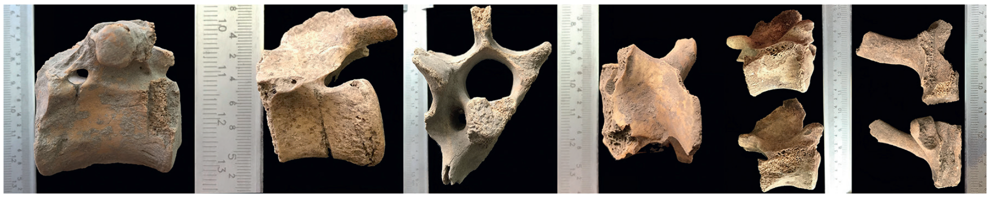

FIGURE 20 Examples of disarticulation sectioning of the vertebral column by different methods at Harlaa. Shown here are examples from (from left) Harlaa 2017 B(4), 2017 B(4), 2017 B(4), 2017 B(6), 2017 B(6), 2019 E(7) and 2019 E(7).

one complication with the use of faunal profiles for such ethnic or religious identification is that the observance of these rules is not necessarily universal across individuals, sites, or regions (Rodinson 2012). One example of this is the consumption of donkeys and tortoises. Consumption of domestic equids (donkeys, horses or mules) is prohibited under all schools of Islamic thought save for the Ḥanbalīs (and for horses, the Shāfiʿīs) (Francesca 2014; Wheeler 2014). However, the remains of these animals (with indications of butchery, cooking, and consumption, especially of donkeys) are common across many sites of Islamic periods in both north Africa and south-west Asia (e.g. Bangsgaard 2015; Chaix & Studer 2001; Estaca-Gómez et al. 2019; Loyet 2004; Marom 2019; MacKinnon 2017; von den Driesch & Docker 2002), as well as at Harlaa, Harar and Ganda Harla. This presence of donkey might be taken as indicative of Sunnī rather than Shi'a sects (Francesca 2014; Wheeler 2014), were it not for an additional complicating factor – the presence of suids.

The consumption of pigs is universally outlawed across Islamic traditions (Francesca 2014; Kocturk 2002; Wheeler 2014). However, pig remains are also systematically present across a great many sites of Islamic periods in north Africa, the Levant, Mesopotamia, Arabia and Anatolia, albeit at very low levels (e.g. Bangsgaard 2015; Brown 2016; Bouchnick 2018; Chaix & Studer 2001; Estaca-Gómez et al. 2019; García-Rivero et al. 2018; Hongo 1997; Horwitz 2009; Loyet 1999, 2004; MacKinnon 2017; Studer et al. 2013; Taxel et al 2017; von den Driesch & Docker 2002). While there is no specific evidence for domestic pigs at Harlaa, Harar, or Ganda Harla, both Harlaa and Ganda Harla have evidence of suids (wild boar and bushpig). Suids are, in fact, more common at Harlaa and Ganda Harla than at Aksumite or post-Aksumite contexts from (Christian) Bieta Guyorgis and Mezber (Cain 2000; Chaix 2013; Woldekiros & D'Andrea 2017), suggesting that Islamic dietary laws may not have been strictly observed at Harlaa or Ganda Harla, or that there was a non-Muslim population component in these sites, which is also feasible.

Harlaa, Harar, and Ganda Harla in Comparative Regional Context

The faunal assemblages from Harlaa, Harar and Ganda Harla provide a window into animal economies in eastern Ethiopia during the 7th to 17th centuries AD. Given the scarcity of faunal studies done in the Horn of Africa from these periods there are few sites against which to compare the samples. At Mifsas Baḥri for example, a late Aksumite site in southern Tigray dated to between c. 550–700, the recovery of 34.6 kg of animal bones is referred to (Yule 2017: 76), but no further information on this material is provided. Similarly, excavations at Mezber have produced isotopic studies on the recovered remains of both humans and (studied) animals, although after more than a decade only the domestic chicken remains have been published (Woldekiros & D'Andrea 2017).

However, a wider regional comparison can be made between Harlaa, Harar and Ganda Harla and some other sites of late- and post-Aksumite northern Ethiopia (c. 6th to 9th/10th centuries AD). From comparison with multiple settlement contexts excavated at Bieta Guyorgis it can be seen that cattle were the predominant domesticate in late- and post-Aksumite periods, and sheep dominated slightly over goats (Cain 2000; Chaix 2013). Both of these patterns are in contrast to the findings from Harlaa. Cattle were the most common domesticate at both Harar and Ganda Harla, although the ovicaprines represented at these sites indicate a predominance of goats in common with Harlaa and unlike samples from Bieta Guyorgis. While fish remains were recovered from both Bieta Guyorgis (Cain 2000) and Harlaa, the fish species at the former are all local freshwater species, while those from Harlaa represented imported maritime species. Chickens are found on all sites, although the guinea fowl (*Numida meleagris*) is absent from Aksumite sites (Cain 2000; Chaix 2013; Woldekiros & D'Andrea 2017) and is only represented in the earlier occupational phases at Harlaa (up to the late 13th century AD).

Some differences in the management of domestic animals can also be seen. In both regions, cattle were predominately culled as adults, although the proportion of cattle culled prior to adulthood is slightly higher from Bieta Guyorgis samples (Cain 2000; Chaix 2013). From analyses of post-cranial fusion only c. 60-80% of cattle can be seen to survive into adulthood at Bieta Guyorgis sites compared with 80-100% of cattle surviving into adulthood at Harlaa, Harar and Ganda Harla. Sheep and goats from Bieta Guyorgis indicate a high culling of infant and juvenile individuals and young subadults (under two years of age) in contrast with the pattern of high culling of older subadult animals seen at Harlaa (Chaix 2013). This suggests that the management practices were different, although the lack of separated age profiles for sheep and goats from the Aksumite sites makes it difficult to confirm this.

Conclusions

The faunal assemblages from Harlaa, Harar, and Ganda Harla have provided significant information on animal economies and religious identity in medieval Ethiopia, and for the first time from an Islamic archaeological context. The appearance of a similar range of butchery techniques suggests that these were linked with the appearance of Muslim traders at Harlaa, and the subsequent spread of Islam to Harar and Ganda Harla. Intriguingly, at Harlaa, Islamic butchery techniques predate other markers of Islam such as mosques or burials by at least four centuries, suggesting that some Muslims might have been present much earlier, but are otherwise materially intangible. The presence of wild pig at Harlaa and Ganda Harla, tortoise rarely at Harlaa, but more commonly at Harar and Ganda Harla, and donkey at all three sites indicates dietary eclecticism, and at Harlaa and Ganda Harla the non-observance of Islamic dietary rules and/or the presence of mixed communities. At Harar, the absence of pig remains infers greater Islamic orthodoxy which would concur with its status as a city of Muslim scholarship and pilgrimage (Insoll & Zekaria 2019).

Social inferences may also be made. The absence of cross-site differences in animal body portions consumed at Harlaa areas B, E, and F, or at Harar and Ganda Harla suggests wealth or status may not have been a factor in access to meat. This correlates to a certain extent with distribution patterns of artifacts such as imported glazed pottery, beads, and shells at Harlaa, which do not show significant disparities across the site, but any such wealth correlations cannot be determined at Harar and Ganda Harlaa where these categories of prestige artifacts were generally absent (Insoll 2017). Similarities across the three sites were also evident in, for example, some of the species present, and in the hunting of small bovids.

The data also indicates differences among the sites, particularly between Harlaa, and Harar and Ganda Harla. For domesticates, goat dominates at Harlaa, and cattle at the latter two sites. All bird bones are absent from Ganda Harla and guinea fowl is only present at Harlaa, and only in the 11th-13th centuries. Imported, probably processed, marine fish are found at Harlaa, with no fish remains occurring at the other sites. Aspects of animal management strategies also appear to differ. The increased slaughter of sub-adult goats at Harlaa compared to Harar and Ganda Harla implies a more cautious approach at the latter sites where there was an emphasis on the increase or perpetuation of livestock numbers. Cattle appear to have only been used for traction at Harlaa. The patterns which are emerging from these faunal assemblages indicate the development of animal economies and dietary identities that are both connected with the wider Islamic world and rooted in the local environment. To explore these more fully it is imperative that comparable zooarchaeological analyses are undertaken at other late Aksumite, medieval, and Islamic sites in Ethiopia and elsewhere in the Horn of Africa.

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Supplementary Material

Supplementary material is available online at: https://doi.org/10.6084/m9.figshare.12152790

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