

Nutritional ecology of the mona monkey in Okomu National Park, Nigeria

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ABSTRACT

Mona monkey is one of the eight nonhuman primate species in Okomu National Park, a lowland rainforest in southwest Nigeria. Little is known about the varieties of plant parts it accesses as part of the diet and much less about the nutritional composition. We studied the feeding ecology of the monkey using field observations and opportunistic collection of food refuse. Nutritional contents of their diet were determined through proximate, fibre fraction and amino acids analyses using standard procedures. Their diet included 28 plants species in 19 families, 57% being fruits. *Gmelina arborea* fruit and *Jateorhiza macrantha* seed discovered in the study were not found in literature as the monkey's diet. Mona monkeys obtained 79% of their diets within the Park. The proximate contents of the foods were higher during the dry season. Percent crude protein of 7.02 ± 1.92 (n=14) is within the 6.4-8.0% recommended by National Research Council for primates in captivity. Amino acids cysteine and methionine had the least values. A good management plan where monkeys obtain all their food resources from within the park is recommended in order to adequately conserve them.

INTRODUCTION

The mona monkey (*Cercopithecus mona*) is an arboreal Old World primate that depends on forest resources for its sustenance. Due to anthropogenic activities, forest covers are fast declining globally. The foods of the mona monkey in degraded habitats need to be understood in order to strategically plan for its conservation. This study determined the food and nutritional ecology of mona monkeys in three locations in Southwest Nigeria; an urban area, the University of Lagos (UNILAG); a semi-urban reserve, Lekki Conservation Centre (LCC), Lagos State; and a wild habitat, the Okomu National Park (ONP), Edo State. Food types and their seasonal availability were determined during a two year dry and rainy seasons survey using focal point technique and all animal feeding behavior method. Proximate, fibre fraction and amino acids analyses of the plant foods were conducted using standard procedures. Given used foods to mona monkeys in captivity was conducted for preference trials. Likert-scale questionnaires were administered to community members in each location to determine their attitude towards mona monkeys conservation. Different parts of 64 plant species from 38 families were identified as components of mona monkeys diets and of which 56% were fruits. *Gmelina arborea* and *Jateorhiza macrantha* fruits were identified as two new foods. The number of foods consumed by mona monkeys in urban, semi-urban and wild habitats were 39, 19, and 29 respectively. Natural foods constituted 33.0%, 71.0% and 79.0%, while the sum of raided, provisioned, and scavenged foods made up 67.0%, 39.0% and 21.0% of the monkeys diets in urban, semi-urban and wild habitats respectively. There was a significant difference ($P < 0.05$) in the number of available foods in the three locations; the difference was between UNILAG and LCC number of foods. The highest similarity quotient for the monkeys food

of 32.7% was between UNILAG and LCC suggesting a similarity between the two habitats in comparison to ONP. The numbers of rainy seasons foods were more than that of dry seasons in all the locations, with some foods occurring in both seasons. The mean percent crude protein of dry season foods in UNILAG was 12.12 ± 2.68 (SEM, n=14); ether extract, crude fibre and nitrogen free extract values were 14.97, 9.87, and 56.95 respectively. There was no significant difference ($P > 0.05$) in the nutrient content of foods from all locations except for ether extract values of foods in UNILAG and ONP that were significantly different ($P < 0.05$). There was a strong negative correlation ($r = -.77$, $P = .001$) between crude protein and nitrogen free extract, and a strong positive correlation ($r = .70$, $P = .003$) between acid detergent lignin and acid detergent fibre of the dry season foods in UNILAG. The monkeys food preference was in the order *Musa sapientum* > *Zea mays* > *Solanum melongena*. These foods had high nitrogen free extract values, implying high energy content. In UNILAG, personal factors did not show significant difference ($P > 0.05$) on variables studied. In LCC, the sex of the respondents was the only factor that showed significant difference ($P < 0.05$) on their views to governments role on conservation. In ONP, educational level significantly ($P < 0.05$) affected peoples attitude to mona monkey conservation. For the three locations, sex and age did not significantly ($P > 0.05$) affect the attitude of respondents towards mona monkeys conservation, but educational level and locality significantly did ($P < 0.05$). Sex, age, educational level and locality had a significant effect ($P < 0.05$) on orientation of respondents about poaching. Records of illegal activities in ONP implies that creation of protected areas do not translate to successful wildlife protection. Education, awareness campaigns and involving the Parks immediate community members on the importance of, and conservation planning for wildlife and natural resources would help in reducing encroachment incidence, and promote conservation. The detailed knowledge of the feeding and nutritional ecology of mona monkeys will help understand

how conservation efforts should be applied within the study sites. The study revealed that the ONP (wild habitat) with the highest number of wild foods is the most ideal location for the conservation of mona monkeys.

Discussion:

The weather records in all the three locations showed high rainfall and humidity. The minimum and maximum temperatures were within the range for the tropics. This implies that the mona monkeys thrive in areas with high environmental moisture. Apart from direct effect on the animal, adequate weather condition is a critical parameter in plant phenology and consequently food availability for them. Seasonal variation in temperature and rainfall affect the availability of edible plant parts for NHPs. As a global hotspot for primate species, Nigeria's great diversity of primates is found in the Gulf of Guinea forests of Cross River State and adjacent areas in Cameroon. These areas are generally moist and are made up of lowland rainforests, mangroves and highlands that harbour these primates, one of which is the mona monkeys. The mona monkeys in the three locations accessed fed on a variety of diets: fruits, seeds, nuts, leaves, flowers, saps and gum exudates. Other studies of Cercopithecines' diets in general and mona monkeys in particular show that fruits, flowers, seeds and nuts are the major components, with arthropods, lizards and birds' eggs complementing. As an arboreal animal, often jumping from one tree top to the other, and ranging over long distances in search of food, a ready source of energy as commonly found in the simple sugars of fruits would be the first preference. Fruits are also less bulky, thereby occupying less space in the alimentary canal. As a monogastric animal, its guts are adapted to less bulky foods.

The challenge of a high fruity diet is the low oils and protein. The mona monkeys must obtain these nutrients from oil and protein rich diets such as nuts and seeds, leaves, and arthropods. It was observed from the three locations that on average, 54% of the foods mona monkeys ate are consumed by man. The foods consumed by both species included fruits of *Anacardium occidentale*, *Carica papaya*, *Mangifera indica*, *Musa* spp., and *Psidium guajava*. Similar dietary resources were ingested by the mona monkey. In UNILAG, mona monkeys accessed four categories of foods: wild, raided, provisioned/assorted, and scavenged foods. The wild foods included *Alchornea cordifolia*, *Avicennia germinans*, *Elaeis guineensis*, *Ficus* spp., *Raphia hookeri*, and *Terminalia catappa*. *Alchornea cordifolia* and *Avicennia germinans* were recorded in the mangrove forest community of the University of Lagos. Their acts of raiding homes and shops to steal food and provisions respectively could put them at risk of being caught and killed. Such raids led to the death of two monkeys in 2012. As an urban habitat, the monkeys seem to have adapted to eating foods offered or left over by humans, thereby making them feed like domesticated animals. They fed on all types of human foods including those they scavenged at dumps sites. This might imply that the foods they obtained from the wild could not sustain them. Over the years their habitat has been fragmented and converted to other human uses such as infrastructures so that few wild food resources remain. In Awka, the Anambra State Capital, Nigeria, mona monkeys especially populations living in close proximity to human settlements accessed foods from the wild, raided family fruit gardens and ate left over of human foods found in littered compounds. They sometimes jumped across fences into people's gardens to raid *Anacardium occidentale*, *Carica papaya*, *Dacryodes edulis*, *Mangifera indica*, *Musa sapientum* and *Psidium guajava*. Scavenging for food seems to be a feeding

strategy the mona monkeys in urban habitats have adapted for their survival. *Dioscorea* spp., *Elaeis guineensis*, *Mussaenda polita* and *Paullinia pinnata* were some of the wild foods identified as mona monkeys' diets in this location that were also indicated as mona monkeys' diet in Lama Forest Reserve, Bénin Republic. Apart from *Elaeis guineensis* and *Blighia sapida*, the other wild foods were not consumed by man. Foods in the other three categories are used by man. This puts the mona monkey in urban habitats like UNILAG to be a potential food competitor with man. This food habit habituates/domesticates thereby making them eat what their counterpart in wild habitats may not accept. Moreover, acceptance of „provisioned“ foods predisposes them to danger of being killed through poisoning. It also exposes them to the risk of being hunted since they are forced while searching for food to be in close proximity to man. Habitat fragmentation could affect primate food availability either by reducing the number of available foods or making accessibility difficult due to removal of forest corridors. Mona monkeys' wild foods such as *Alchornea cordifolia*, *Ficus* spp., *Mussaenda polita*, and *Raphia hookeri* were destroyed when their habitat at UNILAG was fragmented through clearing and conversion. The introduction of food plants sources through food plots could ameliorate the problem. In LCC, *Anacardium occidentale*, *Elaeis guineensis*, *Mangifera indica*, *Xylopia aethiopica* and *Vitex doniana* were some of the foods found in the Reserve and which were similar to those as mona monkey foods in Okomu National Park and Awka respectively. The presence of *Anacardium occidentale*, *Mangifera indica*, *Polyathia longifolia* trees in this location was a sign of previous human habitation of the place. *Mangifera indica* is one of the plants raised in home gardens. *Anacardium occidentale*, *Carica papaya* and *Mangifera indica* though useful to man, are exclusively used by the animals. As a Strict Nature Reserve, the off take of these fruits by humans is prohibited.

Conclusion:

Okomu National Park had unique array of mona monkeys' foods not found in any of the other two places. As a lowland rainforest, it had foods that were climbers, shrubs and trees, some of which included *Annona glabra*, *Barteria nigritiana*, *Musanga cecropioides* and *Pycnanthus angolensis* described the tropical rainforest as cradle of diversity, stating that besides the tropical forest having the most species, they are likely the primary source of diversity on Earth. The Okomu Forest Reserve was very rich in animal and plant species due to its situation in the lowland rainforest. Two foods not known in literature as component of the mona monkey diet were found in this forest, i.e. *Gmelina arborea* and *Jateorhiza macrantha*. *Gmelina arborea* is native to Asiatic countries and primates in those countries have been reported to use it for food. It is an exotic plant in Nigeria. In Ghana, it made up 8.4% of the diet of *Colobus vellerosus*. In order to cut the cost of feeding and as an alternative food to the conventional livestock feeds especially monogastrics, it has been suggested as an unconventional source of feed for swine production. *Jateorhiza macrantha* is a climber that is associated with dense and humid rainforest. Its usefulness is not limited to mona monkeys alone. It has been reported to have values among the Edo people who apply leaf sap, mixed with other medicines, to stop bleeding during pregnancy. The foods types were similar to mona monkey foods. *Elaeis guineensis*, *Ficus exasperata*, *Psidium guajava*, and *Spondias mombin* were some of the diets Matsuda also identified as foods of the mona monkey in Lama Forest Reserve, Bénin Republic.