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Animal Husbandry and Faunal Material: Integrating Data from Finland (AD 1200–1800)

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ABSTRACT

This paper is a synthesis of zooarchaeological evidence from 27 medieval and post-medieval sites from Finland. These faunal samples derive from rural, town, manor, castle and ecclesiastic sites, and their production and consumption patterns were examined by studying the role of the major domesticates (cattle, sheep, goats and pigs). As taxonomic abundance in faunal material may be altered by taphonomic processes, such as burning, these factors were assessed before comparison. The animal husbandry system in Finland was shaped by environmental constraints that limited the number of animals that could be kept over winter. However, some specialisations were observed within the frame of the basic pattern. This paper demonstrates the usefulness of zooarchaeological data in the study of animal husbandry and consumption and production patterns. These findings support data integration as a useful tool for understanding general large-scale processes, such as urbanisation, development, environmental adaptation and the specialisation of animal production.

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Introduction

Synthetic studies combining zooarchaeological data from larger areas and/or longer time periods have been executed in several European countries (e.g. Benecke 1994; Vretemark 1997; Albarella 2004; Grau-Sologestoa, Albarella, and Quiros Castillo 2016; Çakirlar et al. 2019). Although animal husbandry in Finland during the historical period has been studied (e.g. Tourunen 2008; Kivikero 2010; Puputti 2010), no large-scale comparisons of the data have yet been attempted. Moreover, many studies in Finland, published or grey literature, are in Finnish and thus not readily accessible to the international research community. The overviews of these studies are important for understanding the development of different processes in society, such as urbanisation, agricultural techniques, specialisation of food production and adaption of animal husbandry to different environmental constraints (c.f. Grau-Sologestoa, Albarella, and Quiros Castillo 2016).

Major changes took place in society and subsistence in the early medieval period, when the area now known as modern Finland became part of the Swedish Kingdom. The region became Christianised and urbanisation arose as the first towns were established (Haggrén 2016). Towns, manors, castles and monasteries were not self-supporting units of production, but they acquired at least parts of the consumed meat from farms. This created new patterns of needs and the distribution of animal products. Agriculture expanded in southern Finland, and farming spread north during the medieval and post-medieval periods. In the medieval period, butter was an important tax product collected by the government, and several innovations concerning field cultivation and milk technology were adopted (Kivistö 1999; Orrman 2003; Wilmi 2003, 179; Myrdal 2012, 152).

Although societal factors and innovations guided animal husbandry production systems, environmental constraints also shaped subsistence systems in Finland. The long indoor winter-feeding period for farm animals, which could last for up to 34 weeks of the year, was one of the major challenges for Finnish animal husbandry (Ström 1932, 172; Soininen 1974). Before the cultivation of hay was adopted by the end of the nineteenth century, gathering the winter fodder (hay from meadows and forests, tree leaves and straw) required considerable effort by farmers and significantly limited the number of animals they could keep.[1] In summer, cattle and horses were usually left to pasture in the forest, whereas sheep were often transported to islands. In traditional pig-keeping, the pigs were fed with domestic waste and allowed to roam freely through the farm's surroundings in an

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independent search for food (Soininen 1974; Bläuer 2015, 2016). In Western Finland, where field cultivation prevailed during the medieval and post-medieval periods, cattle were the central source of manure for the fields. Farmers kept as many animals as they could during the winter, but animals often faced starvation in the spring (Soininen 1974). Due to the limited amount of winter fodder that was available, feed was prioritised for the most valuable farm animals: horses and, to some extent, dairy cows (e.g. Soininen 1974, 225; Talve 1997, 69).

Medieval and post-medieval animal husbandry systems can also be studied from written sources. Zooarchaeological and historical data can provide different perspectives on the utilisation of domestic animals, ideally contributing to the more multifaceted view of the animals, animal husbandry and their role in society (e.g. Albarella 1999; Thomas 2005; Tourunen 2008). However, sources regarding animal husbandry prior to the sixteenth century are scarce in Finland (Orrman 2003, 103). Among the most utilised sources for the post-medieval period are tax records of horses, cattle, sheep, goats and pigs (Luukko 1958; Nummela 2003, 150–151). Thus, for Finland, zooarchaeological material is an important source for animal husbandry studies spanning from medieval to post-medieval periods.

The aim of this study was to examine the patterns of animal husbandry and domestic animal use in Finland from ca. AD 1200 to ca. AD 1800, the local medieval (ca. AD 1200/1300–1520) and post-medieval periods (AD 1520–) (Haggrén 2016). The beginning of the medieval period is defined by the conquest by Sweden and the Christianisation that followed, and the beginning of the post-medieval period is defined by the Protestant Reformation. Data were gathered on the taxonomic abundance, age and sex of cattle, sheep, goats and pigs. A similar approach to studying variation in animal husbandry systems, production and consumption has been used by several other authors, usually by examining utilising patterns in taxonomic frequency and kill-off patterns (e.g. Benecke 1994; Vretemark 1997; Tourunen 2008; Grau-Sologestoa, Albarella, and Quiros Castillo 2016).

Interpretation of Production and Consumption Patterns in Zooarchaeological Material

The composition of zooarchaeological material is influenced by factors other than the animal husbandry system that was practised in an area. Consumption patterns, the selective trade of animals, material acquired for crafts and waste management all shaped the zooarchaeological material in Finland. Manors, convents, castles and towns could be selective about the breeding, trading and consumption of animals. However, most agriculture in Finland was of the self-supporting type, with low-grade specialisation; even the major urban centres, such as Turku, continued to produce part of their own food stock until the beginning of the twentieth century (Jutikkala 1957; for a summary of animal stock data in towns, see Bläuer 2015).

There can be differences in the distributions of species and anatomy in the deposits created by different activities, such as slaughter, carcass preparation, meat consumption, meat trade, crafts and rituals (e.g. Serjeantson 1989; Heinrich 2017; Bläuer et al. 2019; Bläuer 2020). For example, in the town of Turku, medieval middens consisting predominantly of food waste contain higher percentages of remains of smaller animals, birds, fish and sheep or goats; the bones of larger animals, such as cattle, were discarded elsewhere (Bläuer 2020). Additional factors affecting the composition of the samples include variations in the preservation and recovery of the bone deposits and inter-analyst variation (e.g. Clason and Prummel 1977; Lyman 1994; O'Connor 2003; Lau and Kansa 2018). For example, in burnt material, the proportion of medium-sized mammals (such as pigs and sheep) may be larger than the proportion of large mammals (such as cattle) because such smaller bones are easier to identify in highly fragmented material (Tourunen 2011a). Poor preservation may enhance the proportion of durable elements, including teeth or species with more robust bones, such as cattle (Lyman 1994, 2015). However, comparative studies of faunal remains require the integration of data from different contexts, phases or sites. Preferably, inter-site comparisons should include only material created by similar sets of activities.

The use of age and sex data to uncover historical patterns of animal husbandry has been discussed previously. For example, animals raised for meat production purposes only are often slaughtered as juveniles, but animals used for the production of milk and wool must be allowed to become adults. The selective culling of livestock creates deviances from the natural sex ratio of approximately 50% females and approximately 50% males (e.g. O'Connor 1991, 2003; Vretemark 1997). For example, a large number of adult females in a sample could indicate that these cattle were kept for dairy production, whereas most of the male animals were slaughtered as calves or juveniles (O'Connor 1991; Vretemark 1997). Furthermore, high proportions of adult male cattle have been associated with the use of draught oxen, and high proportions of adult male sheep have been linked with the importance of wool production (Vretemark 1997; Tourunen 2008; Ryder 1983, 452, 465).

However, interpreting age data in particular is not always straightforward. For example, some cattle

types cannot be milked without the calf being present; thus, young calves were not slaughtered in case their mothers stopped producing milk (McCormick 1992). Although there are no surviving documents describing milking methods in medieval Finland, the tradition of keeping cattle indoors over the winter to develop a bond between humans and cows is considered to be one reason for the disappearance of the presence of calves during milking – a change that happened in Nordic countries as early as during the Iron Age (Welinder, Pedersen, and Widgren 1998). However, during the historical period, the natural mortality of infant animals was sometimes very high: the annual mortality rate for calves kept by the landed estates in the sixteenth century has been reported at 27–72% (Vilkuna 1998; Törnblom 1995). Thus, the presence of calf bones in the faunal sample does not necessarily indicate deliberate slaughter. Furthermore, the bones of infant or juvenile animals may be more vulnerable to deterioration, and thus, poor preservation may affect the age distribution of the faunal assemblages (Munson 2000, 404; Payne 1972, 76; also see McCormick and Murray 2007).

Material and Methods

For this study, data from 27 zooarchaeological sites in mainland Finland[2] were collected (supplementary table 1, references in supplementary file 2). These faunal samples derive from rural, town, manor, castle and ecclesiastic sites, which are likely to have different production and consumption patterns. Most of the animal products that came from rural sites were used on the farm, but any surplus could be used to pay taxes or sold at the market in the towns (Kivistö 1999; Kallioinen 2000). Towns, manors and monasteries were likely to employ mixed strategies of obtaining their food partly from the farms they owned, partly by buying it and partly by breeding it themselves (Törnblom 1997; Vilkuna 2011; Hockman 2015). The government-owned manors or landed estates (Fi: *kuninkaankartano*) were bases for government officials who practised large-scale animal husbandry and cultivation, but some of the tax products from the surrounding area could also have been consumed there (Niukkanen 1997). The small castle of Eurajoki Liinmaa is unlikely to have any production of its own (Bläuer 2019).

The material included six previously unanalysed material and data from publications and osteological reports available from the database of the Finnish Heritage Agency (www.kyppi.fi, supplementary table 1 and 2). Only the assemblages that had a total count of 100 or more for cattle, sheep, goat and pig bones (NISP, Number of Identified SPecimens) were included. The data for sheep and goats were combined in this study. According to written sources, during the seventeenth century, goats were present in Western and Southern Finland, but they were very rare in Northern and Eastern Finland (Luukko 1958). When goats are identified in faunal material, they are less abundant than sheep. The material was divided into medieval (ca. AD 1200–1520) and post-medieval (ca. AD 1520–1800) periods. This study focused on zooarchaeological samples located in an area that was dominated by field cultivation in Southern and Western Finland (Figure 1, definition in Soininen 1974). The uneven distribution of excavated archaeological sites and well-preserved bone samples in Finland did not allow for comparable samples from Eastern or Northern Finland.

One of the challenges of the study material was the lack of uniform and systematic recording standards applied to faunal material in Finland (e.g. the use of specific diagnostic zones). Thus, it is likely that the identification of species in the material studied was influenced by inter-analyst variation. For example, in some analyses, all elements of the trunk (cervical, thoracic and lumbar vertebrae and ribs) belonging to cattle, horses or elk have been identified only to the level of 'large ungulate' (e.g. Tourunen 2008, 2011b; Bläuer 2020), whereas in other analyses, at least some of these elements have been identified as cattle (e.g. Salmi 2014).

Most of the Finnish zooarchaeological material from the settlement sites includes non-specialised general household waste in which all the anatomical regions are represented (cf. Tourunen 2008; Bläuer 2020). When the data on species abundance were collected, attempts were made to exclude sites with clear evidence of craft activities. Unfortunately, there is no central database of faunal remains containing the data in a searchable or editable digital format. Although general patterns of anatomical distribution were noted, a comprehensive estimation of the scale of the differences in species identification and a direct comparison of the anatomical distribution are beyond the scope of this article.

The data on age and sex were collected only from large, well-preserved sites where the data had been reported in enough detail to ensure the uniformity of the analysis methods. Some of the materials discussed here were disposed of after the initial analysis, which limited opportunities for reanalysis.[3] However, the analyses that were conducted included most of the suitable assemblages (supplementary file 1). The data on animal age were collected both from epiphyseal closure and dental eruption and wear. The epiphyses were divided into early, intermediate and late closure groups in accordance with Vretemark (1997, 41) and using data from Silver (1969) and O'Connor (1982) (supplementary table 3). The dental data were recorded using the tooth wear and eruption recording system for single teeth developed by Grant (1982). The

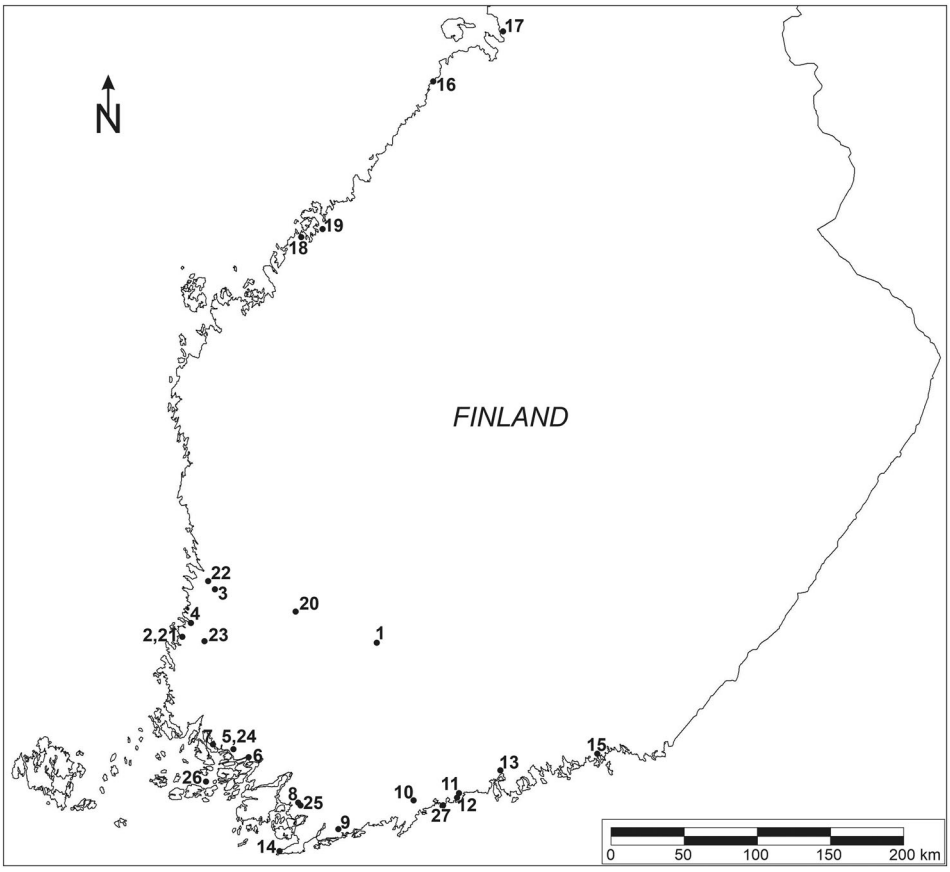

Figure 1. Location of the sites, site names and references in supplementary tables 1 and 2. Cartography by Jussi Kinnunen.

mandibles were then divided into age categories (neonatal, juvenile, immature, sub-adult, adult and elderly) in accordance with O'Connor (2003). The reliability of ageing methods has been widely discussed. The timing of epiphyseal closure may be affected by castration or nutrition, and the rate of dental wear may be influenced by diet (e.g. Noddle 1974, 200; Bullock and Rackham 1982, 79; Moran and O'Connor 1994; Magnell 2006, 38).

For sheep and cattle, sex was determined by measuring the medial edge of the pelvis acetabulum method in Vretemark (1997), with thresholds used for females and males in Tourunen (2008). For pigs, sex was determined by the morphology of the canine teeth.

Results

During the medieval period, the faunal samples derive from rural, town, manor, castle and ecclesiastic sites (Figure 2). The material from the castle of Eurajoki Liinmaa is predominantly burnt food waste, and this has probably led to the low proportion of cattle in the material (Tourunen 2011a; Bläuer 2019). The sample from Hanko Gunnarsängen is poorly preserved and consists predominantly of tooth fragments (Jansson et al. 2010). The faunal remains from the Bridgettine Abbey of Naantali also consist predominantly of food waste (Tourunen 2011b; Bläuer 2020). There seem to be more cattle in the samples from rural sites than in the material from towns. However, in general, the layers in material from towns are better preserved, and this may have affected the proportion of smaller animals contained in it.

In the post-medieval material, there seem to be differences in the faunal assemblages from the different regions (Figure 3). In the northern part of the study area (Oulu, Pietarsaari, Raahe and Kruunupyy), the proportion of pigs is lower and the proportion of cattle is higher. These samples also include elements from the trunk (cervical, thoracic, lumbar vertebrae and ribs) in the cattle counts, which are absent in, for example, the numbers for Turku and Rauma. The effect of this difference in the analysis was tested by re-counting the proportion of cattle without including trunk elements for the samples that had detailed anatomical distribution available (supplementary file 4). This resulted in a change of 1–5% in the proportion of cattle. Thus, while the different analytical systems do affect the numbers of cattle, the effect is not likely to fully explain the difference in their proportions. The highest proportions of sheep and goats in the material are in Southwest Finland and Satakunta – Turku, Salo, Nauvo and Rauma. In the town material, the proportion of pigs increases slightly from the medieval period onwards. However, the overall pattern resembles that of the medieval period, with cattle or sheep and goats dominating the samples.

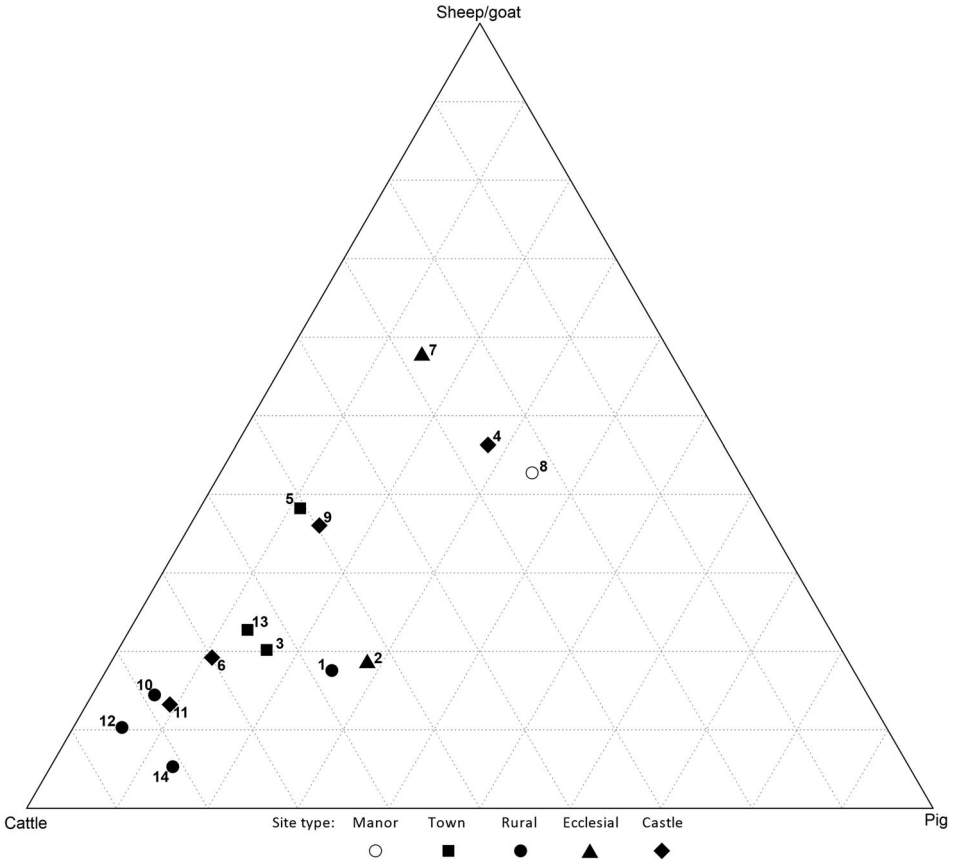

Figure 2. Ternary plot of cattle, sheep and goats, and pigs in the medieval sites (NISP), organised by site type. Sites; 1) Valkeakoski Riihimäki 2) Rauma Franciscan Convent 3) Ulvila Isokartano 4) Eurajoki Liinmaa Castle 5) town of Turku 6) Kaarina Kuusisto Castle 7) Naantali The Bridgettine Abbey 8) Salo Vanhakartano 9) Raasepori Castle 10) Espoo Mankby 11) Helsinki Vartiokylä 12) Vantaa Gubbacka 13) Porvoo Raatihuoneentori 14) Hanko Gunnarsängen Data and references in supplementary tables 1 and 2.

Different animal slaughter patterns appear in cattle age data (Figure 4). The Turku medieval, Rauma Franciscan convent, and Helsinki post-medieval material include mandibles from sub-adults and elderly adults (adult 3 and elderly). In the post-medieval assemblages for Turku and Rauma, the majority of the mandibles derive from elderly adults. A similar pattern is observed in the epiphyseal data, in which the proportion of unfused epiphyses is higher in the Turku medieval and Helsinki post-medieval materials. However, the epiphyseal data from the Rauma Franciscan convent more closely resembles Turku post-medieval pattern (supplementary file 5).

The patterns of sheep use in all the assemblages seem to be based on slaughtering both sub-adult animals and mature animals (adult 3, Figure 5). A slightly different pattern is evident in the epiphyseal data (supplementary file 5). Here, it seems that the Rauma convent material includes the highest proportion of juvenile animals with unfused epiphyses in the late-fusing group, while the Turku medieval material has the highest proportion of fused epiphyses.

For pigs, sub-adult animals are the most common (Figure 5). The kill-off pattern indicates that the majority of the pigs were slaughtered before they reached full maturity. This result is in accordance with the epiphyseal data (supplementary file 5).

The proportions of male and female animals in the material vary (Figure 6). For cattle, the highest proportions of male animals are recorded in the Turku samples. For sheep, more female pelvises are contained in the medieval samples than in the material from the post-medieval sites, however the sample size for especially post-medieval phases is not very large. For pigs, the majority of the canines derive from male pigs in the medieval and post-medieval material from Turku, whereas in the material from the Rauma Franciscan convent, the majority of the canines derive from females.

Discussion and Conclusions

In this paper, aspects of animal husbandry and consumption patterns in Finnish medieval and post-medieval faunal assemblages were explored. Previous studies have shown that zooarchaeological material can indicate different production–consumption networks and social status of the site (e.g. Benecke 1994; Vretemark 1997; Albarella 2004; Grau-Sologestoa, Albarella, and Quiros Castillo 2016). Although the overall pattern of societal change, urbanisation

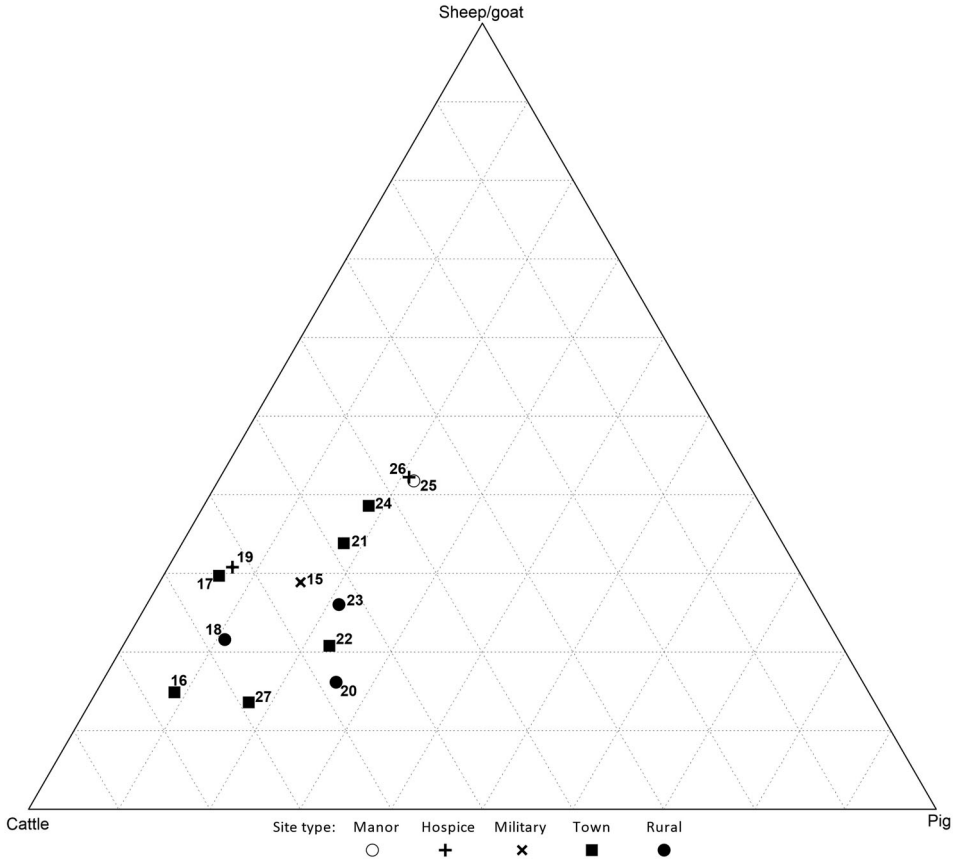

Figure 3. Ternary plot of cattle, sheep and goats, and pigs in the post-medieval sites (NISP). Data and references in supplementary tables 1 and 2. Sites: 15) Kotka Kyminlinna 16) Raahe town 17) Oulu town 18) Pietarsaari Lassfolk 19) Kruunupyy Dårholman 20) Sastamala Vehmaa 21) Rauma town 22) Pori town 23) Rauma Kivikylä 24) Turku town 25) Salo Muntolannokka 26) Nauvo Seili 27) Helsinki town.

and establishment of governmental system during the medieval period in Finland have been studied using written sources, the paucity of medieval source material do not allow a more detailed study of the production network and its development. There are not many synthesis studies that cover neighbouring areas, Sweden and Estonia, for the periods relevant for this study (but see Vretemark 1997; Magnell

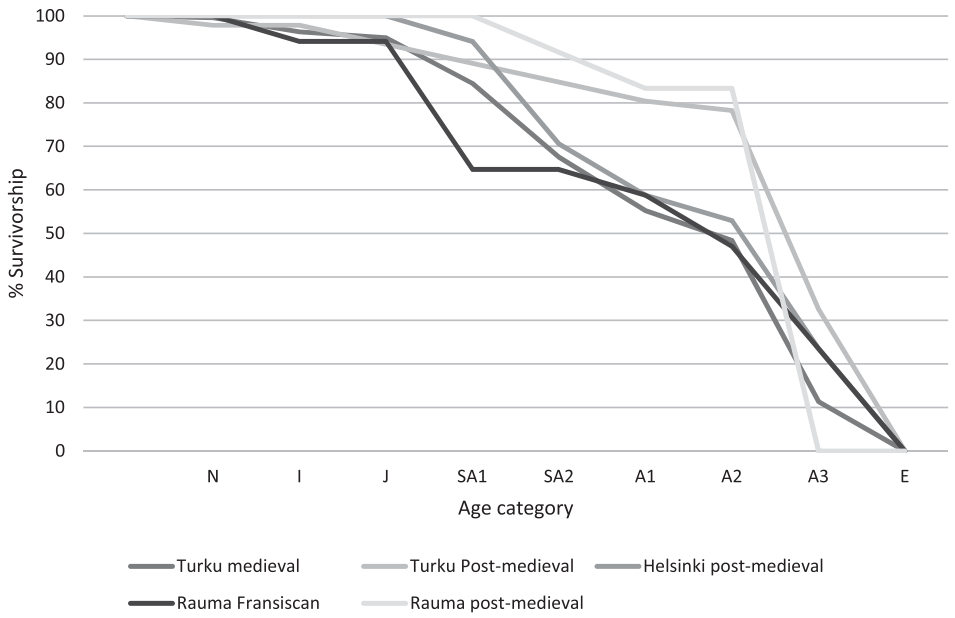

Figure 4. Survivorship curve based on cattle mandibular tooth wear and eruption. N = neonatal, I = immature, J = juvenile, SA = sub-adult, A = adult, E = elderly.

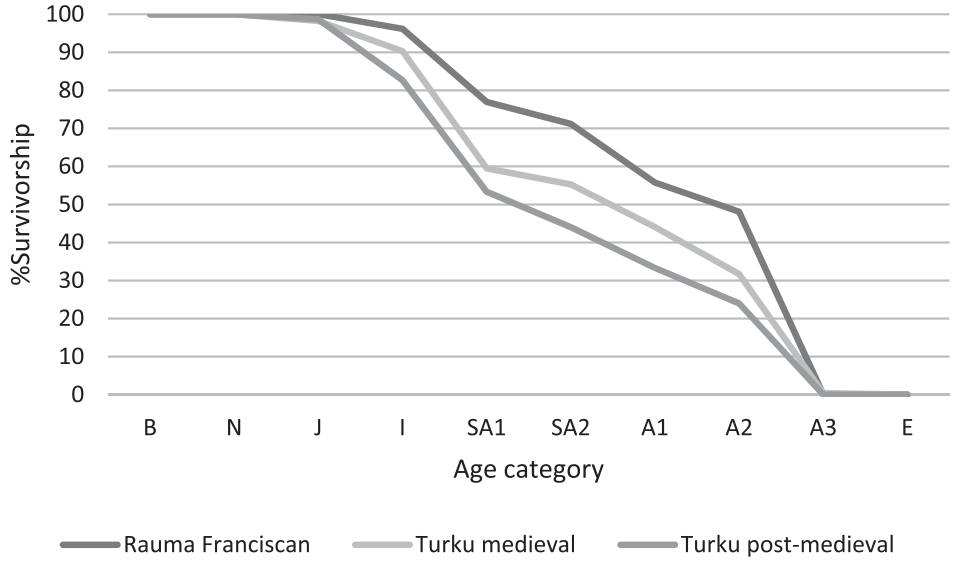

Figure 5. Survivorship curve based on sheep or goat mandibular tooth wear and eruption. N = neonatal, I = immature, J = juvenile, SA = sub-adult, A = adult, E = elderly.

2017; Rannamäe and Lõugas 2019). Thus, comparisons of the development on a general level were possible only to a limited extent.

Although the zooarchaeological material offers good potential for synthesis studies of production-consumption networks, data integration should be done with due caution. In this study, several taphonomic factors that affected the proportions of the animal species were identified, including variations in analytical methods, the preservation of the material and the character of the deposits studied, such as the presence of food waste. These observations are in line with those of previous studies (e.g. Clason and Prummel 1977; Tourunen 2011b; Lau and Kansa 2018; Bläuer 2020). Although the material does not allow for a detailed analysis of minor fluctuations in animal husbandry patterns, the overall pattern formed can be used to analyse major changes in the animal husbandry system.

In the Finnish material, environmental constraints and the limited possibilities for agricultural specialisation contributed to the small taxonomic variation observed during the entire historical period and formed the general frame of the subsistence system. Cattle were central animals in agriculture, kept for manure, milk and traction, sheep was essential for wool and pigs were bred within the limits of available fodder. The number of pigs in the material is lowest in

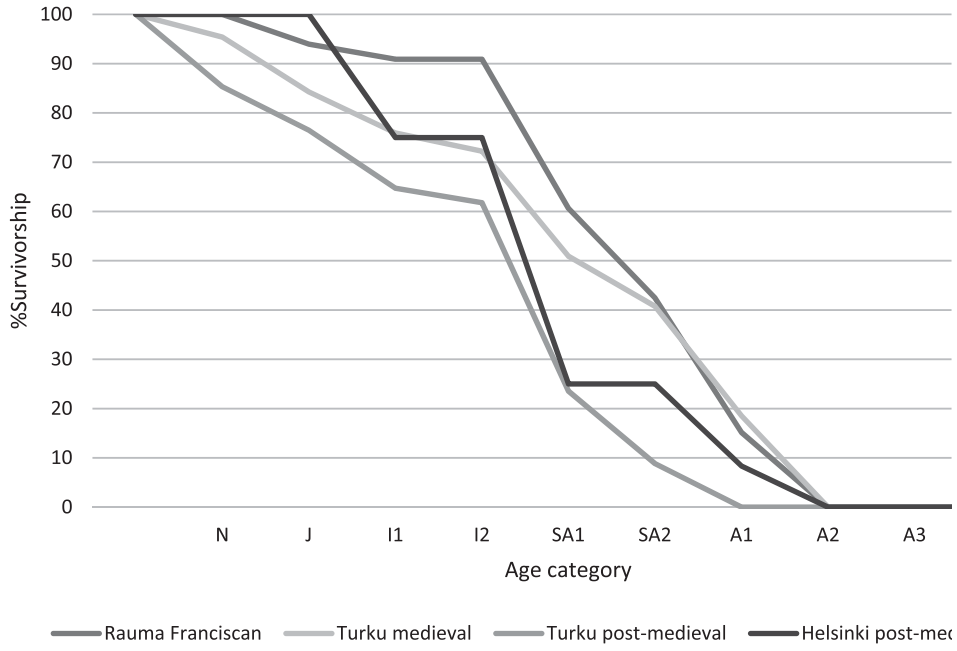

Figure 6. Survivorship curve based pig based on mandibular tooth wear and eruption. N = neonatal, I = immature, J = juvenile, SA = sub-adult, A = adult, E = elderly.

the Northern Finnish samples, increases towards Southern Finland is they are more common still in in Uppsala region in central Sweden (Magnell 2017). This tendency could be related to the unsuitability of colder and harsher climate for pig keeping. However, as major proportion of pig fodder was different waste products, the number of pigs was likely to be more related to the degree of urbanisation, specialisation or intensity of agriculture than directly to the environment (Soininen 1974, but see also Vretemark 1997, 73).

Within this general frame, there are some indications for variation in local agricultural adaptations, which are also evident in the written sources from the post-medieval period (e.g. Luukko 1958; Soininen 1974). The data from northern part of the study area contained more cattle than the southern samples. This could be due to the different character of agriculture in the north, where milk and butter were key agricultural products and meadows were generally abundant (Soininen 1974; Puputti 2010). There was sufficient data on the high number of male cattle in Turku, which was likely to be connected to the use of draught oxen in the area (Vilkuna 1936; see also Rannamäe, Saarma, and Bläuer 2022). Also, it has been suggested that the Turku material includes castrated male sheep, which were probably used for wool production (Tourunen 2008). This could indicate that the secondary animal products, draught power, wool and milk were more pronounced in Western Finland. The higher proportion of sheep and goats in Southwest Finland and perhaps in Satakunta was likely due to the more intensive keeping of goats in the area, evident from written sources (Luukko 1958).

The differentiating socio-economic consumption patterns observed in the Finnish material can be compared with development observed in Northern Baltic Sea area. In early medieval Sweden, and possibly in Estonia, there were higher proportion of sheep (and goat) in the town material, whereas the cattle became more dominant later (Ekman 1973; Vretemark 1997, 75; Magnell 2017; Rannamäe and Lõugas 2019). Previous studies have suggested that cattle was not bred specifically for urban meat markets, but the underlying reason for increasing numbers of cattle was the intensifying agriculture (Vretemark 1997, 75; see also Benecke 1994, 207).

However, a different pattern emerged in Finland. Towns in Finland used a hybrid model for meat purchase, breeding some animals on their own and buying some meat from the surrounding rural area (Kallioinen 2000; Tourunen 2008). The faunal assemblages from the rural sites included more cattle than those from the towns. The better general preservation of the organic material in the material from the towns could explain some of this variation, as the sturdier bones of the cattle could have survived longer in the rural assemblages. The trade of sheep in the towns could also have led to this difference. Cattle, pigs and goats were commonly kept in Finnish towns until the twentieth century (summary in Bläuer 2015). The inhabitants of medieval and post-medieval Turku could have been producing some of the beef and most of the pork they consumed themselves, but sheep in particular were imported from rural areas (Tourunen 2008). Thus, it seems that although it is likely that draught oxen were driven to towns for consumption (Rannamäe, Saarma, and Bläuer 2022), sheep in particular was used to meet the urban demand for meat. Thus, the intensification of agriculture and cattle utilisation for urban consumption that took place in Sweden during the Late Medieval Period did not affect Finland to the same extent. It is likely that the small towns of Finland could not create demand for specialised meat production in the surrounding areas, but most often, surplus animals of agricultural production were consumed in urban space (c.f. Grau-Sologestoa, Albarella, and Quiros Castillo 2016).

Towns in Finland evidently used variable strategies for their meat purchase. In Turku, where medieval and post-medieval data is available, there seem to have been some temporal changes in animal utilisation. The numbers of adult and male cattle, sheep, goats and pigs seem to have increased in Turku during the post-medieval period, although the post-medieval samples are small and would benefit from further investigation (Figures 4–7). This could indicate the import of more carefully selected slaughter animals from the surrounding rural area. The same pattern may apply to Rauma; however, only cattle age profiles were available for comparison. In post-medieval Helsinki, the number of young cattle seems to be higher than those in Turku and Rauma. This could indicate a regional difference between Southwest Finland and Uusimaa, but the data is not yet sufficient for drawing definite conclusions of the possible differences in meat purchase strategies.

It is interesting that in the town of Turku, where it is likely that pig breeding took place, the majority of the sexed individuals derived from males, whereas in the Rauma Franciscan convent, the majority of the sexed jaws derived from females (Figure 7). The frequent infant pig bones indicated breeding within the town of Turku (Tourunen 2008). It is probable that Turku's own pig breeding was only partially capable of meeting the demand, and town inhabitants purchased extra male piglets from the rural area, as castrated males grow faster than females (cf. Virtanen 1927). Similar observations were made for the town material in Sweden (Vretemark 1997, 119). The high proportion of females in Rauma could indicate that breeding of pigs took place in the convent, or that

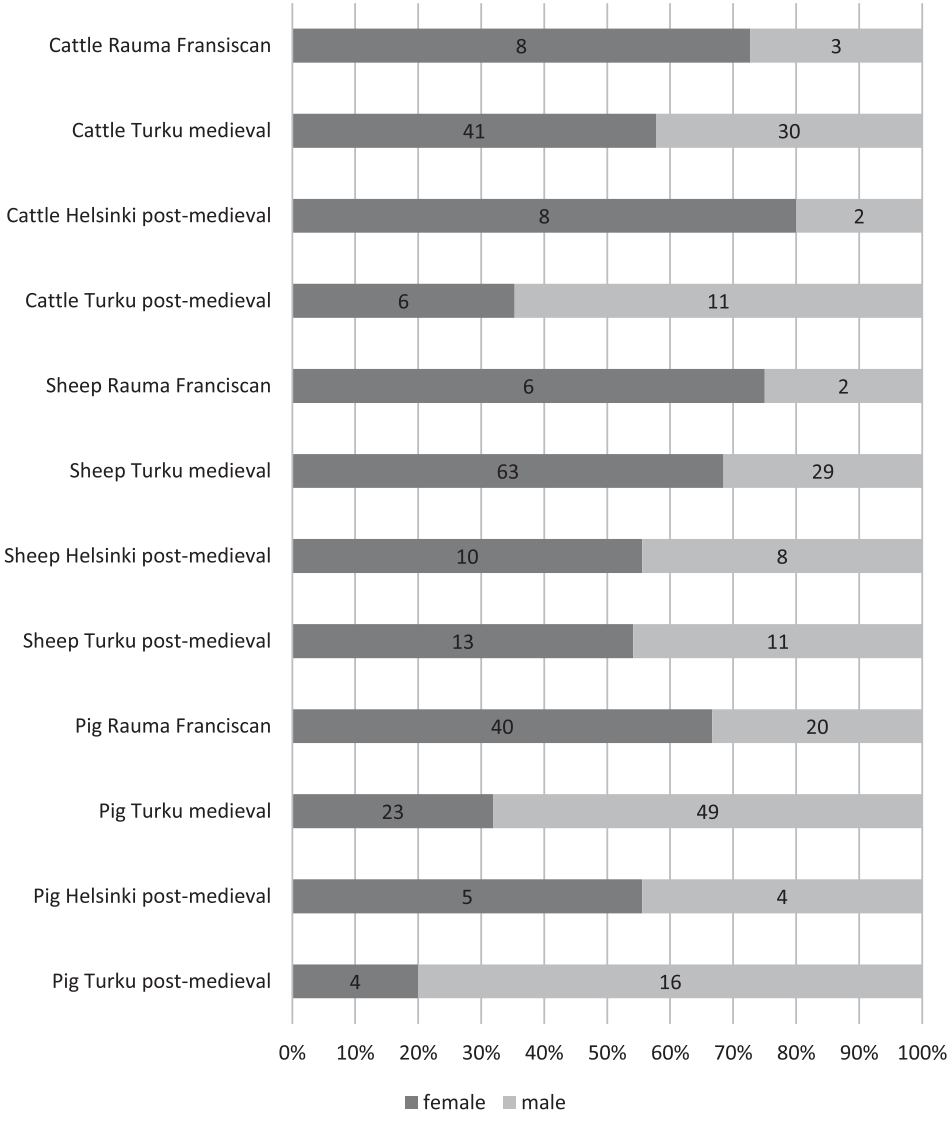

Figure 7. Proportions of male and female cattle, sheep and pigs. Pig data from the canine teeth; cattle and sheep data according to the thickness of the medial edge of the acetabulum.

they selectively purchased females from the local farmers.

The financial resources that monasteries and manors had access to made it possible for them to operate outside the frame of self-supporting subsistence, which is evident in the more variable taxonomic proportions in their faunal material. The economic base of ecclesiastic sites and manors was different from those of rural settlements and towns. The material from Salo Vanhakartano and the Bridgettine Abbey of Naantali had a low proportion of cattle, and the Rauma Franciscan convent had a high proportion of pigs than other material. The presence of specialised food waste in the Naantali sample and the discrepancy of epiphysis-tooth wear age data in Rauma could also be indicative of high status of these sites. Food waste could relate to careful spatial organisation of the food preparation activities. Selective purchase of partial carcasses could lead to the different epiphysis-tooth wear data, as the different anatomical data would derive from the different animals. It seemed that the consumption of pigs and sheep (and perhaps goats) rather than cattle were preferred in these institutions.

This study has created the first overview of data on the medieval and post-medieval cattle, sheep, goat and pig faunal assemblages in Southern and Western Finland. Nevertheless, a more detailed study of the regional differences observed in this paper would be possible in future, when more large assemblages are excavated and analysed. Larger sample sizes would make it possible to study the age and sex division of the material more closely, helping to better understand the selection of the slaughter animals in different site types and regions. This paper have concentrated exclusively on four major mammal species in the assemblages, but the study of the role of fish, birds and wild mammals in the diet would be equally interesting. Furthermore, the Finnish medieval and post-medieval data could be compared with those from preceding Iron Age period to investigate the effect of the Swedish colonisation and urbanisation process in the beginning of the

medieval period. Further, in future when Swedish and Estonian synthesis data will be available, Northern Baltic Sea Region urbanisation development and effect of the different environment for the animal husbandry could be studied in more detail.

Despite these limitations this paper has demonstrated the usefulness of zooarchaeological data in the study of animal husbandry and consumption and production patterns. While synthesis studies require careful consideration of taphonomic factors, integration of data is powerful tool for understanding large scale development and can make it possible to search for typical and untypical features. The history of urbanisation and specialisation of animal production are globally relevant themes that would benefit from multifaceted and multidisciplinary studies, combining zooarchaeology, archaeology and history.

Notes

1. The Finnish word for July means 'hay month' (*heinäkuu*), emphasising the importance of gathering fodder in traditional agriculture.
2. The study area is limited to modern mainland Finland. Given that the cultural connections and development of subsistence on the island of Åland diverge from those on the mainland, it has not been included in this study.
3. In addition, some of the materials discussed here were disposed of after the initial analysis.

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