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DEMYSTIFYING THE FRUGIVOROUS TENDENCY OF OLIVE BABOON (*Papio anubis* Lesson, 1827)

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ABSTRACT

Olive baboons are ecologically flexible and generalist feeders yet selective in choice of diet. Insufficient information on the plants consumed by olive baboons and their dietary preference hinders appropriate and deliberate conservation measures. This study therefore identified the plant species, dominant plant part consumed and unravel the basis for Olive Baboons' predominant diet choice in Kainji Lake National Park (KLNP). Direct observation method was used to record food plant species and plant parts consumed by olive baboons in KLNP for a period of 24 months. Proximate composition of food plants were determined using standard procedures. Data were analysed using descriptive statistics and ANOVA at $\alpha_{0.05}$. Feeding sites were identified in Oli, Doro, Kali and Kemenji ranges. Twenty two plant species belonging to 16 families were identified. Plant parts consumed by olive baboons included fruits (92.0%), tuber (4%) and roots (4%). Among the food plant species, highest crude protein (26.98%), crude fibre (51.16%), ash (20.56%), ether extract (22.92%), dry matter (93.29%) and nitrogen free extract (91.36%) were obtained in *Isoberlina doka, Cochlospermum tinctorium, Grewia molle, Vitex chrysocarpa, Vitelaria paradoxa* and *Icacina trichantha*, respectively. All year round availability, avoidance of conspecific competition and predation, energy cost, nutritional consideration, immune system stability and reduced risk of parasitic infection were the driving factors of olive baboon fruit propensity.Olive baboons' frugivorous tendency has far reaching ecological implications with attendant effect on seed dispersal, seed treatment, seed predation, food provisioning, food competition and food scarcity among other sympatric animals. There is need for research into these ecological interactions and other implications of olive baboons' frugivorous propensity.

INTRODUCTION

Primates consume a wide variety of foodstuffs which primarily includes fruits, leaves and invertebrates but also seed, gums, lichens, bark, roots and in some cases other vertebrates such as mammals, aves and reptiles as well as invertebrates like crabs and insects. Assessing dietary properties is important to a number of areas relevant to primatologists, including life history, ecology and behaviour. Knowledge of the dietary requirements of primates can equally help conservation managers better protect their habitats, and provide insight for captive care managers (Rothman *et.al.* 2013).

All free ranging animals make choices regarding which food to eat, with these choices influencing their nutritional state and ultimately their health and fitness (Altman 1998; Beehner *et.al.* 2006). Investigating the chemical basis of dietary selection in primates has provided a unique understanding of their foraging strategies and provided means to explore determinant of primate abundance (Whiten *et. al.*1991; Oates *et.al* 1990). Understanding the determinants of primate abundance is becoming increasingly important as ecologists are tasked to assist conservation biologists to construct informed management plans for endangered species. This has become critical because most primates live in tropical forests which are increasingly being impacted by human modification (National Research Council, 1992).

Collectively, 125,140 km^2 of forest are lost annually across the geographic distribution of primates, resulting in the annual loss of 32 million primates (Chapman and Peres, 2001), the reason being that these forests serve as source of food and shelter for primates. In fact, global analysis on the status of world mammals indicated that primates are the order most threatened by extinction .These populations are also being seriously harmed by forest degradation, particularly logging and fire, and hunting. For example, if important tree species could be left standing in selective logging operations, population declines following logging might be lower and/or the speed of recovery might be more rapid for those species negatively affected by logging (Chapman *et.al.* 2003).

The starting point however is to identify the important tree species that provide food resources and shelter for these primates. Olive baboon, being the focal animal of the study is one of the primate species widely distributed in Kainji Lake National Park (KLNP). Olive baboons face the risk of malnutrition when there is decline in the quality and quantity of available forages. This may lead to reduced productivity or consequently extermination from the park. Insufficient information on the food plants consumed by Olive baboons and their dietary preference in KLNP hinders appropriate and deliberate conservation measures to be adopted.There is need for up to date information on the feeding ecology of Olive baboons in KLNP in order to consolidate on strategies for the management and conservation of Olive baboons in the park. Findings from this study will be valuable for the management of captive primate populations and other forms of ex situ conservation. This underscores the relevance and importance of this study. Preliminary investigation revealed that olive baboons in

KLNP forage predominantly on fruits. The ingestion of fruit is called frugivory while animals that feed on fruits are referred to as been frugivorous. This study however identified the plant species, dominant plant parts consumed by olive baboons and also attempted to unravel the basis for their choice of fruit diet.

MATERIALS AND METHODS

Study Area

This research was conducted in Kainji Lake National Park. The Park was established in 1979 by the merger of two former non- contiguous game reserves (Borgu and Zugurma) into one enitity. It covers a total area of 5,340.82 km^2. The two sectors (Borgu and Zugurma) of KLNP lie approximately between latitudes 9^0 40'N and 10^0 30'N and longitudes 3^0 30'E and 5^0 50'E respectively (Aremu, *et. al*., 2000).KLNP is situated in the boundary between the North and South of Guinea Savanna. Riparian Forests also occur on the banks of larger water courses. Generally, the vegetation is described as been Northern Guinea Savanna types which as formations of mosaic of plant communities contrasting in structure. The topography of the park is gently undulating with general decrease in elevation from West to East. Some areas are hilly with the highest elevation of about 300-350m above sea level (Ayeni, 2007). The park is drained by a network of rivers and streams, all of which empty into the rivers Oli, Timo and Doro while the drainage in Zugurma sector consists of rivers Manyara and Ruwa Zorugi. The park has a yearly circle of dry and wet season based on Northern Savanna climate. The wet season begins from April to October while the dry season is from November to early April with a short harmattan period between mid-December and February. The annual rainfall ranges from 975mm to 1220mm (Ayeni, 2007). KLNP has about 59 plant families. The dominant tree species include; *Burkea africana, Detarium microcarpum, Afzelia africana, Isoberlina tomentosa, Acacia spp.* etc. There are over 66 species of large mammals represented by about 13 artiodactyls, 10 carnivores and 5 primate species. The area is also rich in bats, birds and insects (Ayeni, 2007). In addition, there are also 62 species of fish belonging to 20 families and 28 species of reptiles and amphibians. Examples of the animal species in the park include Roan antelope (*Hippotragus equinus*), Olive baboon (*Papio anubis*), Patas monkey (*Erythrocebus patas*) Buffalo (*Syncerus caffer*), Senegal (*Kobus kob*), Hippopotamus (*Hippopotamus amphibus*) etc. (Ayeni, 2007).

Method of Data Collection

Direct observation method was adopted in eliciting information on the feeding activities of olive baboons in the study area while they foraged. This is achieved through the following procedures:

i. **Trailing System**

This involved following behind tracing (through the foot prints and fresh feacal droppings) of the animals especially in the evening from drinking sites (water holes such as rivers and streams) to their sleeping sites. Often times, olive baboons retire from water points in the evening to their sleeping sites. However it is worthy of note to state that considerable and appropriate distances were kept away from the animals depending on the visibility and vegetation cover. The minimum distance kept was 5m. This was to avoid the study animals from being agitated and to ensure that the observers were not attacked by the study animals.

ii. **Auditory Clues**

Olive baboons' feeding sites were identified by trailing their vocalization such as long, alarm calls, warning barks and other forms of vocal communications they made right from the sleeping sites before departure for foraging in the morning. There vocalizations were traced from 05:00hrs. The study was conducted for a period of 24 months covering wet and dry seasons.

Food Samples Collection

Terrestrial food samples eaten by Olive baboon were collected with the aid of machetes and plant pruners. Poles were used to extract arboreal foods. Opportunistic collection of food samples was also carried out whereby food samples were picked from fallen fruits or branches dropped by animals. An average of 500g wet weight for each sample was collected as recommended by Rothman *et.al.* (2011).The samples were weighed immediately after collection and labeled appropriately. They were thereafter air dried prior to transportation in a sealed plastic bag to the laboratory for nutritional analysis. The essence of the drying was to inhibit enzymatic activity so as to prevent chemical shift and preserve the samples' nutritional attributes (Rothman *et. al.*, 2011).

Nutritional Composition of Food Samples

Proximate composition of the plant part eaten by olive baboons in the study area was determined using the methods of Association of Analytical Chemist (AOAC, 2005).

Data Analysis

Descriptive statistics such as frequencies, percentages, pie charts and bar charts were used to present results of plant species consumed proportion of plant parts consumed and result of proximate analysis. Analysis of variance was used to establish significant differences among nutrient composition of various plant species consumed by olive baboons. The level of significance was at $P \leq 0.05$.

RESULTS

Feeding Sites and Plant species Consumed by olive baboons in KLNP

Olive baboons' feeding sites were identified in Oli, Doro, Kali and Kemenji ranges in KLNP. Presented in table 1 is the list of plant species consumed by olive baboons in the study area. A total of 22 plant species belonging to 16 families were identified during the entire study period

Proportion of Plant parts Consumed and Proximate composition of plant species eaten by olive baboon in KLNP

Figure 1 indicates the parts of plants consumed by olive baboons in KLNP. Fruits formed the dominant (92%) plant part consumed while roots (4%) and tubers constituted the remaining portion. Presented in tables 2 and 3 are the proximate composition of plant species eaten by olive baboons in dry and wet seasons respectively. Among the food plant species, highest crude protein (26.98%), crude fibre (51.16%), ash (20.56%), ether extract (22.92%), dry matter (93.29%) and nitrogen free extract (91.36%) were obtained in ***Isoberlina doka**, Cochlospermum tinctorium, Grewia molle, Vitex chrysocarpa, Vitelaria **paradoxa*** and ***Icacina** trichantha*, respectively.

Table 1 Plants Species Consumed By Olive Baboons in Kainji Lake National Park

Plant Species	Family	Parts Consumed
Discorea rotundata	Dioscoreaceae	Tuber
Cochlospermum tinctorium	Cochlospermaceae	Root
Swartzia madagascariensis	Fabaceae	Fruit
Isoberlina doka	Fabaceae	Fruit
Kigelia Africana	Bignoniaceae	Fruit
Ficus sycomorous	Moraceae	Fruit
Grewia molle	Malvaceae	Fruit
Piliostigma thonningii	Fabaceae	Fruit
Vitelaria paradoxa	Sapotaceae	Fruit
Icacina trichantha	Icacinaceae	Fruit
Vitex chrysocarpa	Lamiaceae	Fruit
Afzelia Africana	Fabaceae	Fruit
Xamenia Americana	Olacaceae	Fruit
Detarium microcarpum	Caesalpiniaceae	Fruit
Parkia biglobosa	Fabaceae	Fruit
Gardenia sotoemesis	Rubiaceae	Fruit
Tamarindus indica	Fabaceae	Fruit
Strychnus spinosa	Strcychnaceae	Fruit
Spondias mombin	Anacardiaceae	Fruit
Nauclea latifola	Rubiaceae	Fruit
Oncoba spinosa	Salicaceae	Fruit
Adansonia digitata	Bombacaceae	Fruit

Table 2 Proximate Composition of Plant Species Eaten By olive Baboons in Dry Season in Kainji Lake National Park

Plant species	%CP	%CF	%ASH	%EE	%DM	%NFE
Discorea rotundata	4.99^{h}	14.67^{e}	5.29^{c}	0.48^{jk}	32.9^{i}	74.58^{e}
Cochlospermum tinctorium	2.29^{j}	51.16^{a}	3.14^{i}	0.18^{k}	91.33^{ab}	43.23^{m}
Swartzia madagascariensis	22.30^{b}	18.59^{c}	6.40^{b}	5.54^{d}	91.59^{ab}	47.18^{k}
Isoberlina doka	26.98^{a}	11.23^{g}	7.39^{a}	8.19^{b}	34.38^{hi}	46.22^{l}
Kigelia africana	18.09^{c}	6.28^{k}	4.94^{d}	4.28^{f}	32.66^{i}	66.42^{h}
Ficus sycomorous	13.43^{e}	8.16^{i}	4.56^{e}	7.23^{c}	54.61^{f}	66.63^{h}
Grewia molle	11.97^{f}	7.63^{j}	4.08^{f}	7.04^{c}	36.52^{h}	69.29^{g}
Piliostigma thonningii	17.62^{c}	19.35^{b}	5.07^{d}	4.62^{e}	92.76^{a}	53.34^{j}
Vitelaria paradoxa	8.41^{g}	15.33^{d}	3.42^{h}	2.27^{h}	93.29^{a}	70.57^{f}
Icacina trichantha	2.34^{j}	2.01^{n}	3.89^{g}	0.41^{jk}	33.73^{i}	91.36^{a}
Vitex chrysocarpa	5.39^{h}	10.04^{h}	1.91^{l}	22.92^{a}	36.94^{h}	59.74^{i}
Afzelia africana	1.93^{j}	3.65^{m}	2.55^{k}	0.67^{j}	89.95^{b}	91.21^{a}
Xamenia americana	3.79^{i}	3.37^{m}	2.90^{j}	4.66^{e}	62.06^{e}	85.29^{c}
Detarium microcarpum	2.09^{j}	11.89^{f}	3.20^{i}	0.55^{j}	71.91^{c}	82.27^{d}
Parkia biglobosa	16.74^{d}	5.95^{k}	4.19^{f}	3.73^{g}	67.49^{d}	69.39^{g}
Gardenia sotoemesis	3.81^{i}	4.58^{l}	3.28^{hi}	1.33^{i}	38.79^{g}	87.00^{b}

abc means within the same column with different superscripts differs signinficantly ($P \leq 0.05$)

CP: Crude Protein; C.F: Crude Fibre; ASH: Ash Content; EE: Ether Extract; DM: Dry Matter; NFE: Nitrogen Free Extract

Table 3 Proximate Composition of Plant Species Eaten By olive Baboons in Wet Season in Kainji Lake National Park

Plant species	%CP	%CF	%ASH	%EE	%DM	%NFE
Piliostigma thonningii	4.36^{i}	10.93^{c}	3.40^{i}	2.08^{f}	89.06^{a}	68.07^{a}
Grewia molle	6.07^{g}	13.36^{b}	20.56^{a}	1.08^{g}	79.50^{c}	38.44^{c}
Tamarindus indica	16.06^{a}	17.19^{a}	5.44^{f}	2.24^{e}	74.98^{d}	34.06^{d}
Strychnus spinosa	11.31^{e}	7.14^{e}	3.95^{h}	2.95^{c}	30.16^{h}	4.81^{h}
Spondias mombin	9.93^{f}	6.00^{f}	5.01^{g}	3.23^{b}	63.59^{f}	39.43^{c}
Discorea rotundata	12.48^{c}	2.94^{g}	6.65^{e}	1.03^{g}	29.31^{h}	6.33^{g}
Nauclea latifola	4.94^{h}	6.36^{f}	11.52^{b}	2.58^{d}	33.46^{g}	8.07^{f}
Oncoba spinosa	14.06^{b}	8.46^{d}	11.06^{c}	2.29^{e}	65.63^{e}	29.77^{e}
Adansonia digitata	12.09^{d}	6.03^{f}	7.68^{d}	3.62^{a}	86.98^{b}	57.58^{b}

abc means within the same column with different superscripts differs signinficantly (P≤0.05)

CP: Crude Protein; C.F: Crude Fibre; ASH: Ash Content; EE: Ether Extract; DM: Dry Matter; NFE: Nitrogen Free Extract

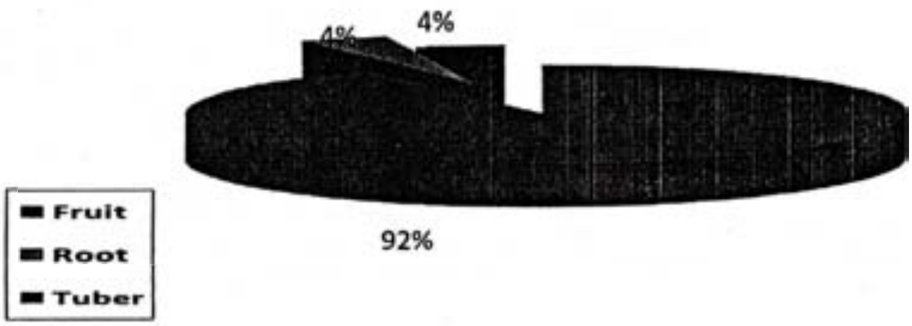

Figure 1: Proportion of Plant Parts Consumed by Olive baboons in Kainji Lake National Park

DISCUSSION

Frugivorous Tendency of Olive Baboon

From the outcome of the study, Olive baboon's diet in KLNP consisted predominantly of fruits belonging to various plant species. Fruigivorous tendency of olive baboons in KLNP cut across both dry and wet seasons. In other words their frugivorous tendency was not season specific. Olive baboons are often times referred to as been ecologically flexible and generalist feeders, yet they are selective or specialized feeders. For instance, Altman and Altman (1970) described baboons as generalist omnivores with their diet comprising numerous types of plants, invertebrates and small vertebrate animals while Clark (1982) opined that the diet of omnivores; a group in which olive baboons belong, is rarely restricted to one type of food. Primates generally eat different types of food ranging from plant parts such as seeds, fruits, leaves, and gum to animals such as insects, larvae, reptiles and small mammals. Despite being generalist feeders, olive baboons can yet be selective in the choice of their diet. Olive baboons were highly selective in their choice of diet in the study area giving preference for fruits. This scenario was also observed among olive baboons in Budongo Forest Reserve, Uganda (Okecha and Newton-Fisher 2006). Whiten *et.al.* (1987) characterized baboons as eclectic but highly selective feeders. Based on the result of this study and other similar researches conducted among various olive baboon populations, there appears to be a nexus between olive baboons and fruits. It is noteworthy to state that there are exceptions to the outcome of this study. For instance, root, stem and leaf constituted the bulk (43%) of the overall food type composition of baboon population in Sukerbosrand Nature Reserve, closely followed by fruit and seed with 42% composition (Segal 2008). Additionally, Silk (1987) discovered in Amboseli National Park that baboons spent more time feeding grass and tubers than fruits. These exceptions may be due partly to the fact that leaves provide moisture, being one of the basic requirements of olive baboons alongside food and sleeping sites. Similarly, tubers being a storage organ is known to serve as water reservoir.

Olive baboons in KLNP consumed more fruits than any other plant part. Their preference for fruit has also been observed by Akosim *et. al.* (2010) in Hong Hills, Adamawa state where out of the identified sixteen plant species foraged by Olive baboon, the fruit of fourteen of them were consumed by the baboons. In Sukerbosrand Nature Reserve, South Africa, over 60% of diet in late wet season contained fruits and seeds (Segal 2008). Kunz and Linsenmair (2008) also attested to baboon's frugivorous tendency as they reported that baboons in Comoe National Park, Ivory Coast were làrgely frugivorous spending about 50% of their feeding time on fruits and seeds. They equally reported that Olive baboons at Shai Hills in Ghana spent a high amount of their feeding time on fruits and seeds.

In addition, fruits constituted a large portion of the diet of baboons in Bylde Canyon Nature Reserve, South Africa, accounting for 62% of the total forage effort while utilization of and reliance on other food types such as pods and roots only increased in dry season to compensate for the decline in fruit availability (Marias, 2005). This implies that their consumption of other food types increased in dry season during the period of fruit shortage but there was no fruit shortage in KLNP during the dry season but rather an increase. This could explain why olive baboons in the study area were consistent with feeding on fruits in both dry and wet seasons.

Further support for the view that baboons have preference for fruits over other food types is the outcome of the study on the diet of olive baboon in Budongo Forest Reserve, Uganda. They spent the largest proportion (47%) of feeding time on fruits and seeds (Okecha and Newton-Fisher, 2006).

Factors Driving Olive Baboons Fruit Choice in KLNP

With all the aforementioned case studies, a question then comes to mind; what are the drivers or probable factors responsible for olive baboon's preference for fruit in KLNP. The following factors suggest their preference for fruits.

1. All Year Round Availability

Going by the outcome of the study, a variety of fruits were available as food for the focal animal all year round. There was no period that baboons had fruit scarcity except that they relatively had more variety of fruits in dry season than in the wet season in KLNP. Most primates that feed on leaves prefer the young foliage because the cell walls of older leaves are thicker and less palatable than that of young leaves which makes the cell content of young leaves to be more accessible to animals (Richard, 1985). Young leaves have more moisture and are usually more succulent and palatable. Not only that, young leaves are richer in protein and minerals, have low fibre, tannin and toxin levels (Altmann, 1998). However availability of young foliage is highly seasonal especially in savanna habitat where young leaf flushes are often seasonal events. In savanna habitats, trees shed their leaves in dry season and growth of new leaves is often synchronized with wet season.

This was not the case with fruits that baboons could access at any season or period of the year in the study area because plants produce fruits at different times of the year. Consequent fruits of some kind were available year round unlike the seasonal availability of leaves.

Furthermore, animals choose food items based on temporal and spatial food availability among other several other factors (Jordano, 2000), that is, available food is not only a function of seasonal variations but also of habitat structure and composition.

Diet choice in animals is influenced by seasonal trends in environment variables which in turn influence plant and animal resource levels and availability within different habitat types (Alberts *et.al.*, 2005). This seasonality favours an all year round availability of fruits for baboon consumption in KLNP.

2. Avoidance of Conspecific Competition and Predation

For the purpose of reducing conspecific feeding competition and vulnerability to predation, olive baboons in KLNP resorted into feeding often on fruits that could quickly be harvested in contrast to other food types like subterranean foods such as roots, tubers, rhizomes and bulbs which imposes more time on prospective consumers. Spending long hours extracting underground plant parts exposes primates and other prey animals to predation. Predators often trail their preys to feeding and drinking points. Baboons are not exempted from the risk of predation. For instance chacma baboon (*Papio hamadryas*) at Moremi Game Reserve in Botswana had elevated mortality predominantly due to predation. Staying long on a particular food item exposes baboon to risk of predation especially in savanna grassland (and other exposed micro habitat) with clear visibility. In a bid to reduce vulnerability to predation, baboons have developed adaptive and survival behaviours by spending minimal time in harvesting food items. This is evident in possession of a morphological feature called cheek pouch. Cheek pouch is a specialized sac on the inside of baboon cheek (Rowe, 1996) used for short term food shortage (Altmann, 1998) and allows baboon to gather as much food as possible (Hayes *et al.*, 1992) within the shortest period of time. Cheek pouches are used commonly when feeding on fruits (Lambert, 2005). For avoidance of predation, it follows therefore that baboons will prefer to forage on food that, as much quantity as possible, can easily and quickly be harvested within the shortest period of time. By implication, baboons favoured harvesting of fruits over subterranean foods such as roots and tubers in KLNP.

3. Energy Cost

Free ranging, unprovisioned primates and other wild animals are confronted with different options when foraging such as when or where to forage on and for how long to forage (Kamil *et.al.*, 1987, Menzel and Wyers, 1987), which means foraging behavior is associated with cost and benefits (Stephens and Kreb, 1986). The benefit being the energy gained from the food while the cost is energy expended in searching and processing of the food such as digging and uprooting.Different food types require differing degrees of manipulation and energy cost: plant parts such as tubers and roots require more degree of manipulation and energy cost than fruits (Clymer, 2006). Even when other food types like plant parts available, bearing in mind the effort and energy cost required to access them, especially when other less energy demanding food types like fruits are available, as it was the case in KLNP, underground plant part may not be predominant in olive baboon choice of diet. This can in a way explain why olive baboons in KLNP frequently sought for more fruits than any other plant parts.

4. Nutritional Consideration

Food choice of Olive baboon in KLNP just like other wild animals was driven by a complex set of criteria, prominent among which was the nutritional content of the potential food item. Olive baboons' fruit use in the study area could have been influenced by the various fruits' nutritional content as reflected in the proximate composition of the food consumed. Olive baboons' selectivity or choice of diet is premised on the basis of meeting energy and nutritional needs as well as the digestibility of the food item. Optimal Foraging Theory predicts that an animal forages in a manner that optimizes energy gain (Perry and Pianka, 1997).

Nutritive value of fruits coupled with moisture content, fibre and quantity of secondary compounds is capable of affecting baboon fruit choice (Glander, 1982). The variety of fruit species in the diet of olive baboons in the study area implies that the fruits provided nourishment. Ripe fruit contains high sugar and carbohydrate levels (Kunz and Linemair, 2007) while seed provide a good source of protein and fatty acids (Heller *et.al.*, 2002).

Fruits, especially those of animal dispersed species (edible fruits) are composed primarily of a succulent flesh that provides a rich source of simple sugars and water. In comparison, the sugar content in fruit is more than double of what is contained in flowers (Richard, 1985). Furthermore, fruits are easy to digest and their protein content is not hindered by secondary plant compounds to the extent seen in leaves (Ganzhorn *et.al.*, 2009).

5. Immune System Stability

Apart from the more apparent explanations earlier given for baboon fruit choice in KLNP, there could be other intrinsic factors that favoured fruit selection in baboon diet choice. One of such is a link between fruits consumption and immune stability of the focal animals. The non-seasonality or year round availability of fruits in KLNP eliminates or better still, minimizes the possibility of dry season-induced dietary stress. Seasonality of resources caused by dry season is capable of inducing dietary stress as resources availability declines, depressing the immune system (Nelson, 2004; Chapman *et. al.*, 2006).So rather than the Olive baboons in KLNP have depressed immune system due to food shortage, their immune system will at least be stable, if not boosted by year round availability of fruits. Animals that depend on seasonal food would be more prone to starvation and diseases.

6. Reduced Risk of Parasitic Infection

Frugivorous primates including baboons eat less volume of food when compared to leaf eating primates. This implies that leaf-eating primates have tendency to ingest more parasites than the fruit-eating (Gogarten *et .al.*, 2012) exposing them to different parasitic infections. To corroborate this view, comparative studies showed that extent of folivory is positively correlated with diversity of helminth species across primate species (Nunn *et. al.*, 2003; Vitone *et. al.*, 2004). In essence, the more Olive baboons include fruits in their diet, the less the risk of parasitic infection.

CONCLUSION

This study has shown that olive baboons in KLNP fed on a variety of plant species. However their diet comprised predominantly of fruit irrespective of season. Olive baboons' frugivorous tendency has far reaching ecological implications. Their fruit diet will have effect on seed dispersal, seed treatment, seed predation, food provisioning, food competition and food scarcity among other sympatric animals that have fruits constituting a portion of their diet. This calls for research into these ecological interactions and other implications of olive baboons frugivorous propensity. Efforts should also be geared towards habitat improvements and conservation of identified in the park in order to ensure the perpetuity of the animals in the park. There should also be further studies on the spatial variation of olive baboons' food plant species vis-à-vis their distribution and habitat utilization.

REFERENCES

Akosim, C., Joseph, J. and Egwumah, P. O. 2010. Assessment of Feeding Behaviour of Olive Baboons (*Papio anubis*) in Hong Hills, Adamawa State, Nigeria. Journal of Research in Forestry, Wildlife and Environment. Vol. 2(1): 60-72.

AOAC, 2005. Official method of analysis. Association of Official Analytical chemists, Washington D.C., USA.

Alberts, S. C., Hollister-Smith, J. A., Mututua, R. S., Sayialel, S. N., Muruthi, P. M., Warutere, J. K., and Altmann, J. 2005. Seasonality and longterm change in a savanna environment. Pp. 157-195 *in* C. V. Schaik and D. K. Brockman, eds. Seasonality in primates: studies of living and extinct human and nonhuman primates. Cambridge Univ. Press, New York.

Altmann, S.A. and Altmann, J. 1970. Baboon Ecology. Chicago: University of Chicago

Altmann, S. A. 1998. Foraging for survival. Chicago: University of Chicago Press.

Aremu, O. T., Elekhizor, B. T. and Likita, I. B. 2000. Rural people awareness of wildlife resources conservation around Kainji Lake National Park, Niger State. ROAN- The Journal of Conservation (1): 80-87.

Ayeni, J. S. O. 2007. Participatory management plan in Kainji Lake National Park. ENVIRON-CONSULT: Lagos. 156p.

Beehner, J. C., Onderdonk, D. A., Alberts, S. C., & Altmann, J. (2006). The ecology of conception and pregnancy failure in wild baboons. Behavioral Ecology, 17(5), 741–750.

Chapman, C. A., and Peres, C. 2001. Primate conservation in the new millennium: The role of scientists. *Evol. Anthro.* 10: 16–33.

Chapman, C. A., Wasserman, M. D., Gillespie, T. R., Speirs, M. L., Lawes, M. J., Saj, T. L. and Ziegler, T. E. 2006. Do nutrition, parasitism, and stress have synergistic effects on red colobus populations living in forest fragments? Am. J. Phys. Anthropol. 131:525–534.

Clark, D. A. 1982. Foraging behaviour of a vertebrate omnivore (*Rattus rattus*): meal structure, sampling and diet breadth. *Ecology* **63(3):** 763-772.

Clymer, G.A. 2006. Foraging responses to nutritional pressures in two species of *Cercopithecine*: *Macaca mulatta* and *Papio ursinus*. MA thesis (unpublished). Georgia State University: College of Arts and Sciences.

Ganzhorn, J. U., Arrigo-Nelson, S., Boinski, S., Bollen, A., Carrai V, Derby, A. 2009. Possible Fruit Protein Effects on Primate Communities in Madagascar and the Neotropics. PLoS ONE 4(12): e8253.

Glander, K. E. 1982. The impact of plant secondary compounds on primate feeding behavior. *Yearbook of Physical Anthropology* 25: 1-18.

Gogarten, J. F., Brown, L. M., Chapman, C. A., Cords, M., Doran-Sheehy, D., Fedigan, L. M., Grine, F. E., Perry, S., Pusey, A. E., Sterck, E. H. M., Wich, S. A., and Wright, P. C. 2012. Seasonal Mortality Patterns in Non-Human Primates: Implications for Variation in Selection Pressures across environments. *Evolution* 66 (10): 3252-3265.

Hayes, V. J., Henzi, S. P., Freedman, L. and Gaynor, D. 1992. The differential use of cheekpouches in a troop of *Papio ursinus*. *Primates* 33(4): 477-500.

Heller, J.A., Knott, C.D., Conklin-Brittain, N.L., Rudel, L.L., Wilson, M.D. and Froehlich, J.W. 2002. Fatty acid profiles of orangutan (*Pongo pygmaeus*) foods as determined by gas- liquid chromatography: cambium, seeds and fruit. *American Journal of Primatology* 57(1):44.

Jordano, P. 2000. Fruits and frugivory. Pp. 125-165 In Fenner, M. (ed.). *Seeds. The ecology of regeneration in plant communities*. CABI, Wallingford.

Kamil, A. C., Krebs, J. R. and Pulliam, H. R. 1987. *Foraging Behavior*. Plenum Press, New York.

Kunz, B.K. and Linsenmair, K.E. 2007. Changes in baboon feeding behaviour: maturity dependent fruit and seed size selection within a food plant species. *International Journal of Primatology* **28:** 819-835.

Kunz, B. K. and Linsenmair, K. E. 2008. The disregarded West: Diet and behavioural ecology of Olive baboons in the Ivory Coast. *Folia Primatologica* 79: 31-51.

Lambert, J. E. 2005. Competition, Predation, and the Evolution Significance of the *Cercopithecine* Cheek Pouch: The Case of *Cercopithecus* and *Lophocebus*. Am J. Phys. Anthropol.126: 183-192.

Marias, A. J. 2005. Resource Utilization of the Chacma Baboon in different Vegetation types in North-Eastern Mountain Sour Veld, Blyde Canyon Nature Reserve. Masters dissertation. University of Southern Africa. pp 129.

Menzel, E.W. and Wyers, E.J. 1987. Cognitive aspects of foraging behavior. In: *Foraging behaviour: ecological, ethological and psychological approaches* (Ed. by Kamil, A.C.,Krebs, J.R. and Pulliam, H.R.). Pp 355-378. Garland STPM Press, New York.

National Research Council. 1992. *Conserving Biodiversity: A Research Agenda for Development Agencies*, National Academy Press,Washington, DC.

Nelson, R. J. 2004. Seasonal immune function and sickness responses. Trends Immunol. 25:187–192.

Nunn, C. L., Altizer, S., Jones, K. E. and Sechrest, W. 2003. Comparative tests of parasite species richness in primates. Am. Nat. 162:597–614.

Oates, J. F., Whitesides, G. H., Davies, A. G., Waterman, P. G., Green, S. M., Dasilva, G. L.,and Mole, S. 1990. Determinants of variation in tropical forest primate biomass: New evidence from West Africa. *Ecology* 71: 328–343.

Okecha, A. A. and Newton-Fisher, N. E. 2006. The diet of Olive baboons (*Papio anubis*) in the Budongo Forest Reserve, Uganda. In: *Primates of Western Uganda* (Eds: Newton-Fisher, N. E. Notman, H., Paterson, J. D., Reynolds, V.). Springer. Pp 61-73.

Perry, G. and Pianka, E. R. 1997. Animal foraging: past, present and future. *Trends in Ecology and Evolution* **12(9)**: 360-364.

Richard, A.F. 1985. Primates in nature. Freeman, W.H. and Company, New York.

Rothman, J. M., Chapman, C. A., Van Soest, P. J. (2011). Methods in Primate Nutritional Ecology. Int J. Primatol. pp25.

Rothman, J. M., Vogel, E.R. and Blumenthal, S.A. 2013. Diet and Nutrition. In Sterling,E.J., Bynum, N. and Blair, M.E., eds. Primate Ecology and Conservation: A handbook of Techniques, pp 194-212. Oxford University Press, United Kingdom.

Rowe, N. 1996. The Pictorial guide to the living primates. East Hampton (NY): Pogonias Press.263 pp.

Segal, C. 2008. Foraging behaviour and diet in chacma baboons in Suikerbosrand Nature Reserve. Master of Science dissertation. University of the Witwatersrand, Johannesburg. pp76.

Stephens, D.W. and Krebs, J.R. 1986. *Foraging theory*. Princeton University Press, Princeton.

Silk, J.B. 1987. Activities and feeding behavior of free-ranging pregnant baboons. *International Journal of Primatology* 8(6): 593-613.

Vitone, N. D., Altizer, S. and Nunn, C. L. 2004. Body size, diet and sociality influence the species richness of parasitic worms in anthropoid primates. Evol. Ecol. Res. 6:183–199.

Whiten, A., Byrne, R.W., Henzi, S. P. 1987. The behavioural ecology of mountain baboons. International Journal of Primatology 8:367-388.

Whiten A, Byrne RW, Barton RA, Waterman PG, Henzi SP. 1991. Dietary and foraging strategies of baboons. Phil Trans R Soc Lond 334(1270): 187-97.