Feeding ecology of primates in Pandam wildlife park, Plateau State, Nigeria.

Ecología de alimentación de primates en el parque natural de Pandam, estado de Plateau, Nigeria.

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ABSTRACT

Primates are ecologically flexible and generalist feeders yet selective in choice of diet. Insufficient information on the plants consumed by primates hinders appropriate and deliberate conservation measures. I therefore seek to identify the plants species, dominant part consumed in Pandam Wildlife Park (PWLP). Direct observation method was adopted along 2km line transect to record food plants species and part consumed by primates for a period of 6 months. Proximate composition of food plants were determined using standard procedures. Data were analyzed using descriptive statistic and ANOVA at (p<0.01). Feeding sites were identified along riparian strata, savanna woodland and the swampy strata and four primates species belonging to one family (Cercopithecidae) were encountered, which include *Cercopithecus mona, Erythrocebus patas, Papio anubis* and, *Chlorocebus tantalus,* all primates were observed to feed in group. Seventeen food plants beonging to 14 families, one grass species (*Andropogon gayanus*), four invertebrates *(Lumbrucis terrestris, Eurymerodesmus spp* and *Chinocectes opilio*) and two crop plants (*Zea mays* and *Sorghum vulgare*) were identified. Plant parts consumed by primates include fruit, (75%) and leaves (25%). Among the food plant species, the highest crude proteins (11.86±0.07ᵃ), fats/oil (13.57±0.06ᵃ), ash (10.67±0.03ᵃ), moisture (13.63±0.07ᵃ), and crude fiber (27.85±0.48ᵃ) where obtained in *Piliostigma thonningii, Rafia sundanica, Piliostigma thonningii, Stryhtinos spinose,* and *Tamarindus indica*. Primates in the study area fed on variety of food items, predominantly on fruits irrespective of the season. Their frugivorous tendency has far ranching ecological

implication with attendant effect on seed dispersal, seed treatment, seed predation, food predation, food competition, food provision, food scarcity among other sympatric animals that have fruits constituting a portion of their diet.

Key words: Feeding, behavior, primates, ecology

RESUMEN

Los primates son alimentadores ecológicamente flexibles y generalistas pero selectivos en la elección de la dieta. La información insuficiente sobre las plantas consumidas por los primates dificulta las medidas de conservación apropiadas y deliberadas. Por lo tanto, busco identificar las especies de plantas, parte dominante consumida en Pandam Wildlife Park (PWLP). El método de observación directa se adoptó a lo largo de un transecto de línea de 2km para registrar especies de plantas alimenticias y parte consumida por primates por un período de 6 meses. La composición proximal de las plantas alimenticias se determinó usando procedimientos estándar. Los datos fueron analizados usando estadística descriptiva y ANOVA en (p <0.01). Se identificaron sitios de alimentación a lo largo de estratos ribereños, bosques de sabana y los estratos pantanosos y se encontraron cuatro especies de primates pertenecientes a una familia (Cercopithecidae), que incluyen *Cercopithecus mona, Erythrocebus patas, Papio anubis* y *Chlorocebus tantalus*. Se observó que todos los primates grupo. Se identificaron diecisiete plantas alimenticias pertenecientes a 14 familias, una especie de pasto (*Andropogon gayanus*), cuatro invertebrados (*Lumbrucis terrestris, Eurymerodesmus* spp y *Chinocectes opilio*) y dos plantas de cultivo (*Zea mays* y *Sorghum vulgare*). Las partes de plantas consumidas por los primates incluyen frutas, (75%) y hojas (25%). Entre las especies de plantas alimenticias, las proteínas crudas más altas (11.86 ± 0.07a), grasas / aceite (13.57 ± 0.06a), ceniza (10.67 ± 0.03a), humedad (13.63 ± 0.07a) y fibra cruda (27.85 ± 0.48 a) cuando se obtuvo en *Piliostigma thonningii, Rafia sundanica, Piliostigma thonningii, Stryhtinos spinose* y *Tamarindus indica*. Los primates en el área de estudio se alimentaron con una variedad de alimentos, predominantemente en frutas, independientemente de la temporada. Su tendencia frugívora tiene una implicación ecológica que afecta la dispersión de semillas, el tratamiento de semillas, la depredación de semillas, la depredación de alimentos, la competencia alimentaria, la provisión de alimentos, la escasez de alimentos entre otros animales simpátricos que tienen frutas que constituyen una parte de su dieta.

Palabras clave: alimentación, comportamiento, primates, ecología

INTRODUCTION

Primates together with many other animals' taxa are forced to cope with large shift in basic ecological conditions because of rapid anthropogenic induced changes in their range habitats. Therefore, most primate species are forced to adopt with large shifts in ecological conditions and associated food resources (Fahrig, 2003). Food as one of the vital components of the environment influenced the interrelationships among animals and their natural environment. Feeding ecology is the central component of species biology, relating to its survival, reproduction, production dynamics, habitat requirement and pattern of sociality (Hohmann et al., 2012). Food is extremely important to all living organisms; it provides nutrients for growth, maintenance and is the main source of energy.

Comparative studies of feeding ecology in primates have documented considerable intra-specific dietary variation in several species for example Procolobus tephrosceles (Chapman et al., 2003). Based on the limited available data, it is clear that noteworthy variation in diet and habitat use in primate exits not only between population of the same species, but also among social groups of the same population. Understanding the diet of an animal helps to interpret its ranging behavior in relation to food availability and it also indicates some of the ecological relationship between plants and animal thus, reviewing the range condition or status of the protected area (Kate, 2000). Different variety of food stuffs are consumed by the primate which primarily include fruits and leaves including seeds, gums, lichens, bark, roots, and in some other vertebrates such as mammals, aves, and reptiles as well as invertebrates such as crabs and insect (Akosim et al., 2010).

Assessing dietary properties and foraging behavior of animals is important to a number of areas relevant to the primatologist and range scientist, including ecological study and behavioral knowledge of the dietary requirement of primates and provide a means to explore determinant of primate abundance. This can help conservation managers to protect their habitat, and provide insight for captive care managers. All free ranging animals make choices regarding which food to consume, thus, influencing the nutritional state and ultimately their health and fitness (Beehner et al., 2006).

Primates habitat are facing structural and dynamic changes (Pan et al., 2011), which can affect forest composition, shelter, food productivity and species abundance. Fauna distribution is primarily determined by the nature and richness of available habitat, the underlying ecological factors and the relationship to the key components of

population ecology/dynamics and food components that an area can support (Yager *et al.,* 2018). The starting point however, is to identify the important tree species that provide food resources and shelter for these primates.

Primates face the risk of malnutrition when there is shortage or decline in the quantity and quality of food availability. Insufficient information on food plants consumed by primates and their dietary preference in Pandam Wildlife Park (PWLP) hinders appropriate and deliberate conservation measures to be adopted. There is need for up to date information on the feeding ecology of primates in PWP in other to consolidate for strategies on the managements and conservation of primates in the park. The research therefore seeks to determine: (i). feeding behavior and food items consumed by the primates. (ii). the nutritional composition of some food plants materials consumed by the primates.

MATERIALS AND METHODS

Study Area: The Pandam Wildlife Park is located North of Benue River and South of Plateau State, along Lafia-Shendam Road in Quanpan Local Government Area of Plateau State (Uloko and Yager, 2017). It lies between latitudes 8o 35' N and 8o 55' N, and longitudes 8o 00' E and 10o 00' E (Akosim *et al*. 2007). It is bounded on the East by Namu and Kayarda towns, on the West and North, by the Dep River and on the South by Aningo, Pandam and Nasukuuk towns (Akosim *et al*. 2008). It covers a total area of 22,400 km2 (Ezealor, 2002). The entire Park lies within the Northern Guinea Savanna (Fig.1). The Pandam Wildlife Park consists of a Y- shaped lake, which has a length of about three kilometers and the width is between 67-100 m. Major vegetation types of the Park include wooded Guinea Savannah comprising *Afzelia africana, Vitellaria paradoxum* and *Parkia biglobosa*. A riparian vegetation mostly observed along the many smaller rivers that form tributaries to the lake and all along the banks of the Pandam lake with the presence of *Elais guinensis, Berlina grandiflora* and *Bosqueia angolense*. Marshlands form an open continuous wetland separating the lake and the Savannah vegetation. The two major features of the climate of the Park are divided into wet and dry seasons and the variability from year to year due to climate change. The wet season extend from April to October, while the dry season extends from November to March and annual rainfall in the Park is between 1,000 – 1,500 mm per annum (Ezealor, 2002).

Data Sampling and Collection: Feeding ecology of the Pandam primates was determined using line transect method as outlined by Peres, (1999). Eight transects (2 from swampy habitat, 3 from woodland habitat and riparian forest each were established). The distribution of transects was based on probability proportional to size. Transect length of 2.0km and widths of 0.02km were systematically laid, 1.0km from each other Bukie *et al*., 2015 method. Also, Information on feeding activities of primates

followed procedures as described by Odebiyi and Alarape, (2017) and covered a period of nine months (September, 2017 – April, 2018).

Trailing Method: This involve following behind tracing (through foot prints and fresh fecal droppings) of animals especially in the evening from drinking sites (water holes such as streams and rivers) to its sleeping or roosting site. Often primate retires from water point in the evening to their sleeping sites. However, it is worthy of note to state considerable and appropriate distance that was kept away from the animals depending on the visibility and vegetation cover. A minimum distance of 5m was adopted. This is to avoid the study animal from being agitated and to ensure the study animals don't attack the observer.

Auditory Clues: Primate feeding sites was also identified by trailing their vocalization such as long alarm calls warning barks and other forms of vocal communications they make right from the sleeping sites before departure foraging in the morning. Their vocalization was traced from 05.00hrs.

Food Items Samples Collection: Terrestrial food samples eaten by primates were collected with aid of machetes and plant pruners. Poles were used to extract arboreal foods. Opportunistic collection of food samples was 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). Samples were weighed immediately after collection and labeled appropriately. They were air dried prior to transportation in a sealed plastic bag to the Animal science Department laboratory, University of Agriculture, Makurdi for nutritional analysis. The essence of drying was to inhibit enzymatic activity so as to prevent chemical shift and preserve the samples nutritional attributes (Rothman *et al*., 2011).

Data Analysis: Descriptive analysis, Analysis of Variance (ANOVA) was used to determine significance differences among nutrient composition plant items consumed by primates. Proximate composition of some plant parts eaten by primates in the study was determined using the methods of association of analytical chemist (AOAC, 2005).
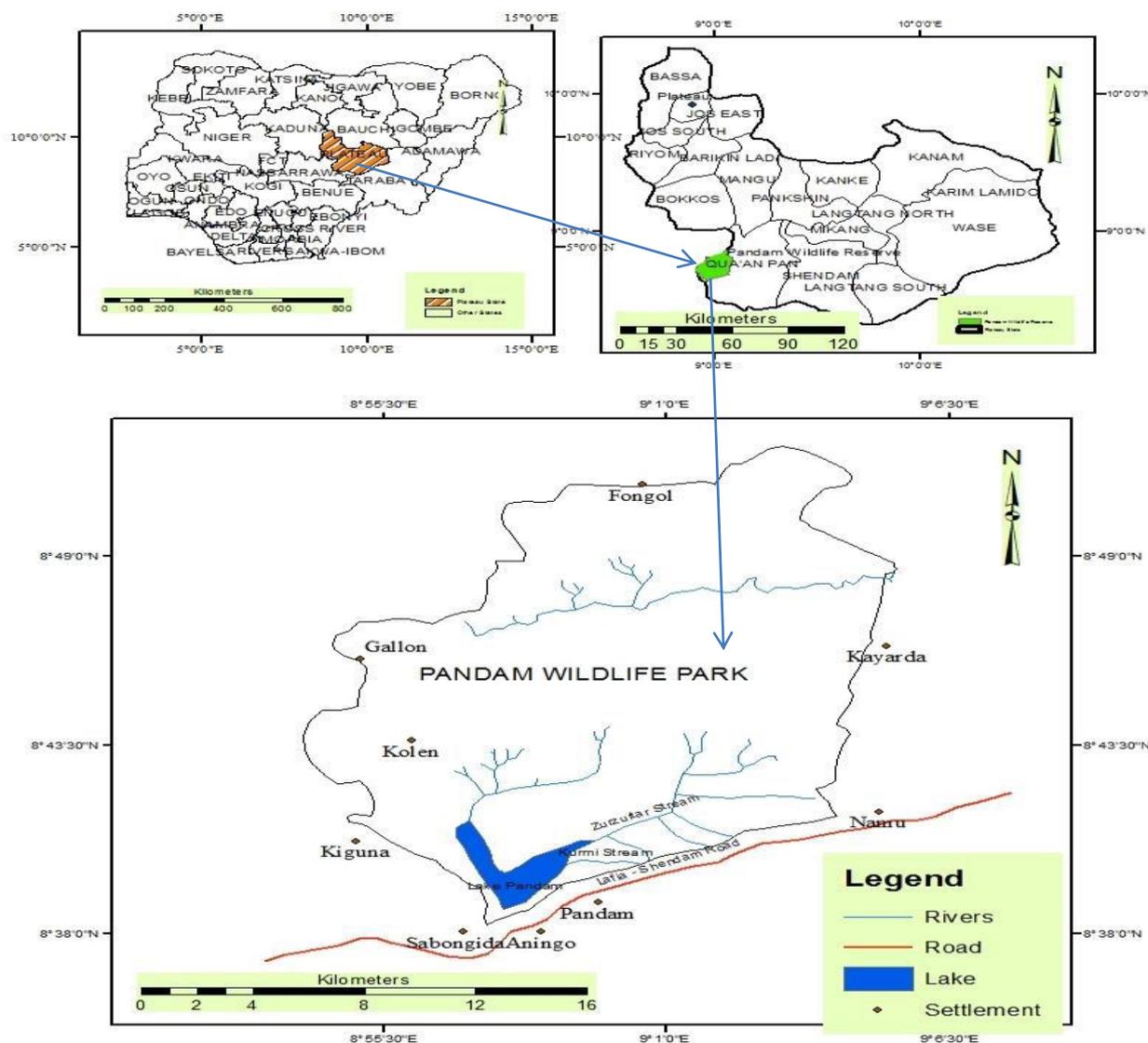
Fig. 1. Map of Nigeria and Plateau State Showing the Study Area

RESULTS

Primate Species Encountered and their feeding behavior in the Study Area: Primate species encountered and their feeding ecology in the study area presented in Table 1, shows that four species belonging to one family (*Cercopithecidae*) was observed. There monkeys (*Cercopithecus mona, Erythrocebus pata,* and, *Chlorocebus tantalus* and a baboon (*Papio anubis)* were encountered. All the primates were observed to feed in group and exhibit diurnal feeding behavior except *Chlorocebus tantalus* that exhibit both diurnal and nocturnal feeding habit.

Table 1. List of primate specie encountered and their feeding habit at Pandam Wildlife Park

Common Name	Scientific Name	Family	D	N	Group	A	T	
Baboon	*Papio Anubis*	Cercopithecidae	✓		✓		✓	
Mona monkey	*Cercopithecus mona*	Cercopithecidae	✓		✓			✓
Patas Monkey	*Erythrocebus patas*	Cercopithecidae	✓		✓		✓	✓
Tantalus Monkey	*Chlorocebus tantalus*	Cercopithecidae	✓	✓	✓		✓	✓

Sources: Field survey, 2018
Note: D = Diurnal, N = Nocturnal, T = Terrestrial, A = Arboreal and √= Applicable

Food items consumed by primates: The result of food items consumed by primates in the study area presented in Table 2, revealed that primates feed on various food items which range from plant materials to insects. This includes 17 food plants, a grass species (*Andropogon gayanus*), four invertebrates (*Lumbrucis terrestris, Eurymerodesmus spp and Chinocectes opilio*) and two crop plants (*Zea mays* and *Sorghum vulgare*). Among the food plant item consumed, fruits form the dominant portion of plant parts eaten by primates in Park with 75% of fruits consumed against 25% of leaves consumed (Fig. 2).
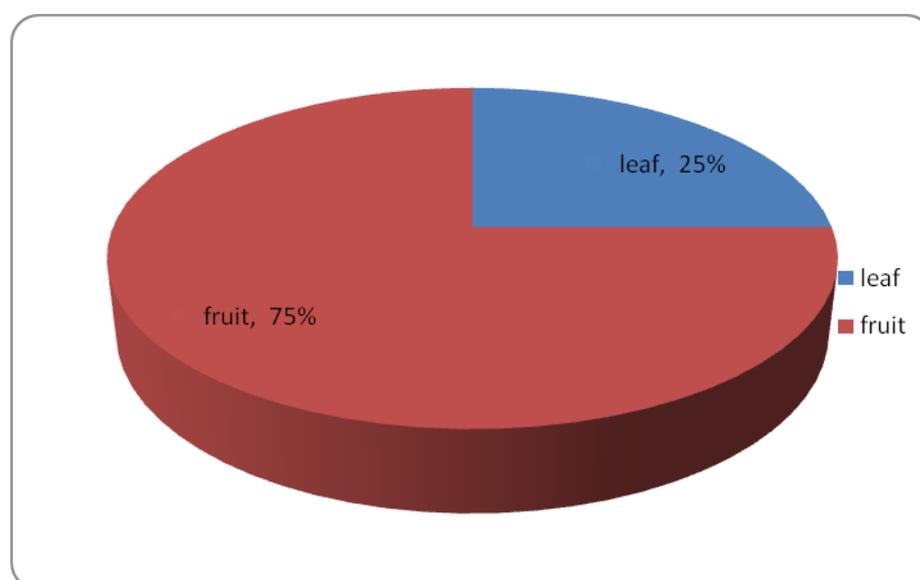

Fig. 2. Plant Parts Consumed by primates in Pandam Wildlife Park (PWLP)

Proximate composition of some plants species consumed by primates: Table 3 revealed the proximate composition of some plant species consumed by primates in the study area. Among the food plant species, the highest crude proteins (11.86±0.07[a]),

fats/oil (13.57±0.06[a]), ash (10.67±0.03[a]), moisture (13.63±0.07[a]), and crude fiber (27.85±0.48[a]) where obtained in *Piliostigma thonningii, Rafia sundanica, Piliostigma thonningii, Stryhtinos spinose,* and *Tamarindus indica* respectively.

Table 2. Identified Food Items Consumed by Primates in the Study Area

Plant Material	Family	Part Consumed	Primates			
			MM	OB	TM	PM
Anogeissus leiocarpus	Combretaceae	Leaf	✓	✓		
Annona senegalensis	Annonaceae	Fruit		✓	✓	✓
Andropogon gayanus	Poaceae	Grass				✓
Borassus aethiopum	Aracaceae	Fruit				✓
Detarium microcarpum	Caesalpiniaceae	Fruit		✓	✓	
Elaseis guineensis	Arecaceae	Fruit	✓	✓		✓
Piliostigma thonningii	Moraceae	Fruit	✓	✓		✓
Khaya senegalensis	Meliaceae	Leaf	✓			
Mangifera indica	Anacardiaceae	Ripe fruit	✓	✓	✓	✓
Parkia biglobosa	Fabaceae	Fruit		✓		✓
Rafia sundanica	Arecaceae	Fruit	✓			
Sarcocephalus latifolus	Rubiaceae	Fruit	✓			✓
Stryhtinos spinose	Strechnaceae	Fruit	✓	✓	✓	✓
Tamarindus indica	Fabaceae	Fruit			✓	
Vitelleria paradoxa	Sapotaceae	Fruit				✓
Vitex doniana	Verbenaceae	Leaf/fruit		✓		✓
Xmenia Americana	Olaceceae	Fruit		✓	✓	
Invertebrates Species						
Earth worn (*Lumbrucis terrestris*)	Lumbricidae	Whole part				✓
Millipedes (*Eurymerodesmus* spp)	Eurymerodesmidae	Whole part				✓
Snow crab (*Chinocectes opilio*)	Cancridae	Soft part				✓
Grasshoppers (Caelifera)	Acrididae	Whole part				✓
Crop plant						
Maize (*Zea mays*)	Poaceae	Immature stem			✓	✓
Guinea (*Sorghum vulgare*)	Poaceae	Immature stem			✓	✓

Sources: Field survey, 2018
Key: MM= Mona monkey, TM = Tantalus monkey, PM = Patas monkey and OB = Olive baboon and √= Applicable

Table 3. Variations in Proximate composition of Plant Species consumed by primates in PWLP

Plant Species	Fractions				
	CP	Fats/oil	Ash	Moisture	CF
Anogeissus leiocarpus	4.35±0.04[h]	2.61±0.02[c]	6.65±0.04[e]	10.45±0.00[f]	15.04±0.04[d]
Borassus aethiopum	2.65±0.02[j]	1.58±0.04[f]	10.50±0.04[ab]	12.81±0.04[b]	10.49±0.04[g]
Elaeis guineensis	5.70±0.02[f]	1.34±0.00[g]	6.46±0.09[f]	6.29±0.13[j]	5.79±0.09[i]
Khaya senegalensis	7.10±0.14[d]	2.49±0.05[d]	5.94±0.02[g]	9.40±0.01[h]	22.06±0.05[b]
Mangifera indica	3.90±0.05[i]	2.15±0.04[e]	3.39±0.03[kl]	11.90±0.07[c]	3.82±0.20[j]
Piliostigma thonningii	11.86±0.07[a]	5.70±0.02[b]	10.67±0.03[a]	10.57±0.06[f]	13.88±0.04[f]
Parkia biglobosa	4.39±0.02[h]	1.31±0.04[g]	5.39±0.02[i]	12.77±0.12[b]	6.03±0.02[i]
Rafia sundanica	5.28±0.04[g]	13.57±0.06[a]	4.57±0.05[j]	8.38±0.04[i]	20.50±0.01[c]
Sarcocephalus latifolius	10.90±0.04[ab]	1.10±0.01[h]	7.88±0.05[c]	11.57±0.07[d]	8.07±0.02[h]
Stryhtinos spinose	6.59±0.04[e]	0.92±0.04[i]	3.68±0.07[k]	13.63±0.07[a]	14.33±0.04[e]
Tamarindus indica	9.21±0.02[c]	0.24±0.05[j]	5.71±0.06[gh]	11.14±0.12[e]	27.85±0.48[a]
Vitex doniana	5.70±0.02[f]	1.52±0.04[f]	7.32±0.14[d]	9.64±0.12[g]	15.32±0.41[d]
P-Value	<0.01	<0.01	<0.01	<0.01	<0.01

Means on the same column with different superscript are statistically significant (p<0.01)

CP: Crude Protein; Fats/oil; Ash: Ash Content; Moisture, CF: Crude fiber

DISCUSSION

Primates encountered in the park were observed to feed in group and in the day time except C. *tantalus* which was observed to feed in the night as well around the staff quarters. In the present study, primate diet consist predominant fruits and leaf belonging to various plants species. This finding agrees with the reports of Aubrey and Marian (1999); Segal (2008) in Sukerbosrand Nature Reserve, South Africa; Akosim *et al*., (2010) in Hong hill; Tyowua *et al*., (2017) in Gashaka-Gumti National Park; Odebiyi and Alarape (2017) in Old Oyo National Park, that primates generally eat different types of fruits, leaves, and gum to animals such as insects, larvae, reptiles and small mammals. However, fruits are the favorite food of primates. According to Akosim *et al*., (2010) variation in the food item and foraging behavior of primate is determined largely by food availability. However, food plant availability is largely a function of plant (phenology). Invertebrates were observed to be fed upon by *Er. pata* and *P. anubis* among other primates in the study area.

The inversion of primate's habitat by farming activities in the park as reported by Uloko and Yager, (2017) must have compelled primate's especially *P. anubis* and *Er. pata* to become crop raiders in the study area. Series of successful raids of human crops by

primates were observed in maize and guinea corn in the study area. This is in line with the reports by Gonzalez- martinez (2004); Yirga *et al*., (2010) and Akosim *et al*., (2010) that primates especially *P. anubis* and *Er. pata* spends more time patronizing farm lands than foraging wild lands during the cropping season, probably because of its high quality and low toxicity as observed by Richard, (1999) in *P. anubis* which prefer human crops because of their nutritive value and low toxicity.

Food choice of primate in the study area just like other wild animals was driven by complex set of criteria's, prominent among them is the nutritional content of the potential food item. Primates fruits choice could have been influenced by the various fruit nutritional content as reflected in the proximate composition of food consumed. Primate choice of diet is premised on the choice of meeting energy and nutritional needs as well as the digestibility of the food items (Odebiyi and Alarape, 2017). Nutritive value of fruits couple with moisture content, fibre and quantity of secondary compound is capable of affecting primate food choice. The variety of fruit species in the diet of primate in the study area implies that fruits provide nourishment. Ripe fruits contain high sugar and carbohydrate level (Kunzs and Linemar, 2007) while seed provides good source of protein and fatty acid. Furthermore, fruits are easier to digest and their protein content is not hindered by secondary plant compound to the extent seen in the leaves (Ganzhorn *et al*., 2009). This study shows that primates in PWLP fed on variety of plant species. However, their diet comprised predominance of fruits. Primate's frugivorous tendency has reached ecological implication. The fruit diet will have effect on seed dispersal, seed treatment, seed predation, food predation, food competition, food provision, food scarcity among other sympatric animals that have fruits constituting a portion of their diet in a given rangeland.

We recommend that further studies on primate spatial variation of food plants and habitat utilization for both dry and wet season be carried out and Conservation education should be intense to protect the existing primate habitat in order to improve on the range condition of the park.

REFERENCES

Akosim, C., Kwaga, B. T., Ali, A. & Mamman, G.S. 2007. Flora resources and structure in Pandam Wildlife Park, Plateau State, Nigeria. Agriculture Journal 2: 740-747.

Akosim, C., Kwaga, B.T., Umar, B. & Mamman, G. S. 2008. The role of aquatic bodies in

avifauna and fish conservation in Pandam Wildlife Park, Pandam, Plateau State Nigerian Journal of Fisheries Intitute 3: 7-11.

Akosim, C., Joseph, J., & Egwumah, P.O., 2010. Assessment of Feeding Behavoir of Olive Baboon (*papio anubis*) in Hong Hills Adamawa State Nigeria. Journal of Research in Forestry, Wildlife and Environment, 2: 60-72.

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

Aubrey, M., & Marian, S.D. 1999. An introduction to animal behavior (4th edition) Cambridge University press.

Bukie, J. O., Ebu, V. T. & Nchor, A. A., 2015. Population Ecology of the White-Throated Monkey (*Cercopithecus erythrogaster*) in Afi Mountain Wildlife Sanctuary (AMWS), Cross River State, Nigeria. International Journal of Agriculture and Forestry, 5: *245-248 DOI*: 10.5923/j.ijaf.20150504.05

Beehner, J. C., Onderdonk, D. A., Alberts, S. C., & Altmann, J. 2006. The ecology of conception and pregnancy failure in wild Baboon, Behavioral Ecology, 17: 741-750

Chapman, C.A., Chapman, L.J., Rode, K.D., Hauck, E., M.J., & Mcdowell, L.R., 2003. Variation in nutritional value of primate foods: among trees, time period and areas*.* International Journal of Primatology 24: 317-333.

Ezealor, H.U., 2002. Critical sites for conservation in Nigeria. Nigerian Conservation Foundation, Lagos, Nigeria. 46-47.

Fahrig L., 2003. Effects of habitat fragmentation on biodiversity. Annual Review of Ecology, Evolution, and Systematics 34: 487–515.

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 Neotropics. PLoS ONE 4(12): e8253.

González-Martinez, J. 2004. The introduced free-ranging rhesus and Patas monkey populations of southwestern Puerto Rico. PR. Health Sciences Journal, 23: 39-46

Hohmann, G., Boesch, C., & Robbins, M., 2012. Feeding ecology in apes and other primates. Max Planck-Institute fur Evolutionare Anthropologie, Germany;

Kate, A. 2000. Behavioral ecology data and its relevance for management, Conservation research in the African rainforests, atechnical handbook.Gumuz Region, Western Ethiopia. SINET: Ethiopian Journal of Sciences 33: 67–72

Kunz, B.K. & Linsenmair, K.E., 2007. Changes in Baboon Feeding Behavior: Maturity dependent Fruit and Seed Size selection within. A Food plant species. International Journal of Primatology, 28: 819-835

Odebiyi, B. R., & Alarape, A. A. 2017. Demystifying the frugivorous tendency of olive baboon, Procedings of the Maiden conference on wildlife Management Society of Nigeria (WIMSON), 169-176 pp.

Pan, Y. D., Birdsey, R. A., & Fang, J. Y. 2011. A large persistent carbon sink in the worlds Forest Science, 133, 988-993.

Peres, C. A., 1999. General guidelines for standardizing line-transect surveys of tropical forest primates. Neotropical Primates 7: 11-16.

Richard, A. F., 1998. Primate 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. Pp2

Segal, C. 2008. Foraging behavoir and diet in Chacma Baboons in Suikerbosrand Nature Reserve. Master of Science Dissertation. University of the Witwatesrand / Johannesburg. Pp76

Tyowua, B.T., Yager, G.O., & Samuel, D.E., 2017. Feeding Ecology of Primates in Southern Sector of Gashaka-Gumti National Park (Filinga Range), Taraba State, Nigeria, Asian Journal of Environment & Ecology 2: 1-9.

Uloko, J.I., & Yager, G.O., 2017. Indigenous Land Tenure System as a Hindrance to the development of Pandam Wildlife Park, Plateau State, Nigeria. Asian Journal of Environment & Ecology 5: 1-9.

Yager, G. O., Bukie, J. O., & kaa, A. E. 2018. Assessment of Population Density and structure of Primates In Pandam Wildlife Park, Plateau State, Nigeria. Sustainability, Agri, Food and Environmental Research, 6: 19-30

Yirga, S., Shenkut, M., Ashagrie, M & Sertse, D., 2010. A Preliminary survey of Erythrocebus patas in Anbesa Chaka, Bambesi Woreda of Benishangul- Gumuz Region, Western Ethiopia. SINET: Ethiopian Journal of Sciences 33: 67–72.