

How inter-species variation in strontium-calcium ratios of leaves and fruit informs dietary reconstructions

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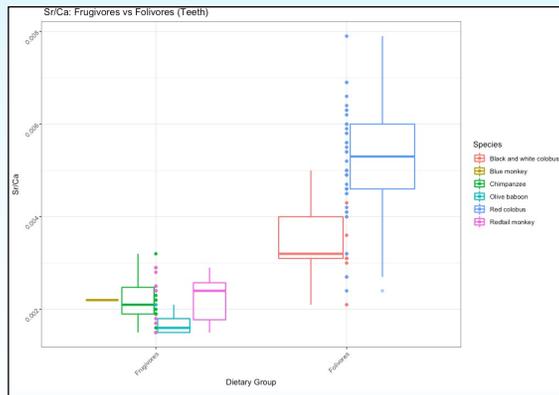
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INTRODUCTION

Strontium-calcium ratios (Sr/Ca) are a useful tool for dietary reconstructions. While often used to assess trophic level, Sr/Ca ratios may also vary *within* trophic levels based on the concentrations of each element within dietary sources. Frugivores and folivores, for example, should differ because of discrimination during xylem transport within the plant. We use ICP-MS and non-destructive X-ray fluorescence (XRF) to quantify and compare the strontium, calcium, and Sr/Ca ratios in fruits (XRF), leaves (XRF), and primate tooth enamel (ICP-MS) from specimens collected in Kibale National Park, Uganda from 2014-2017.

RESULTS: PRIMATE TEETH

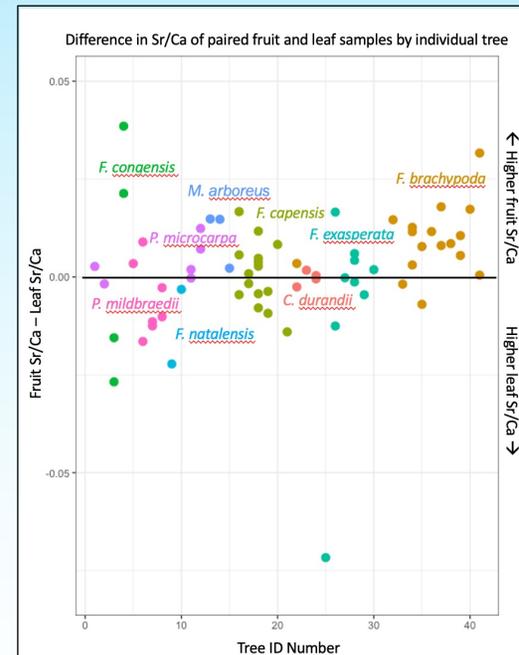
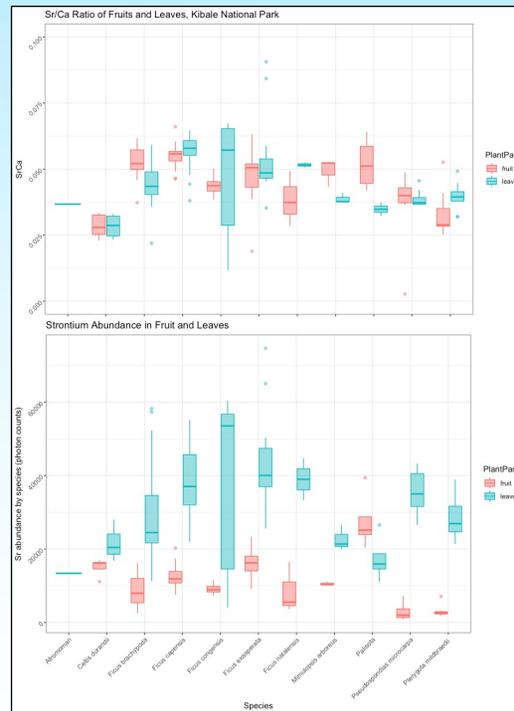
Folivorous primates have higher Sr/Ca ratios than frugivores primates, but fruits and leaves themselves have indistinguishable Sr/Ca ratios. This is because leaves have higher absolute concentrations of both Sr and Ca than fruits. While Ca uptake is metabolically regulated, Sr concentrations in tissues correlate with concentrations in food sources, leading to greater concentrations in folivores.



RESULTS: FRUITS AND LEAVES

Previous research shows absolute concentrations of Sr and Ca, as well as Sr/Ca ratios, change throughout plant tissues, based on soil composition, and between species. There is substantial variation in absolute and relative abundance of Sr and Ca among Kibale trees.

1. While leaves and fruits do not overall differ in Sr/Ca ratios, some individual species do exhibit significant differences (ex: *Ficus brachypoda*), in which fruit have higher Sr/Ca ratios than leaves
2. Some trees (*Celtis durandii*, *Mimulopsis arboreus*) have leaves with notably lower Sr concentrations; folivores with preference for these species would have lower Sr/Ca ratios than other folivores (ex: black and white colobus monkeys)
3. Paired fruits and leaves from the same canopy location within the same tree show differences in intra-species variability, with some species (*F. exasperata*, *F. congensis*) exhibiting high variation in Sr/Ca fruit/leaf differences and others (*C. durandii*) exhibiting very little variation.



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IMPLICATIONS AND FUTURE DIRECTIONS:

- The difference in Sr/Ca ratios *between* dietary guilds is robust to variation within food sources such that folivores have reliably higher ratios than frugivores within an ecosystem
- *Within* dietary guilds, species-specific variation in Sr and Ca, and Sr/Ca ratios, can influence Sr/Ca in primate tooth enamel. For example, while black and white colobus monkeys are more dedicated folivores than red colobus monkeys, reliance on relatively low-Sr leaves drives their Sr/Ca ratio lower than that of more frugivorous red colobus monkeys.
- Sr/Ca ratios are a promising avenue of dietary reconstruction for fossil species. Future studies must examine the role of location in driving Sr, Ca, and Sr/Ca variation in plants to determine the geographic transferability of this method and assess if XRF is an accurate way to obtain Sr/Ca data from primate teeth.