

Mesowear analysis on Finnish medieval horses

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Mesowear analysis is a powerful tool for paleodiet reconstruction in ungulates. In this study, we apply this method to archeological data. We conduct mesowear analysis on cheek teeth of medieval horses from the Levänluhta site in Ostrobothnia, western Finland and, for comparison, we study medieval and post-medieval horse teeth from Viljandi and Tallinn, Estonia. Our results show attrition-dominated mesowear indicating browsing diet for the medieval Levänluhta horses, while the Viljandi horses have mesowear indicating more mixed diet. Mesowear on teeth from Tallinn horses suggest primarily grazing-like abrasive diet. Differences maybe due to different diet of horses in Finland and Estonia, or may point to seasonal differences in diet and thus indicate different times of death for these horses.

Introduction

Teeth are important research material for archaeologists studying remains of animals hunted or raised by humans. Morphology of teeth is used for species identification (e.g., Halstead *et al.* 2002), eruption stage is used for estimating the age of death (e.g., Silver 1969, Grant 1982) and paleopathological studies can give information about the use and physical condition of the animals (e.g., Burke & Castanet 1995, Dobney & Ervynck 2000).

In paleontology, mesowear method introduced by Fortelius and Solounias (2000) has turned out to be a powerful tool for diet reconstruction in ungulates. Original mesowear analysis is based on facet development on the buccal side of the occlusal surface of ungulate cheek teeth. Wear profile of the buccal enamel band

of metacone and paracone is analyzed. Because the mammalian teeth wear in response to abrasive food items as well as in response to occlusion with a corresponding tooth, different wear facets are observed for abrasive and non-abrasive food items. When eating non-abrasive food, most wear is caused by tooth-on-tooth attrition. This accentuates cusp profiles resulting in high occlusal relief with sharp cusps. On the other hand, grinding of abrasive food items, such as grass, results in more even wear throughout the occlusion surface.

Very few archeological studies have employed mesowear analyses on domestic animals. Rivals *et al.* (2011) studied wild and domestic ungulates in Sparta, and included a mesowear analysis in their work. They found that wild ungulates were browsers while domestic ones were more grazers, and concluded that domestic cattle, sheep

and goat were kept in or near villages where they mainly fed on grass.

In this study, we bring the mesowear method into archeological research of historical horse. This study is a part of our attempt to reconstruct life histories of enigmatic medieval horse finds buried in place used also as a human burial site in the Iron Ages, Levänluhta. Levänluhta is located in Ostrobothnia, Finland, near the city of Vaasa. We hypothesize that the Levänluhta horses and those of neighboring areas were mainly grazers feeding on grasses in summer and on hay, which may be rich in silicates and dust, during winters. We test this hypothesis here using the mesowear analysis.

Material and methods

Archeological horse teeth

The main material in our analysis was the medieval horse remains found in a spring in Levänluhta, Ostrobothnia, western Finland. As reference materials, we studied two materials from a medieval suburban site in Viljandi, and a post-medieval urban site in Tallinn (both in Estonia).

The teeth from Levänluhta belong to the collection of the Finnish National Museum (with NM numbers 6110-746, 6110-78, 6110-18-760, 6110-7-701, 6110-10-758, 21814-80; a M2 and M1 without numbers were also included). Minimum number of individuals (MNI) is 5. The teeth from Viljandi belong to the collection of the Viljandi Museum (Museum number VM 11090). MNI is 4. The three studied crania from Tallinn belong to the collection of the Historical Institute of the University of Tallinn. They were found during the excavations in 1994, 1999 and 2001. MNI is 3.

The archaeological site Levänluhta is a spring with unburnt human and animal bones (Formisto 1993, Edgren 1994, Wessman 2009). Based on the artefact typology and the AMS datings, the human bones were buried AD 300-700 (Wessman 2009). The AMS dates of horse bones and teeth gave medieval dates (AD 1350-1515), indicating that they do not belong to the Iron Age burial activity (M. Oinonen pers. comm.). Complete horses were probably deposited, as

indicated by the presence of different bones and teeth. However, the material is very fragmentary and no associated body parts or teeth preserved in jaws have been found.

The mesowear analysis

The mesowear analysis was conducted for upper cheek teeth. Following the extended model by Kaiser and Solounias (2003) available upper teeth from P4 to M3 were scored. The original method of Fortelius and Solounias (2000) was used. Very worn and unworn teeth were omitted and both buccal cusps, paracone and mesocone, were scored, and the sharpest cusp of the two was chosen for the analysis (Fortelius & Solounias 2000).

We also compared our mesowear profiles with those of Fortelius and Solounias (2000) for modern zebras (*Equus quagga* and *E. grevyi*) and Kaiser and Franz-Odenaal (2004) for Middle Pleistocene *E. capensis*.

Results

The Levänluhta horse teeth showed mesowear similar to browsers, having a high percentage of high cusp and sharp facets. The Estonian horses, however, show mesowear similar to mixed feeders (Viljandi) or grazers (Tallinn). The mesowear profiles of medieval horses from Finland and Estonia differ (Fig. 1). The profile of Levänluhta horses is very similar to that of the Pleistocene *E. capensis*, whereas profiles of the Estonian horses resemble those of modern zebras (Fig. 1).

Discussion

Our analysis indicates that the diet of the Levänluhta archeological horses consisted of non-abrasive items, but horses in nearby Estonia were clearly grazers. This difference is very similar to that found between a Pleistocene species of *E. capensis* from South Africa and modern zebras. According to Kaiser and Franz-Odenaal (2004), *E. capensis* fed on fynbos, a newly-evolved vegetation type poor in grasses. Horses in our study

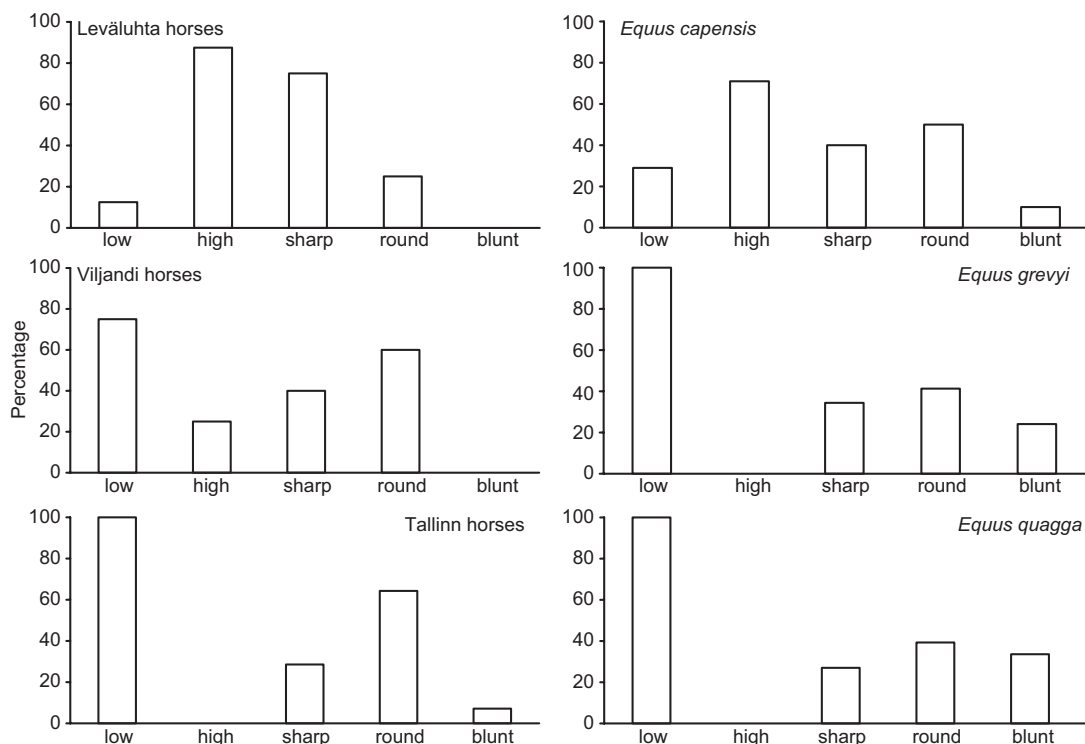


Fig. 1. Results of the mesowear analysis on three archeological materials examined for this study and two recent zebras (from Fortelius & Solounias 2003) and a Middle Pleistocene horse (from Kaiser & Franz-Odenaal 2004).

relied on food supplied by humans and lived in a strongly seasonal environment.

Leväluhta horses were probably stabled during the cold, winter months and turned out during the summer months. Had horses been turned out in forests, mostly browsing would have been available to them. It is however likely that there were pastures in the Ostrobothnia medieval landscape, and grazing was available to horses. One possible explanation for the differences in mesowear among the medieval horses is the season of death. Mesowear signal measures the diet of past weeks, maybe months (Solounias *et al.* 2014). Thus, a horse that died in spring would maintain a mesowear pattern indicating the winter diet. If this is true, then the winter diet would have been non-abrasive.

Horse breeding was well-established in Finland to the extent that good horses were exported to Europe already in the 14th century (Edgren 1985, Kallioinen 2000: 192). However, medieval diet of horses is generally poorly known and very little is known on horse husbandry in Fen-

noscandia. It has been suggested that during the Iron Age in Scandinavia large herds of horses were kept free-roaming (Sundkvist 2004), and this may also be true for the medieval period in Finland. It is, however, likely that best brood mares and stallions were well cared for and there was an established system for horse feeding during harsh winter months.

Our study suggests that in the 14th and 16th centuries in Ostrobothnia horses fed on less abrasive feed, at least during part of the year. In addition to meadow hay, their winter food could have consisted of dried leaves, bark, moss and lichens. Also dried rushes, reeds and sea grasses could have been given to horses (Vilkuna 1935, Talve 1997). In British medieval cities legumes were used to make special horse bread (which was also eaten by humans during famine) (Davis 2004). Historical notes mention that even fish were sometimes fed to horses (Olaus Magnus 1555, Antikas 2008). Isotopic analyses could verify whether it was also true in medieval northern Europe.

There is no doubt that a combination of different osteoarcheological methods, including isotope and dental-wear analyses, and written records will bring about a synthesis and broader understanding of horse husbandry in early times. This pilot study of the mesowear in archeology cannot reveal all the potentials but we believe that mesowear will bring useful raw data for archeological interpretations. Domestic animals are dependent on human provision at least seasonally and this complicates the interpretation of their mesowear analyses.

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