

7 Abstract

The objective of this thesis was to reconstruct the living conditions and particularly the nutrition base of an urban and a rural medieval population in Brandenburg, Germany and one population near the sea in Mecklenburg-Vorpommern, Germany. The goal was to comprehend the staple diet as well as the basic quality of the food. The history of human population is tightly interrelated to temporal changes of the inhabited ecosystems. The natural or anthropogenic changes of the environment cause changes in human behaviour and lead to the development of various adaptive strategies of adaptation. Especially the search for resources has elicited man to alter his environment. As such an investigation was lacking until now, femoral and rib samples of about 20 adult individuals and 15 – 21 children of each population as well as animal bones were taken and prepared for the analysis of trace elements and stable isotopes. 15 trace elements (As, Cd, Co, Pb, Ni, Cu, Al, Sr, Zn, Mg, Fe, Mn as well as Ca and P) and the stable isotopes of carbon, nitrogen and oxygen were analysed. The comparison of the rural und urban populations allowed to find qualitative and quantitative differences in the diet and to trace environmental impacts. More features were found to differentiate between social groups, both sexes and different age groups. Another focus of this research was the weaning age of children and the stress caused by heavy metals. Collagen is well suited for the analysis of stable isotopes. It can maintain its molecular structure for thousands of years after the individual's death and is resistant for post-mortem changes. In a living organism the collagenous material will be completely renewed every 10 to 30 years. Based on this fact, it is possible to draw conclusions on dietary customs of an individual living a long time ago. This is possible using the stable isotopes analysis of nitrogen and carbon.

Collagen represents mainly one fraction of protein in food. The main part of nitrogen is taking up with the daily food. The proteins of single individuals possess similar $\delta^{15}\text{N}$ values.

As a result of the “trophic level effect” where consumer tissue $\delta^{15}\text{N}$ values are elevated by approximately 3 - 4 ‰ over dietary protein, breastfeeding children have tissue $\delta^{15}\text{N}$ values 2 - 3 ‰ higher than their mothers. During the weaning process, the consumption of supplementary foods results in a decline in infant $\delta^{15}\text{N}$ values. When a child is fully weaned its protein $\delta^{15}\text{N}$ values are nearly identical to those of its mother, indicating similar diets.

The hydroxylapatite of mineralized tissues contains about 2 - 4 % carbonat (CO_3^{2-}). The $\delta^{13}\text{C}$ in carbonate varies with that in an individual's diet, the offset between diet and carbonate values being about 9 – 10 ‰. For an adult skeleton, a complete

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replacement cycle takes about 7 – 10 years. Carbonate $\delta^{13}\text{C}$ reflects the carbon stable isotope values in whole diet not just in proteins.

In the mineral fraction of bones and teeth, oxygen is present both in carbonate and phosphate. Oxygen isotope ratios ($\delta^{18}\text{O}$) in meteoric water varies with climate, and in most regions a firm relationship exists between $\delta^{18}\text{O}$ and temperature, lower temperatures causing a lower $\delta^{18}\text{O}$ values in body are, for most larger mammals, directly related to their drinking water.

According to this analysis in Bernau weaning happened at the age of about two. In the village of Tasdorf weaning occurred a little later, at the age of two-and-a-half year and in Usedom it was the longest weaning process: children were breastfeeding up to and above the age of three years.

In medieval times meat was expensive and only available to the upper class or perhaps even only for the wealthy. As a result the stable isotope analysis of the skeletons from people of lower social status should indicate a higher fraction of vegetable food.

The distribution of the fractions of stable carbon and nitrogen in the village of Tasdorf suggests a high portion of vegetable food, whereas the nutrition base of the urban environment in Bernau offered a higher proportion of meat-consumption. Interestingly, the women of Tasdorf showed a lower $\delta^{15}\text{N}$ value compared to the men, suggesting that the men in Tasdorf consumed more meat than their wives.

In Usedom, the $\delta^{18}\text{O}$ values indicate to a colder climate than in Bernau or Tasdorf, and astonishingly, in the island town Usedom marine protein can be ruled out as a major source of nutrition.