

Carbon isotope ratios of human tooth enamel record the evidence of terrestrial resource diet during the Jomon period

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Archaeological remains strongly suggest that the Holocene Japanese hunter-gatherers, the Jomon people, utilized terrestrial plants as their primary food source. However, carbon and nitrogen isotope analysis of bone collagen indicates that they primarily exploited marine resources. We hypothesize that this inconsistency stems from the route of protein synthesis and the different proportions of protein-derived carbon in tooth enamel versus bone collagen. Carbon isotope ratios from bone collagen reflect that of dietary protein and may provide a biased signal of diet, whereas isotope ratios from tooth enamel reflect the integrated diet from all macronutrients (carbohydrates, lipids, and proteins). In order to evaluate the differences in inferred diet between the archaeological evidence and bone collagen isotope data, this study investigated carbon isotopes in Jomon tooth enamel from four coastal sites of the Middle to Late-Final Jomon period (5000-2300 years BP). Carbon isotope ratios of human teeth are as depleted as coeval terrestrial mammals, suggesting that C₃ plants and terrestrial mammals were major dietary resources for the Jomon people. Dietary dependence on marine resources calculated from enamel was significantly lower than that calculated from bone collagen. The discrepancy in isotopic ratios between enamel and collagen and the nitrogen isotope ratio in collagen shows a negative correlation on individual and population levels, suggesting diets with variable proportions of terrestrial and marine resources. This study highlights the usefulness of coupling tooth enamel and bone collagen in carbon isotopic studies to reconstruct prehistoric human diet.

Keywords: diet, collagen, enamel, human, Holocene