# An experimental study of feeding preferences of *Ctenosaura similis*

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*Abstract: Ctenosaura similis* is a primarily herbivorous lizard, but has been observed to consume a wide variety of other foods including small rodents and lizards, insects, fruits and flowers. We hypothesized that, when given a choice, ctenosaurs would select foods with (apparently) higher nutritional value than leaves. We tested our hypothesis by providing ctenosaurs with a variety of foods, then observing their consumption order and the amount of each food consumed. Ctenosaurs showed strong preferences for items with relatively high sugar (fruits) or relatively high protein (meat or insects) and rarely chose leaves or flowers. This implies that when the costs of food capture and foraging are removed, ctenosaurs will opportunistically feed on foods other than their normal diet.

*Key Words: food preference, herbivory, Iguanid lizards, omnivory, opportunistic feeding*

## Introduction

The iguanid lizard, *Ctenosaura similis*, consumes a wide variety of foods. Its diet is partially dependent on the season and food availability. Nevertheless, ctenosaurs are considered to be primarily herbivorous, eating a mix of low growing herbaceous vegetation with a preference for leaves that are relatively low in fiber and relatively high in protein (Janzen 1983). In the dry season, when succulent growth is scarce, ctenosaurs often make long trips to feed on flowering and fruiting trees (Janzen 1983). However, ctenosaurs have also been known to consume insects, rodents, small lizards and to cannibalize the eggs and tails of other ctenosaurs, suggesting an omnivorous capability. In this study, we investigated the food choices and preferences of ctenosaurs. We hypothesized that ctenosaurs should optimize their nutritional intake when given a choice, i.e., when the costs of food capture and foraging are eliminated, ctenosaurs should consume foods with the highest nutritional value.

## Methods

On 11 January 2002, between 10:00 and 15:00, we observed *Ctenosaura similis* on the grounds of the OTS Biological Station in Palo Verde National Park, Guanacaste Province, Costa Rica. On 12 January 2002 between 10:00 and 12:00, we observed *Ctenosaura similis* in the vicinity of the park ranger station (the "Hacienda") ~2 km west of the OTS Station. Ctenosaurs were presented with a choice of five different food types: meat, fruit, flowers, insects and leaves. The meat was cooked ground beef with seasonings and was considered to represent a high protein and high lipid food choice. The fruit was a combination of bananas and fruit from a *Sideroxylon capiri* tree (we had earlier observed ctenosaurs feeding on the latter). These fruits were considered to be a source of dietary sugar and water. We collected small purple flowers from a low growing herbaceous plant along the airstrip south of the OTS Station, which probably contained some trace sugars and nutrients. We also caught nearby insects (predominantly grasshoppers), which represented a less concentrated protein source than the beef. We froze the insects to prevent their escape from the petri dish. Lastly, we collected a heterogeneous mixture of herbaceous leaves from low-growing vegetation that we had observed ctenosaurs eating around the OTS Station. The leaves, like the flowers, were considered to be low in protein and digestible carbohydrates.

We presented the food to 20 individual ctenosaurs on a 10 x 40 cm ceramic plate, placing an equal volume of each food choice in individual petri dishes and aligning the petri





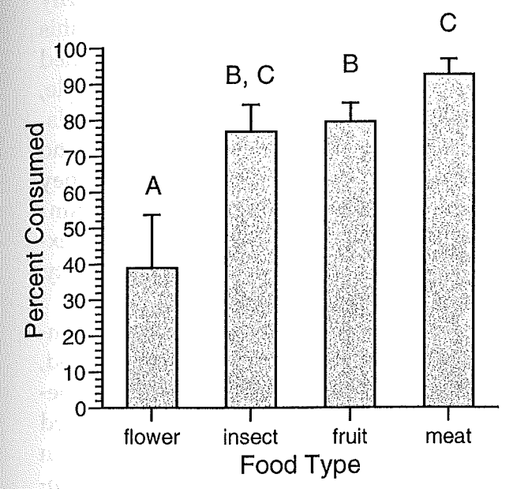


FIG. 1. Results of food choice trials with ctenosaurs at Palo Verde. Data are mean ± SE percent of each type of food that ctenosaurs consumed. Data are only included for trials in which some of the given food type was consumed. Different letters indicate significant differences (Tukey-Kramer) between food types.

dishes at intervals on the plate equidistant from the focal ctenosaur. The food was placed in a random order on the plate and rotated for each trial. We placed the plate of food as close to a focal ctenosaur as possible without scaring it, then backed away to observe its response. We recorded the order in which the food was consumed and once the ctenosaur moved away from the food, we retrieved the plate and estimated the percent volume of each food the ctenosaur consumed.

Data were analyzed in two ways: the order in which the food types were chosen (1st, 2nd and 3rd choices) and the percent of chosen food that was consumed. Using a G-test, we evaluated whether or not the ctenosaurs chose food types randomly and investigated the various food choice permutations. We used an ANOVA and a Tukey-Kramer comparison to determine whether the amount of chosen foods differed.

## Results

The ctenosaurs exhibited strong food preferences when presented with a choice between fruit, meat, insects, flowers and leaves (Table 1). They showed a distinct preference for fruit as their first selected food item ($G = 44.36$, $df = 4$, $P < 0.0001$). When fruit was chosen first, the predominant second choice was meat. When fruit was chosen first and meat was chosen second, insects were the most common third choice (Table 1). Flowers were rarely eaten and leaves were never consumed. In 12 of the 20 trials, the ctenosaurs made three or more selections during the trial period. In the other 8 trials, the ctenosaurs stopped eating after selecting one or two food types. The ctenosaurs chose the permutation of fruit first, meat second and insects third, 50% of the times when three choices were made ($n = 6$). The next most common permutation when three choices were made (fruit, insects and then meat) occurred only 14% of the time. The

TABLE 1. Food preferences of ctenosaurs given the choice of several food types. Data are percentage of times ctenosaurs chose each food type first, second after fruit and third after fruit and meat. Since fruit was the overwhelming first choice, alternatives for second and third choices after first choice other than fruit were statistically insignificant ($G3 = 6.00$, $P = 0.11$).

| Food Type | Percent of times chosen first | Percent of times chosen second after fruit | Percent of times chosen third after fruit and then meat |
|---|---|---|---|
| Fruit | 72.7 | - | - |
| Meat | 27.3 | 78.6 | - |
| Insects | 0 | 14.3 | 85.7 |
| Flowers | 0 | 7.1 | 14.3 |
| Leaves | 0 | 0 | 0 |

TABLE 2. Food preferences of ctenosaurs given the choice between several food types. Data represents percentage of times ctenosaurs chose each food type first, second and third.

| Food Type | Percent of times chosen first | Percent of times chosen second | Percent of times chosen third |
|---|---|---|---|
| Fruit | 73 | 17.6 | 8.3 |
| Meat | 27 | 64.7 | 16.7 |
| Insects | 0 | 11.7 | 58.3 |
| Flowers | 0 | 5.9 | 16.7 |
| Leaves | 0 | 0 | 0 |

ctenosaurs consumed greater than 50% of the foods they chose in the petri dishes, except in the case of the flowers of which they consumed less than 40% ($F_{3, 49} = 7.39$, $P = 0.0004$, for test of no difference among food types in percentage consumed; Fig. 1).

## Discussion

When given the choice between fruit, meat, insects, flowers and leaves, ctenosaurs prefer primarily fruit, secondarily meat and then insects, flowers and leaves respectively. Our results support the hypothesis that when given the opportunity, ctenosaurs will choose foods that we presume to have the highest nutritional value instead of choosing the leaves that generally compose most of their diet. This strategy should maximize their nutritional intake. Ctenosaurs may primarily consume low-growing vegetation because this food source is plentiful and can be obtained with less effort and skill than, for example, hunting insects or small mammals. Ctenosaurs may be opportunistic eaters who maximize their nutritional intake when they have the chance. Under normal circumstances, it is likely that they do not often expend the energy required, or have the ability, to capture live animal food.

Possible problems with our experimental design include the presentation method, as well as the types of food we offered. Because the type of cooked meat that we used would never be found in nature (except in human refuse), the presentation of an improbable food source may have affected our results. Nevertheless, a strong preference for meat was shown and this suggests a preference for highly nutritional food source. This study demonstrates that, although organisms may have a wide variety of dietary habits, their realized diet is potentially limited by food availability and the costs associated with food capture.

## Literature Cited

Janzen, D. H. 1983. *Ctenosaura similis*. Pp. 394 - 396 *in* D.H. Janzen ed. Costa Rican Natural History. Chicago, IL: The University of Chicago Press.