



A palaeodietary investigation of a multi-period churchyard in Stavanger, Norway, using stable isotope analysis (C, N, H, S) on bone collagen

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ABSTRACT

Stable isotopes (C, N, H and S) chemically record information in bone about numerous aspects of past human lives, such as diet, residence and migration. Although widely applied, few stable isotope studies have been carried out for palaeodietary research using Norwegian material, and none from the southwest coast. The first animal and human stable isotope values from the Norwegian Stavanger region are presented in this study, revealing changes in dietary habits through a period of cultural, religious and economic changes in Norway, from the 9th century AD to the post-reformation period (17th century/early 18th century AD). ¹⁴C-datings of some skeletons that gave ages between AD 800–1150 (calibrated, 2 sigma) raise questions about their origin and the expansion of Christianity. The stable isotope results indicate a high protein diet with a substantial amount of marine input. Across the centuries, changing dietary patterns emerge that are probably related to changes in Christian rituals and people's lifestyle. The intensification of fishing activities that characterises medieval Europe is also visible in the isotopic record of Stavanger. The multi-proxy approach in this study proved useful as the addition of hydrogen stable isotopic data allows for improved interpretation of the palaeodiet, whereas sulphur stable isotope data needs further exploration in order to indicate possible migration.

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1. Introduction

Excavations in 1968 and 1993 at Stavanger Cathedral, Norway, revealed burials dating to various archaeological periods. Although the survival of this bone assemblage is quite unique due to poor bone preservation in this region (Naumann et al., 2014), little research has been done on these bones. The excavated remains have suffered a complex curation history, and one skeletal assemblage, excavated in 1968, has since become co-mingled (Denham, 2014). Nevertheless, chemically recorded information from the skeletal material can still be retrieved using stable isotope analysis. As few studies using Norwegian material currently exist (Johansen et al., 1986; Naumann et al., 2014), this assemblage offers the opportunity to examine past life in the Stavanger region across several archaeological time periods. This article focusses on dietary reconstruction for humans and animals covering 800 years of Stavanger history, from the Viking Age to the post-reformation period (17th century/early 18th century). The multi-isotope approach also allows exploration of geographic origin.

The transition from the Viking Age ($\pm$ 800 AD) to the early Middle Ages (11th century) was a time of change for people in Scandinavia (Batey et al., 1994; Price, 2015), during which the increased contact with mainland Europe influenced the Nordic countries on a social-economical, political and religious level, possibly influencing dietary practices as well. During the medieval warm period, people changed from mostly pastoral to arable farming (Sawyer and Sawyer, 1993; Øye, 2002; Yoder, 2010) and fertilised their fields with manure, fish offal, seaweed and algae to increase crop yields (Kvamme, 1988; Orrman, 2003a). Cultivated crops consisted of peas (*Pisum*), beans (*Vicia*), cabbage (*Brassica*), flax (*Linum usitatissimum*) and root vegetables, with barley (*Hordeum*), rye (*Secale*) and oats (*Avena*) being the main cereals (Batey et al., 1994; Price, 2015). The diet was primarily supplemented by fish, as well as a range of other sources, such as nuts, berries and fungi (Roesdahl, 1998). In Southwestern Norway the cultivation of crops in the Viking Age and onwards seems to concentrate on barley and oats, while cultivation of rye and wheat (*Triticum*) was scarce (Øye, 2002; Soltvedt et al., 2007; Prøsch-Danielsen and Soltvedt, 2012; Westling and Jensen, in preparation). The strategy to get dietary supplements from the outfields has had a strong tradition in Norway, and collection for consumption of both nuts and berries continues (Griffin, 1994; Soltvedt and Sandvik, 2012).

An increase in marine resource exploitation across Northwestern Europe emerges in the 10th and 11th centuries, possibly connected to

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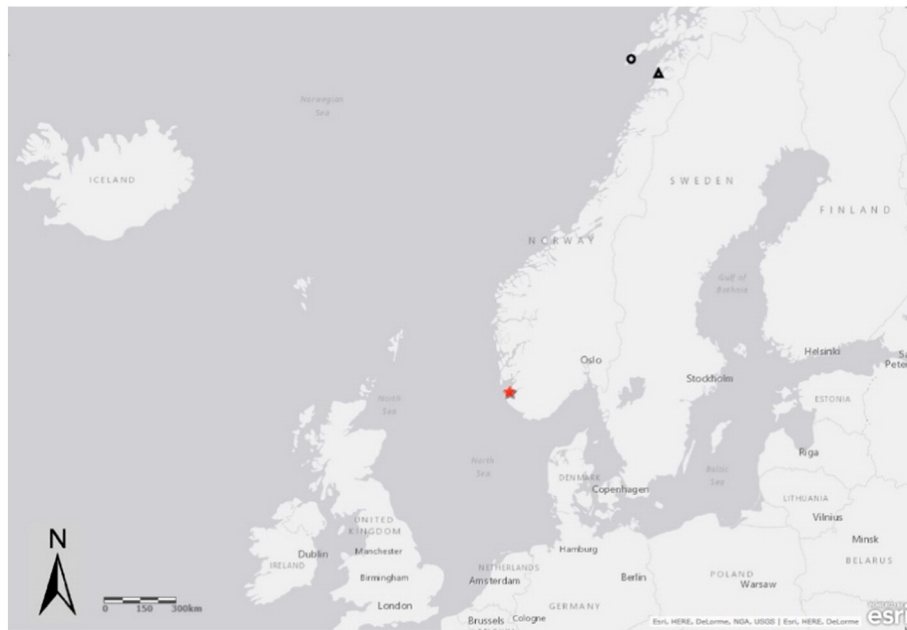


Fig. 1. Map of Northwestern Europe showing the location of Stavanger in Rogaland (star), Holkestadvika in Steigen (triangle) and Storbåthallaren in Flakstad (circle), the latter two both Nordland.

Christian fasting practices and expanding urban centres (Barrett and Richards, 2004; Barrett et al., 2011). High quality stockfish from Arctic Norway soon became the most important traded item, not only during this period but also in the 13th and 14th centuries (Barrett and Richards, 2004). The late Middle Ages witnessed Europe's economic decline due to a deteriorating climate and large numbers of Black Death casualties (Derry, 1979; Price, 2015). These two catastrophes had a large impact on the Norwegians, and survivors in the sparsely populated landscape returned to animal husbandry for their daily living (Orman,

2003b). The Reformation reached Stavanger in 1537 AD (Erslund and Solli, 2012), leading to mitigation of strict Catholic fasting rules. Little is known about the diet in Norway during these transitional phases. Moreover, two individuals dating to the 8–9th century represent the earliest Christian burials yet found in Norway, and may shed new light on the contacts between Scandinavia and mainland Europe before the formal Christian conversion in the 10th century. In addition, the intensification of fishing activities is well studied in regions outside Norway and often assigned to contact with Viking Age colonists, who

Table 1

Overview of the physical anthropological data, museum and sample codes of the human and animal bone material.

Sample number	Taxon	Anatomy	Sex**	Age-at-death	Museum number	Stavanger sample code
NO-STD-HB-19	Human	Femur, right	Female	Adult*	Aksnr 1968/27 S12180.148	SD.1968.FE.R.11
NO-STD-HB-20	Human	Femur, right	Male	Adult (45–50)	Aksnr 1968/27 S12810.282	SD.1968.FE.R.9
NO-STD-HB-21	Human	Femur, right	Possible female	Adult*	Aksnr 1968/27 S12810.211	SD.1968.FE.R.1
NO-STD-HB-22	Human	Femur, right	Male	Young adult (~20)	Aksnr 1968/27 S12810.293	SD.1968.FE.R.10
NO-STD-HB-23	Human	Femur, right	Probable male	Adult (30–40)	Aksnr 1968/27 S12810.286	SD.1968.FE.R.4
NO-STD-HB-24	Human	Femur, right	Probable male	Adult*	Aksnr 1968/27 S12810.290	SD.1968.FE.R.5
NO-STD-HB-25	Human	Femur, right	Probable male	Adult (35–45)	Aksnr 1968/27 S12810.288	SD.1968.FE.R.7
NO-STD-HB-26	Human	Femur, right	Female	Adult*	Aksnr 1968/27 S12810.404	SD.1968.FE.R.3
NO-STD-HB-27	Human	Femur, right	Probable female	Adult*	Aksnr 1968/27 S12810.405	SD.1968.FE.R.6
NO-STD-HB-28	Human	Femur, right	Female	Young adult (~20)	Aksnr 1968/27 S12810.292	SD.1968.FE.R.8
NO-STD-HB-29	Human	Femur, right	Male	Adult*	Aksnr 1968/27 S12810.406	SD.1968.FE.R.2
NO-STD-HB-30	Human	Femur, right	Indeterminate	Adult*	Aksnr 1993/79	SD.1993.FE.R.7 1993/79 Kasse 3 Boks 3
NO-STD-HB-31	Human	Femur, right	Probable female	Adult*	Aksnr 1993/79	SD.1993.FE.R.5 1993/79 Kasse 3 Boks 2
NO-STD-HB-32	Human	Femur, right	Probable female	Adult*	Aksnr 1993/79	SD.1993.FE.R.4 1993/79 Kasse 4 Boks 1
NO-STD-HB-33	Human	Femur, right	Indeterminate	Adult*	Aksnr 1993/79	SD.1993.FE.R.1 1993/79 Kasse 4 Boks 3 Grav N
NO-STD-HB-34	Human	Femur, right	Probable Male	Adult*	Aksnr 1993/79	SD.1993.FE.R.3 1993/79 Kasse 6 Boks 1 Grav F
NO-STD-HB-35	Human	Femur, right	Indeterminate	Adult*	Aksnr 1993/79	SD.1993.FE.R.2 1993/79 Kasse 4 Boks 1 Grav K
NO-STD-HB-36	Human	Femur, right	Possible Male	Adult*	Aksnr 1993/79	SD.1993.FE.R.6 1993/79 Kasse 3 Boks 1
BER-1	Seal	Humerus				JS 493 Prøve nr 9
BER-2	Cattle	Scapula				JS 493 Prøve nr 7
BER-3	Pig	Femur				JS 493 Prøve nr 4
BER-4	Pig	Ulna				JS 493 Prøve nr 3
BER-5	Cat	Femur				JS 493 Prøve nr 10
BER-8	Cod	Vertebra				JS 493 Prøve nr 5
BER-9	Cod	Vertebra				JS 493 Prøve nr 6
BER-10	Cattle	Scapula				JS 493 Prøve nr 8
BER-11	Cat	Femur				JS 493 Prøve nr 11
BER-12	Ling	Vertebra				JS 493 Prøve nr 2
BER-13	Ling	Dentale				JS 493 Prøve nr 1

* Can't be more specific.

** Based on reconstruction of co-mingled individuals by osteometric sorting. See Denham, 2014 for further information.

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