

# **Feeding ecology of golden-faced sakis in a forest fragment in Manaus, Brazil: Comparison to sympatric squirrel monkeys**

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## **Introduction**

Niche separation is considered an important mechanism to reduce competition for limited resources and facilitate the coexistence of different species. Primate communities in Central and South America are characterized by the high occurrence of frugivores compared to the other primate communities in Asia, Africa, and Madagascar. For a better understanding of the mechanisms that maintain the American primate communities, a comparative study focusing on the detailed usage of fruits is required. Pitheciines (sakis and uacaris) are known to exhibit unique feeding habits on fruits. Unlike most primates that only eat the pulp of ripe fruit, pitheciines also frequently eat the seeds, especially those of immature/unripe fruits. In this study, I aimed to demonstrate the relative characteristics of the feeding ecology of golden-faced saki (*Pithecia chrysocephala*), in comparison with sympatric non-seed-eating primate, common squirrel monkeys (*Saimiri sciureus*).

## **Methods**

I conducted this study in a 26-ha forest fragment in Manaus, Amazonas, Brazil. I observed the feeding behavior of two groups of golden-faced sakis and a group of common squirrel monkeys for 3–4 days per month, from March 2019 to February 2020. When monkeys ate fruits, I recorded the species, eaten part, and ripeness stages. I also conducted monthly fruit censuses to estimate fruit availability. To reveal the relative advantages of sakis in fruit availability, I calculated the proportion of available fruiting trees and vines for each

primate species separately, based on the observed diet, and compared them. To examine the factors that influence their fruit choice, I collected eaten and uneaten fruit items and measured their chemical components and morphological traits. I performed multivariate analysis to evaluate the relative importance of the factors that influence the overall fruit choice and the choice for each fruit part (seed and pulp), respectively.

## **Results and Discussion**

The proportion of available fruiting trees and vines was significantly higher and more temporally stable for golden-faced sakis than for sympatric squirrel monkeys. This was because sakis used shared fruit species earlier and over a longer period than squirrel monkeys by consuming the fruits at both unripe and ripe stages. Sakis used a wider variety of fruit species than squirrel monkeys, but it did not contribute to the higher fruit availability. Thus, the fruit feeding system of sakis identifies aspects of a niche that is less restricted in the timing of fruit consumption, which led to a relative advantage in fruit availability. In overall fruit item choice, sakis positively chose fruit items with large seeds. In contrast, squirrel monkeys avoided fiber-rich, hard items. These differences between sakis and squirrel monkeys suggest sakis' special morphological and physiological adaptations to enjoy the nutritional value of seeds. In addition, sakis' selectivity for seeds and pulp (i.e., avoiding hard seeds and choosing pulp to maximize protein intake) implicated challenges of sakis' almost exclusively fruit-composed diet: they need to meet their energy and nutritional requirements within one category of food, fruits, and may tend to lack protein compared to folivores or insectivores. The fact that the interspecific difference appeared even in the choice of ripe pulp indicated sakis not only broadened their diet breadth to hard, fibrous fruit items but also changed the choice for ripe pulp, a common and competitive food resource for primates.

## **Conclusion**

The present study revealed that sakis' flexible fruit choice involving choice of consumption timing gave them relative advantages in fruit availability over sympatric squirrel monkeys. In addition, I found the different criteria that determine the species-specific fruit choice of sakis and squirrel monkeys, which indicated both benefits and constraints of sakis' feeding ecology in terms of nutrition intake.