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The Feeding Ecology of Red-Patas Monkey (*Erythrocebus* Patas) in Old Oyo National Park, Southwest Nigeria

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Abstract

The present trend in the modification of primates' habitat had caused the proportion of secondary forests to increase at the expense of primary forests adversely affecting forest composition and species abundance forcing most primate species to cope with large shifts in ecological conditions and associated food resources. This study was initiated to assess the feeding ecology of Red patas monkey (*Erythrocebus patas*) in Old Oyo National Park (OONP) using scan sampling techniques. Sixty-three scans with 39 (61.91%) and 24 (38.09%) scans were recorded in Sepeteri and Marguba ranges respectively. The diet of *Erythrocebus patas* consists primarily of *Acacia seyal* (swollen thorns, leaves and flowers), *Parkia biglobosa* (fruits), *Mangifera indica* (fruits) and *Vitellaria paradoxa* (leaves and fruits). The highest percentage of time spent (25.31 = 41 minutes) was with *Acacia seyal* (flowers, gum and young swollen thorns) while the lowest time spent ((6.17% = 10 minutes) was recorded for *Vitellaria paradoxa*), both at Sepeteri range with no significant difference ($p \geq 0.05$; $t = 0.91$) in the time spent by the animals in eating in the two study areas. It is, therefore, necessary to safeguard the tree species most importantly, those forming the food of the animal, from indiscriminate felling for charcoal production and also anti-poaching patrol should be beefed up to save the relics of the animal from expiration.

Keywords: Primates; Ecological Condition; *Erythrocebus Patas* Indiscriminate Felling; Anti-Poaching

Introduction

The patas monkey (*Erythrocebus patas*) is a large primate gum-specialist and the only Old-World anthropoid that shows a degree of specialization on gum diet [1] with the adult female weighing about 4 – 7.5 kg, and adult males, about 7.5 – 13 kg [2]. *Erythrocebus patas* is diurnal in nature and spends about 20% of their active time feeding [2,1]. In Laikipia, Kenya, products from *Acacia drepanolobium* forms about 83% of their diet Isbell [2] and in other areas, they eat gum and other products from a variety of *Acacia* species [1,3]. Gum is eaten year-round, with increased importance Nakagawa [3] as no signs of nutritional stress and reproductive rate not

affected during the dry season [4]. Gum and arthropods, such as ants (e.g., *Tetraponera* and *Crematogaster*), make up an estimated 40 – 50% of their diet including young and mature swollen thorns of *Acacia*, flowers, seeds, pods, and mushrooms [1,2,4]. They naturally feed on the ground, regularly standing by means of their two rear limbs Nash [1] and could travel an average of 3,800 – 4,200 m per day finding small, quickly eaten, and widely dispersed foods [2]. Hall [5] describes *E. patas* in Uganda as feeding at a steady walk and at least 76% of their diet included gums and arthropods, mainly ants in Kenya, based on a combination of all occurrences and scan sampling [2]. In Cameroon however, feeding is primarily on gums and arthropods, especially grasshoppers [3]. Gums and ants are common, easily accessible, and eaten throughout the year, and they are stapled foods for patas monkeys [1,4].

Marguba and Sepeteri range in Old Oyo National Park (OONP) has been known as conservative forest for *E. patas* as one of the dominant primate species in the past. *E. patas* is listed as species of Least Concern by the IUCN [6] but the population is declining rapidly year in year out due to heavy human activities within the park (Goodwin pers. com.) and due to the fact that the animal's global population is not large; increased conservation of the species needs to occur to prevent populations from declining any further. In the present perspective of the rapid anthropogenically modified landscape of primate habitat countries, causing the proportion of secondary forests to increase at the expense of primary forests, primate habitats are facing structural and dynamic changes which can affect forest composition and species abundance [7]. Improving our knowledge about the capacity of primates to adapt is crucial Corlett [8] as most primate species are forced to cope with large shifts in ecological conditions and associated food resources [9]. Much has not been reported on the feeding ecology of patas monkeys in Nigeria since the general research carried out elsewhere by Hall [5], although other terrestrial primates, such as baboons have been adequately investigated [10-17]. This study, therefore, seeks to investigate some aspect of the feeding ecology of Red Patas monkey in two Ranges in Old Oyo National Park.

Materials and Methods

Study Area

Old Oyo National Park covers a land area of approximately 2,512 km^2 making it the fourth largest national park in Nigeria. Politically, it lies in Oyo State in the Southwest of Nigeria and borders Kwara State in the Northeast.).

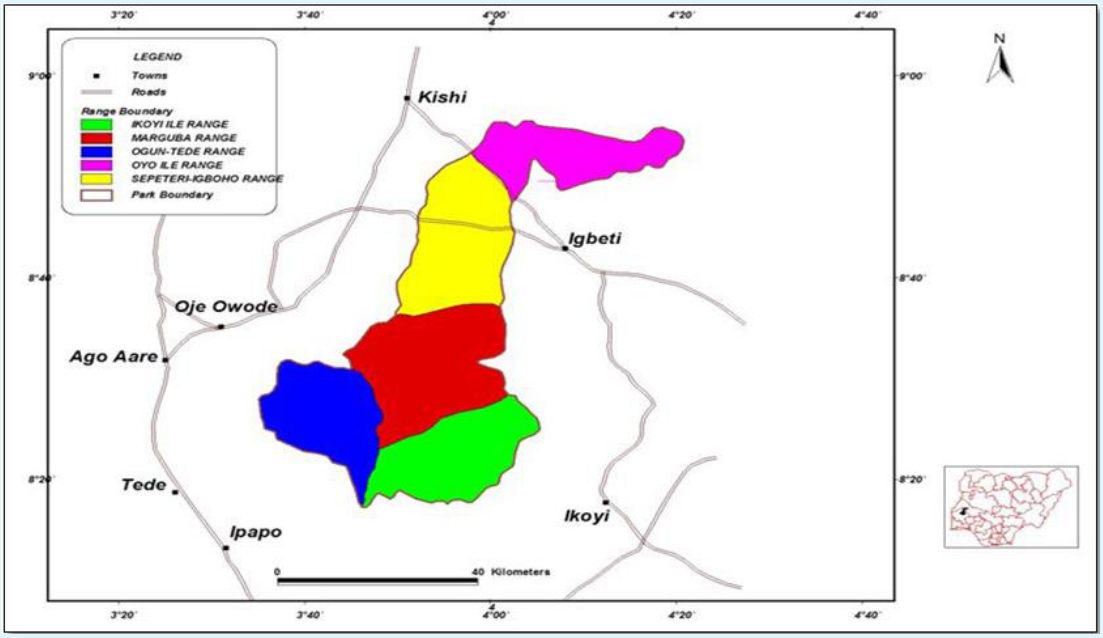

Figure 1: Map of Old Oyo National Park showing it ranges Ogunjinmi, et al. (2016) [23].

Annual rainfall varies between 1600 and 2000 ml. The site experiences a bimodal annual rainfall pattern, between April and July and from September to October, separated by a dry season [18]. Old Oyo National Park comprises of five ranges (Tede range, Sepeteri range, Marguba range, Oyo-ile range, Yemoso range), out of which two (Marguba and Sepeteri range) were purposefully selected. The entire park lies in the southern Guinea savanna. The vegetation in the park has been classified into dense woodland and forests outlines in the south, eastern part, and North West corner.

Method of Data collection

Sepeteri and Marguba Ranges were purposefully selected for this work because of the large population of the animals there and the presence of already laid transect lines. A troop was located and followed in each of the study sites (n= 14 in Sepeteri, n=9 in Marguba) on foot from a distance of 15-30 m from 0600 hours until 1800 hours as long as possible, on each day of data collection Isbell [2] depending on when a troop was located. Data were collected for ten consecutive days (five days in a week in each of the study sites) for two weeks' period (14th April to 28th April 2016). Quantitative data were recorded through scans which were taken every 15 minutes throughout the full-day or as long as possible [19]. Feeding activities were recorded for the first 2 individuals spotted in the group/subgroup. Five minutes were allowed for finding the individuals and the group/subgroup was circled between scans to get a random selection of individuals. Once an individual was spotted, the observer waited 5 seconds before recording the behaviour to ensure eye-catching behaviours were not over-represented [20]. In order to reduce bias, the surveys were stopped when animals were partially hidden or moved completely out of sight. A 10 X 42 magnification Binocular was used when the study group was at a far distance and the observer faced obstacles to approaching the group. When animals were recorded as foraging, the food source (in this case, higher plant parts) was identified and the specific part being consumed i.e. root, stem, fruit, flower, seed or leaf was documented. Data collection on feeding ecology typically included length of feeding bout, plant species eaten, plant parts eaten (for example, fruit and leaf), diameter and height of food plant [2,20].

Data Analysis

Data collected was analyzed with the Computer PAST model version 3™ software using student t-test to compare the sample means between the two ranges. Percentage of time spent on food eaten by the animal was calculated using the formula

$$T = [\frac{t1}{t\ (total)}]\ X\ 100\%$$

Where t_1 is the time spent in eating a given food item
t (total) is the sum total of time spent in feeding
The results obtained were displayed using frequency tables, percentages and bar charts.

Results

A total of 63 scans were recorded in both Sepeteri and Marguba ranges of OONP with 39 scans (representing 61.91% of the total scan) in Sepeteri and 24 scans (representing 38.09%) in Marguba range where red Patas monkey fed exclusively on plant species. The diet of red Patas monkey was simple as only 4 plant species were observed to contribute to their diet in OONP. These higher plant species include *Acacia seyal (*swollen thorns, leaves and flowers*), Parkia biglobosa (*fruits*), Mangifera indica* (fruits*) and Vitellaria paradoxa (*leaves and fruits).

Food Items in the Diet of Red Patas Monkey at OONP

Table 1 shows the summary of food items in the diet of red Patas monkey at OONP. At Sepeteri range, four plant species were identified namely: *Mangifera indica* (fruits); *Vitellaria paradoxa* (leaves and fruits); *Acacia seyal* (flowers, gum, and swollen thorns) and *Parkia biglobosa* (fruits) forming parts of the diet of *E. patas* while *Parkia biglobosa* (Fruits); *Mangifera indica* (Fruits); *Vitellaria paradoxa* (Leaves, fruits) were taken by the animal in Marguba range.

Ranges	Plant species	Part eaten
Sepeteri Range	*Mangifera indica*	Fruits
	Vitellaria paradoxa	Leaves, fruits
	Acacia seyal	Flowers, Gum, Swollen thorns
	Parkia biglobosa	Fruits
Marguba Range	*Parkia biglobosa*	Fruits
	Mangifera indica	Fruits
	Vitellaria paradoxa	Leaves fruits

Table 1: The food items in the diet of red Patas monkey at OONP.

Percentage of Time Spent on Feeding

Table 2 presents the time spend during feeding (percentage). At Sepeteri range, the highest percentage of time (25.31% = 41 minutes) recorded for feeding was

where the animal fed on the flowers, gum and young swollen thorns of *Acacia seyal.* This was followed by 16.6% (27 minutes) of time used in the feeding on the fruits of *Parkia biglobosa* and the lowest percentage of time spent in feeding (6.17% = 10 minutes) was recorded for *Vitellaria paradoxa*. About, 16.67% (representing 27 minutes) was the average time used in feeding on *Mangifera indica* in Marguba range. This is closely followed by 12.35% (20 minutes) for *Parkia biglobosa* while the lowest was 7.41% for *Vitellaria paradoxa* leaves.

Ranges	Plant species	Part eaten	Ave. Feeding time
Sepeteri Range	*Mangifera indica*	Fruits	25 minutes
	Vitellaria paradoxa	Leaves, fruits	10 minutes
	Acacia seyal	Flowers, Gum, Swollen thorns	41 minutes
	Parkia biglobosa	Fruits	27 minutes
Marguba Range	*Parkia biglobosa*	Fruits	20 minutes
	Mangifera indica	Fruits	27 minutes
	Vitellaria paradoxa	Leaves fruits	12 minutes

Table 2: Percentage of Time spent on Feeding.

Student's t-test result of the percentage time spent on eating in the study areas (Table 3) shows that there is no significant difference ($p \geq 0.05$; $t = 0.91$) in the time spent by the animals in eating in the two study areas.

Tests for equal means			
	Sepeteri		**Marguba**
N:	3	N:	4
Mean:	15.637	Mean:	13.275
95% conf.:	(-8.1407 39.414)	95% conf.:	(6.26 20.29)
Variance:	91.617	Variance:	19.435
Difference between means:	2.3617		
95% conf. interval (parametric):	(-11.284 16.007)		
95% conf. interval (bootstrap):	(-7.3117 11.828)		
t :	0.44489	p (same mean):	0.675
Uneq. var. t :	0.39695	p (same mean):	0.72126
Monte Carlo permutation:	p (same mean):	0.7171	
Exact permutation:	p (same mean):	0.71429	

Table 3: The students' test of the percentage of time spent on eating in the study areas.

The Diameter at breast height (dbh) and the height of food plants ranged between 17 – 47 cm and 9 – 16 m for Sepeteri and Marguba ranges respectively (Table 4). *Mangifera indica* had the highest dbh (47 cm), *Parkia biglobosa* had the height (16 m) while the least dbh (19 cm) and height (9 m) belong to *Vitellaria paradoxa* of 47 cm while *Vitellaria paradoxa* had the least (19) in Sepeteri range. Marguba range recorded *Parkia biglobosa* having the highest dbh (30 cm) and height of 15 m with *Vitellaria paradoxa* having the least dbh (17 cm) and height (9 m) respectively.

Ranges	Plant species	Dbh of food plant (cm)	Height of food plant
Sepeteri Range	*Mangifera indica*	47	13 m
	Vitellaria paradoxa	19	9 m
	Acacia seyal	32	12 m
	Parkia biglobosa	35	16 m
Marguba Range	*Parkia biglobosa*	30	15 m
	Mangifera indica	29	12 m
	Vitellaria paradoxa	17	9 m

Table 4: The Diameter at breast height and the height of food plants.

Discussion

The weight of red Patas monkeys is four times the largest primary gummivorous or insectivorous primate. Over 65% of the foraging activity of patas monkey was done on the ground. Results from this study suggest that at least two-thirds of their diet in OONP (through estimation by time spent in the ingestion of food items Isbell, et al. [2] consisted of gum, flowers, leaves, and fruits from the plant. Gum flowers and swollen thorns of plants contain high amounts of carbohydrates, protein, and lipids and are therefore high in quality [21]. The abundance of Acacia seyal in Sepeteri range accounted for more time spent feeding on its flowers, gum and swollen thorns which may be due to the spicy scented or sweet-smelling flowers which attract them.

Searching for small and widely dispersed foods are usually considered time-consuming, and larger-bodied primates usually cannot survive to a great extent on gums and swollen thorns because they cannot obtain sufficient quantities to meet their dietary needs [20,22]. However, red Patas monkeys in OONP, may be able to sustain themselves on a diet largely of gum flowers and swollen thorns of plants, despite their large body size, because their diet consists of a rare combination of high-quality foods that are small and dispersed but also easily and quickly found Isbell [2].

Conclusion

This study identified some higher plant components of food of red Patas monkey in Old Oyo National Park. It also established that four plant species including *Acacia seyal* (swollen thorns, leaves and flowers*), Parkia biglobosa* (fruits), *Mangifera indica* (fruits*) and Vitellaria paradoxa* (leaves and fruits) form part of the daily diet of red Patas monkey and the management of the park should consider the protection of these family of tree species in the habitat for effective conservation of the animals.

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