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Lactation and gestation influence the body calcium isotope composition: insights from wild and domestic mammals

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Milk production and excretion may drive sex specific differences in body calcium (Ca) isotope composition, as evidenced by sheep bones collected within a single herd [1]. Such differences between sexes are however not observed in human populations [2], raising questions about Ca isotope fractionation mechanisms in mammals. We investigated this issue by studying a free-ranging red deer population and three female pigs raised under controlled conditions. We coupled this experimental approach with box-modeling of a female pig-like animal experiencing different scenarios of Ca fluxes and isotopic fractionations. The wild red deer population exhibits a similar male/female isotopic difference ($\Delta^{44/42}Ca_{\text{lactating females-males}}$ = +0.17 ± 0.10 ‰) compared to domestic sheep ($\Delta^{44/42}Ca_{\text{females-males}}$ = +0.14 ± 0.08 ‰ [1]), demonstrating that sheep are not an isolated case. The experiment with domestic pigs and associated modeling confirm that bone ^{44}Ca relative enrichment occurs during nursing as a consequence of lactation. Our data also suggest that consecutive gestations and associated high Ca intakes (e.g. in animal husbandry contexts), can reduce the isotopic offset between animal tissues and diet (e.g. $\Delta^{44/42}Ca_{\text{bone-diet}}$), an essential finding for accurately interpreting Ca isotopes as a diet proxy in mammal past communities. Finally, in line with other publications (see Tacail et al. 2020 and reference therein [3]), our experimental and modeling results also support that bone mineralization is associated with a more restricted Ca isotopic fractionation than previously envisioned. A result which has notable implications for the use of Ca isotopes as a human bone balance proxy and osteoporosis diagnostic tool.

References:

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