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Feeding Habits of *Trachemys callirostris* (Gray, 1856) (Testudines: Emydidae), San Benito Abad, Sucre, Colombia

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Abstract

Objective: An analysis was carried out on the volume of digestive contents of plant and animal origin materials, using *Trachemys callirostris* collected during subsistence hunting as a reference based on the differences between the genders. **Methods/Statistical Analysis:** The digestive contents of 53 *T. callirotris* individuals were examined: 10 males and 43 females, from the wetland complex of the municipality of San Benito Abad, Sucre, Colombia. The analysis of the digestive contents was grouped by gender, differentiating between plant material and animal material; in addition, morphometric measurements of the specimens were taken. **Findings:** No significant differences were determined for the plant material between the genders. However, for the animal material, there were significant differences that favored the females; there were significant differences between the genders, with higher variable means in the females. **Application:** This knowledge on diet helps establish differences for the appropriation of food resources that may be related to the ecological aspects of this species, while offering valuable information that can be used for the conservation of this species and its habitat.

Keywords: Caribbean, Chelonian, Colombia, Diet, Natural Environment

1. Introduction

Trachemys callirostris, commonly known as hicotea or the Colombian Slider, is a species that belongs to the Order Testudines, Family Emydidae. It is aquatic to semi-aquatic, with a moderate size that does not exceed 35 cm in total length. It has diurnal habits although, in the reproductive season, its habits can be nocturnal. It has been documented that *T. callirostris* is one of the more exploited turtles in Colombia[1].

It has been reported as omnivorous and opportunistic, feeding on algae and aquatic vegetation, but also including tadpoles, worms, mollusks, insects and arthropods and even dead fish and mud rich in nutrients in its diet. Young individuals and juveniles show a greater attraction towards animal prey and ingesting large quantities of small insects and zooplankton[2–5].

In general, aquatic turtles are omnivores, with some exceptions such as *Chelonia mydas* (Green Sea Turtle), which feeds on seagrass and *Dermatemys mawii* (Central American River Turtle), which is eminently herbivorous6. However, variations in diet can occur depending on the time of year, habitat, ontogenetic development and gender[7].

In the present study, an analysis of digestive contents was carried out, differentiating plant material and animal material, using specimens collected during subsistence hunting as a reference based on the differences between

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the genders, which came from the wetland complex of the municipality of San Benito Abad, Sucre, Colombia.

2. Materials and Methods

2.1 Study Area

The municipality of San Benito Abad is located in the southwest of the Department of Sucre, Colombia, Caribbean region, at 8°38'N and 75°04'W, between 15 and 20 m.a.s.l.; it contains a wetland formation with a tropical dry forest[8]. Four zones were used (Table 1). The present study was carried out during the months of January, February, April, July, August and November of 2013 and 2014.

2.2 Methods

The analyzed specimens came from captures for consumption or subsistence hunting exercised by the inhabitants of the area during the dry season and flood season. The digestive contents were taken: Stomach and large intestine of 53 individuals: 10 males and 43 females[9]. Each sample was labeled with the date, capture site, gender and maturity stage.

Once deceased, the digestive tract was removed and 4% formaldehyde was injected to paralyze the digestive processes[10]. The preservation of the material (stomach and intestines) was done with a solution of 10% formaldehyde buffered with glycerin. In the laboratory, the material was separated, washed with distilled water and stored individually in a 70% ethanol solution for preservation and subsequent study. The analysis of the ingested amounts of plant material and animal material, by gender was done in a laboratory with a stereoscope (WF10x and WF20x, 10X and 20X magnification) (Amscope, Se400-z).

The morphometry included taking measurements in a straight line, using a field scale and pediatric measuring tape: Weight (P) in gr, Total Length of the Carapace (LTC) cm, Total Length of the Plastron (LTP) cm, width of the carapace (Ac) cm, bridge length (P) cm and height (H) cm[11].

Table 1. Study area with coordinates of the capture sites of the analyzed specimens

Zones	North	West
La Isla	8°54´33´´	75°01´57´´
Cispataca	8°53´08´´	75°04´07´´
Olaya	8°50´54´´	75°00´21´´
Machado	8°51´57´´	75°58´03´´

2.3 Data Analysis

The complementary statistical analyzes included normality tests of Shapiro-Wilk and/or Kolmogorov-Smirnov for the data corresponding to the plant digestive contents and animal digestive contents and a contrast test of the means to compare the mean weight of the digestive contents in the males and females[12].

3. Results

The digestive contents of 45 females and 10 males were examined. The contrast tests of the means, differentiating the variables for each gender, showed that there were statistically significant differences by gender, with higher variable means in the females (Table 2).

In the plant material, abundant remains of grasses, algae and seeds were found, along with smaller quantities of pieces of stems, flowers and petals; in the animal material, remains, such as scales and spines of fish, bivalve shells and mollusks were observed, along with small portions of exoskeletons of some insects.

The contrast test of the means showed no statistically significant differences between the genders for the plant material. However, for the animal remains, there were significant differences that favored the females (Table 3).

4. Discussion

Feeding can be regulated by numerous factors, including the availability of prey, energy requirements, environmental conditions, social behavior and diet quality[13, 14]; all of these factors play an important role in the regulation of ingestion, but animals regulate their diet to obtain the necessary energy requirements[15].

A correlation between body size and greater or less herbivory may occur because the required energy factors limit the ability to obtain the metabolic requirements in a total carnivorous diet[16, 17]. A large muscle mass means that larger turtles spend much more energy in the pursuit and capture of prey than smaller turtles. The net gain for large turtles is lower than for small turtles; so a diet with plants allows a lower energy expenditure because they are

Table 2. Statistical analysis of morphometry by gender

Variables	Gender	N	Average	Standard deviation	Sig.
Weight (g)	Male	10	619.10	174.69	0.000**
	Female	45	1116.11	257.86	
Total length of the carapace (mm)	Male	10	164.70	16.75	0.000**
	Female	45	197.00	16.70	
Carapace width (mm)	Male	10	155.00	15.54	0.000**
	Female	45	199.29	18.96	
Height (mm)	Male	10	66.70	9.37	0.000**
	Female	45	87.44	10.85	

** Statistically significant difference $p < 0.05$

Table 3. Statistical comparison between the genders for the digestive contents

Weight of digestive contents	Median	Reference values		Rank	p
		Minimum	Maximum		
Vegetables					
Female	0.65	0.03	92.08	92.05	0.636
Male	2.58	0.33	6.72	6.39	
Animals					
Female	0.10	0.01	6.08	6.07	0.009**
Male	0.61	0.01	1.49	1.36	

** Statistically significant difference $p < 0.05$

typically more abundant than animal prey[18]. This could partially explain the difference found in the ingestion of plant material in the females, which, although it was not statistically significant, was observed when examining the minimum and maximum ranges, leading to this inference.

There is an unfavorable relationship between body mass, specific energy requirements and intestinal capacity according to the size of the animal, which limits diet possibilities and consequently decreases the ability to subsist on low nutrient diets and low energy concentrations, including diets composed primarily of plants[18, 19]. A better strategy would be omnivory, where the ingestion of animal material plays an important role; hence, chelonians with a small body size can function as herbivores if their capacity to process adequate volumes of diluted nutritional diet is limited[18, 19]. An omnivorous diet benefits an animal because the nutritional value is greater than when the diet is only composed of animal items or plant items exclusively, which favors many species of chelonians[14], as is the case in the instant analysis of the functional feeding strategy[17].

The intake of animal material was significantly higher in females, which could be related to their size and the need for the appropriation of better quality protein given the needs of their reproductive metabolism, involving an increase in their metabolic rate; undoubtedly, diet is related, among other aspects, to energy requirements[13] and gender[7]. In general, the ingestion of animal material seen in both genders is favorable if one takes into account that a simple diet is not qualitatively superior since mixtures allow for the complementary intake of necessary nutritional foods (plants and vegetables), which aid in digestion and the use of nutrients post-digestion[20].

5. Conclusion

The existence of an omnivorous diet was evidenced for *T. callistrostris* whose content is broad since it includes several plant and animal items. On the other hand, it is particularly important to note that differences according to gender were determined with respect to the intake of food types, which could be related to specific metabolic requirements and size differences.

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