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Resilience and local dietary adaptation in rural Poland, 1000–1400 CE

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ABSTRACT

In Europe during the medieval period, new constraints were introduced to the balance of people's food production, distribution and consumption. As a proxy indicator of diet, stable isotope ratios from osseous remains offer a window into past human lifeways and the adoption of new dietary regimes. We report stable carbon and nitrogen isotope results of a large diachronic study of skeletons from Poland's Pomeranian region in the Vistula River valley, using concepts of resilience, agency, and transition in bioarchaeological research frameworks to explain pace of diet change and intra-population variations in diet. Two skeletal samples are from 10 to 13th century Kałdus, an economic center of the early Piast dynasty, and two are from 12 to 14th century Gruczno, a neighboring agricultural village. Humans exhibit a mean $\delta^{15}N$ value of 9.8 ± 0.9‰, a mean $\delta^{13}C_{coll}$ value of −19.4 ± 0.9‰, and a mean $\delta^{13}C_{ap}$ value of −12.74 ± 1.30‰. Despite similar time periods and shared geographic region, Kałdus and Gruczno differ markedly in terms of fish and millet consumption. Diet does not change according to expectations based on the Christianization, urbanization, and marketization of Poland at this time. Rather than broad national trends affecting what people ate, more significant influences on diet appear to have been local sociodemographic conditions, to which people adjusted in ways that enabled them to retain fundamental aspects of their daily lives spanning the medieval period.

1. Introduction

Diet is one of humans' most fundamental biocultural adaptations, reflecting a balance between energy expenditure, environmental constraint, and nutritional demand, embedded in contexts of varied cultural norms. Social differentiation, systems of production and exchange, religion-based dietary restrictions, and other cultural transitions introduce constraints and prospects to this balance over time, which people can manage in many ways. Adoption of new dietary behaviors is a central research focus in anthropology, reflecting aspects of indigenous resistance (VanDerwarker et al., 2013), destabilization (Kuhnlein and Receveur, 1996), social organization and reorganization (Morehart and Eisenberg, 2010) and changing health (Mailer and Hale, 2015). Isotopic studies of past human populations complement anthropology's ethnographically based understandings of how people mediate demographic and sociopolitical transitions impacting health and behavior, and of how malleable people are in adjusting diets to new cultural, environmental, and biological circumstances.

Transition and change are of thematic importance in bioarchaeology. With the advantage of deep time and the human skeletal record as data, bioarchaeologists are well-positioned to query population-level changes in diet, health, and activity concomitant with large-scale social, political, demographic, and economic transitions. Adaptive responses to large-scale changes were "the founding and first wave of theoretical engagement in bioarchaeology" (Agarwal and Glencross, 2011: 1–2), and a major foothold for the field of bioarchaeology was gained from systematic, compiled studies of biocultural consequences of one of the most significant cultural changes of the human experience, the transition to agriculture (Cohen and Armelagos, 1984; Cohen and Crane-Kramer, 2007; see reviews by Armelagos, 2003 and Gage and DeWitte, 2009). Perhaps owing to this legacy, studying transitions is the bread and butter of the discipline.

Evolutionary frameworks are used to interpret bioarchaeological data, and bioarchaeology has been described as a "field committed to understanding the *adaptation* and the *evolution* of

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social systems" (Armelagos, 2003: 27) and one which "[uses] the analysis of skeletons to measure the effects of social, political, and economic *transformations* on health and illness" (Armelagos, 2003: 29; italics added). Decades of developments in evolutionary theory have expanded neo-Darwinian evolutionary perspectives to embrace cultural and developmental sources of variation and adaptation (Jablonka and Lamb, 2005), yet arguably, evolutionary approaches in biological anthropology continue to prioritize "trait-based natural selection and the use of cost-benefit analyses in explaining human behavioral action" (Fuentes, 2016: S13). Expectations that diet and lifestyle adjustments stem from exterior forces, habitual in bioarchaeology, may be contrasted with the concepts of agency and resilience, in which external pressures do not change people's lifestyles as expected, because people either resist, reshape our environments, or adjust in unlooked-for ways. Whereas evolutionary predictions involving adaptation and change may be adequate to explain human organization on broad time scales, the "noise" of people's behavior on short time scales may be incompatible with this perspective. While concepts of agency and resilience do not specifically describe stasis or a lack of change, they do describe the capacity of a system to dampen the upset of external transition. Agency refers to human beings' capacity to act with intentional and conscious choice (Smith, 2013). Resilience refers to "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks" (Walker et al., 2004). These two concepts, agency and resilience, are closely related because resilience of a socioecological system is greatest when that system has the ability to self-organize into new strategies in the face of exterior forces (Carpenter et al., 2001).

Foodways in particular may be quite resilient in the face of exterior forces, owing to how deeply embedded social identity is in diet and eating behaviors (Counihan, 1999; Holtzman, 2006; Mintz and Du Bois, 2002; Twiss, 2012). Aspects of diet may change without abolishing fundamental characteristics of the menu (cf., Weismantel, 1989). In the present study, we consider concepts of resilience and agency in examining human dietary response to a shifting medieval sociopolitical milieu in the context of rural Poland, contrasting national with local influences on human diet. We apply stable carbon and nitrogen isotope analysis to a large sample of rural peasants from two sites in Poland that differed in their function: Kałdus, a regional commercial/trade hub in decline, and Gruczno, an agricultural village. The four cemeteries included span 1000–1400 CE in 100–150 year increments.

Our first goal is to test the hypothesis that human diet in rural communities of medieval Europe was impacted by broad, national changes. In this paper, we use the term "national" to refer to events widely affecting the geopolitical entity of Poland, without implying the population shared a sense of national identity. A second goal is exploring the rate at which people may have adopted these changes. Specifically, we examine whether there were increases in (1) food diversity, a reflection of trade through interregional and international connectedness, and (2) socioeconomic differentiation, as evidenced by patterned isotopic heterogeneity, including sex-based variations. We also explore whether fish consumption increased at the sites, concomitant with Christian fasting directives that prescribed fish instead of terrestrial animal meat more than 200 days *per annum* (Kloczowski, 2000; Woolgar, 2000). If rural settlements are affected by broad, national trends, we expect to see these predicted changes in diet between 1000 and 1400 CE. Conversely, rural inhabitants may have elected to adhere to traditional foodways, thus exhibiting few changes in isotopic signatures over time, or to make small-scale or unforeseen adjustments in during sociopolitical upheaval, in which case diet change would not track with expectations for change described above.

2. Bioarchaeological stable isotope research in medieval Europe

Use of stable isotope data in paleodietary studies derives from the fact that isotopic ratios of different types of food are preserved in the tissues of consumers (DeNiro and Epstein, 1978, 1981; van der Merwe and Vogel, 1978; Vogel and van der Merwe, 1977). Stable carbon isotope ratios in tissues provide information about the ecosystem of a consumer, distinguishing between terrestrial versus marine niches (Chisholm et al., 1982), and between broad classes of plants (DeNiro and Epstein, 1978; Smith and Epstein, 1971). Stable nitrogen isotope ratios reveal information about an organism's trophic position in the local food chain, distinguishing between carnivores, omnivores and herbivores, and between aquatic and terrestrial food webs (DeNiro and Epstein, 1981; Schoeninger and DeNiro, 1984; Steele and Daniel, 1978). Both carbon and nitrogen stable isotope ratios in plants at the base of the food web are subject to microenvironmental variations and anthropogenic land modifications, meaning not all variation in stable isotope ratios is directly attributable to differences in foods consumed among individuals or populations (Makarewicz and Sealy, 2015; Szpak, 2014; Tieszen, 1991).

Widely applied to examine broad-scale prehistoric agricultural and prehistoric/early historic demographic transitions, stable isotope data increasingly are applied to identify variable dietary patterns in medieval Europe (Alexander et al., 2015; Bourbou et al., 2011; Ciaffi et al., 2013; Fuller et al., 2003; Garvie-Lok, 2001; Halffman and Velemínský, 2015; Herrscher, 2003; Kjellström et al., 2009; Müldner and Richards, 2005, 2007; Polet and Katzenberg, 2003; Quintelier et al., 2014; Reitsema et al., 2010; Reitsema and Vercellotti, 2012; Richards et al., 2006; Schutkowski et al., 1999). Large skeletal samples, refined chronologies, and the contextual information frequently available for the medieval period are boons for hypothesis testing and population research. In much of Europe, the medieval period spans approximately one thousand years of demographic, political and economic transition. Some of these transitions were sweeping, marked, and well-documented (e.g., Christianization, marketization, and urbanization), while others were regional, small-scale, and undocumented. Related changes in settlement structure, occupational differentiation, and food access through trade are reasoned to impact human diet and health by affecting nutrition, disease transmission and resource access (Steckel, 2004). Archaeological medieval diet reconstructions point to a considerable range of variation in human diets in the first two millennia CE. Early and continued focus of biochemical research on the United Kingdom increasingly is being supplemented by work from further east in Europe, which is fortunate, given interregional differences in what constitutes medieval lifestyles. Stable isotope analysis has been applied in a limited number of contexts in modern-day Poland (e.g., Neolithic: Kozłowski et al. (2013), Popieszny (2015); Bronze Age: Pokutta (2013); Iron Age: Reitsema (2012); Roman era: Reitsema and Kozłowski (2013)).

3. Biocultural context

Poland is located at the seam of eastern and western Europe, and provides a conduit from the Baltic Sea to inland regions. Poland's history is marked by migration, cultural diffusion, and multiculturalism. Ethnographically-based questions regarding food access, changing production systems, and dietary choices in the past are well-cast in the context of Poland. In Poland, the medieval period (commencing in 966 CE with the baptism of the Piast state's leader Prince Mieszko) represented a relatively abrupt shift from a tribal existence to a socially, economically, and religiously diverse population (Buko, 2008; Gieysztor et al., 1979). At the turn