

# Ecological characteristics with emphasis on food and feeding habit of Uganda kob (*Kobus kob*) in Nimule national park - South Sudan

## Abstract

This Study was conducted in Nimule National Park in four locations namely; Matar site, Panjalla, Somo I and SomoII, during the wet and dry seasons of 2015 and 2016. The purpose of the study was to determine food habits and the diurnal activity patterns of Uganda kob (*Kobus kob*). Thirty-three plant species comprising forbs, grasses and trees were identified in the diet composition of Uganda kob using micro-histological technique. The highest percentages of grass species in the fecal pellets are *Cyperus imbricatus* followed by *Echinochloasp*, *Setaria verticillata* and *Setaria sp*. The highest percentages of forbs were *Ipomoea aquatic* and *Polygonum argyocoleon*. The highest percentage of trees were *Acacia seberiana*, *Acacia comphygantha* and *Acacia Seyal*. The diurnal activity of the animal starts early in the morning from 7:00 am till 12 pm when the animal begins feeding walking and resting and from the midday to 7:00 pm the resting time increases while the feeding activity decreases. Habitats composition of Uganda kob *Kobus kob* should be protect from human destructions to meet appropriate requirements during the entire seasons of the year.

**Keywords:** food habits, diurnal activity patterns, micro-histological technique

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## Introduction

Uganda Kob *Kobus kob* is an antelope found across sub-Saharan Africa from Senegal to South Sudan. The distribution from western Africa to central east Africa is patchy. It is seen in Murchison falls and Queen Elizabeth National park in Uganda as well as grassy floodplains of South Sudan. Food availability is one of the most important factors influencing the distribution of free ranging wild ungulates and hence formulation of management strategy for a protected area that necessarily requires adequate information on the food habits.<sup>1</sup> Equally important for sound management is the information on spatio-temporal variation in food availability, possibility of competition for certain food resources. Hence food regulating ungulate populations needs detailed dietary studies. The diets composition selected by wild and domestic ungulate have long been of interest to range and wildlife ecology. Numerous tabulations of diet composition are available in the literature. However, diets composition data alone are not satisfactory for explaining the reasons for observed diet difference between animal species. The study of food and feeding habits of Uganda Kob *Kobus kob* in Nimule National Park will provide base line information for population distribution in different localities. There is a large number of Uganda Kob *Kobus kob* in the area compared to other animals, hence needs sound management plan. Identification of vegetation samples from trees, shrubs, grassland and woodland, as well as plant species utilized by grazing and browsing Uganda Kobs *Kobus kob* in the area will give information for the status of the study site carrying capacity. The study aim was to determine food and feeding habits and provide accounts of food spectrum and seasonal variation in diet of Uganda Kob *Kobus kob* in Nimule National Park.

## Study area

Nimule National Park (NNP) was established in 1935 as a game reserve and upgraded to a National Park in 1954, with an area of 410

Km<sup>2</sup>.<sup>2</sup> The climate of Nimule National Park and its surrounding is not different from that of the southern part of the Southern Sudan especially those of high wood land savanna. It is essentially of continental dry season. The rainy season in Nimule area starts in April and ends in November. The mean annual rainfall in Nimule varies between 1000 and 1200 mm, and the mean daily temperature is 27°C. The highest temperature occurs in March reaching 29 while the lowest usually in July 24.<sup>3</sup> NNP is mainly in area of deciduous high woodland savanna characterized by broad leaf trees some of which are evergreen. The grasses are perennial that grow to a height of 4-8 feet according to Abdalla.<sup>2</sup>

## Material and methods

Samples were collected in Nimule National park, South Sudan in the wet and dry seasons in 2015, and 2016. The collection of samples began during the wet season of August to November 2015, where many plant species reached to the stage of maturation and were noticeable for identification. Collection of samples for the dry season began from January to the early April 2016. Data were collected at four locations in the park. The first location is Matar site which fall in the middle of the park lying along river bank, dominated by different types of habitats, grassland and woodland varying from trees to shrubs that provide food and shelter for Uganda Kob *Kobus kob* and other wildlife species. The second location is Pancallaat the south side to the border of South Sudan - Uganda which acts as feeding site to Uganda kob *Kobus kob* and migratory route of elephants. The third location is Samo II which lies to river side opposite to the eastern side of Nimule Town. The area is a feeding site for Uganda Kob *Kobus kob* and other wildlife species such as elephants, warthogs, reedbucks, hippopotamus, dig dig and wildcats. The fourth location is SomoI which is generally composed of woodland at the western north and is dominant by *Acacia seberiana*, *nilotica* and *Combretumsp* (Figure 1).

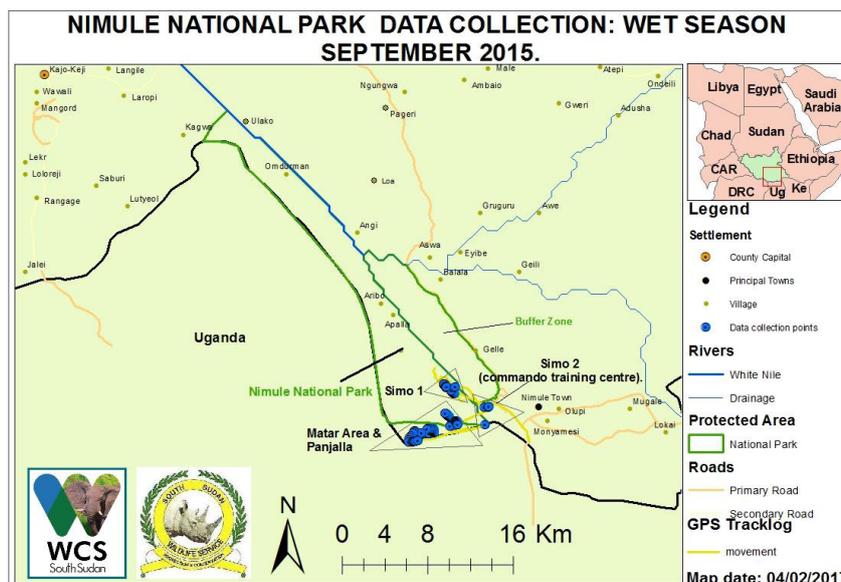


Figure 1 Location map of Nimule National Park and the Study sites, September 2015.

## Direct observation

Direct observation of animal in the field was carried out according to Altman.<sup>4</sup> Observations were conducted to estimate the feeding preferences and selection. Each observation represents one individual of Uganda Kob foraging on plant species according to Altman.<sup>4</sup> Time budget of Uganda Kob in the study area during the dry season was conducted at different levels of 12 hours a day. Twelve hours of the diurnal activities were systemically divided in to 15 minutes observations. Counts start from 7:00 am and end at 7:00 pm. for different activities carried by Uganda kob *Kobus kob* during the day time such as feeding, walking, drinking, running, resting, standing and looking. Direct observation of a Uganda kob *Kobus kob* foraging was conducted at Matar site where most of Uganda kobs *Kobus kob* were found feeding due to availability of food and other biological needs which are available there. fresh and old fecal pellets were scanned, plant species and other types of habitats in squares quadrate were classified and recorded using digital Camera in Matar site.

## Samples of plant species collection

Samples of grasses, forbs and trees were collected in the wet and dry seasons, grasses and forbs were collected during the rainy season from August to November 2015 and 2016. Transects of square quadrates were used for vegetation sampling in the four locations of the study area. Plant collected were preserved and kept in herbarium. Plant species were collected after approaching stage of development where its parts were easily visible for further identification such as leaf, steams, fruits, and flowers. Plant identification was done using Field Guide of Sudan Text book of Ecology. The unknown plants species from grasses and forbs were taken to a Botanist for further identification. Keys identification of plant fragments of Dinder National Park Sudan was used Awad.<sup>5</sup>

## Fecal pellets collection

Fresh and old fecal pellets were collected and placed in a tube labeled with the day, date, month and year of collection. Footprints of Uganda kob *Kobus kob* and other animals found in the feeding areas were scanned. Fecal pellets collected for each tube were ranging

between 10 -12 pellets from each of fresh and old drops. 15 tubes of fecal pellets from each of feeding site were collected separately.

## Fecal pellets preservation and analysis

Preservation of fecal pellets was done based on drying through direct sun heat. Each tube containing fecal pellets was placed into white paper for dehydration and amount of sodium chloride (Salt) was added on it thoroughly to prevent decomposition of samples. Samples were packed into tubes after completed dehydration and then papered for analysis using -Micro histological technique. The dietary composition of the Uganda kob *Kobus kob* was determined according to Stewart.<sup>6</sup>

## Slides preparation

Fecal pellets were ground through a Wiley mill (1-mm screen) to ensure thorough mixing, three slides from composted pellets of each feeding locations of the study area were prepared independently. Phase contrast microscopic X100 Lens was used for identification of slide samples following the procedure of Sparks and. A total of 100 fields per sample were read through a phase contrast microscopic, each slide was magnified 50 times and all recognizable plant fragments were recorded. Plant fragments were identified in the microscopic fields and were compared to the observed characteristics of the plant fragments of the same material on a reference slide.<sup>7</sup>

## Results and discussion

Identification of plant species comprising food composition of Uganda Kob *Kobus kob* using Micro histological technique is based on tissue structure of the plant species found in its fecal pellets. Thirty-one species of plants were identified in the fecal pellets of Uganda kob *Kobus kob*, comprising 41.9% grasses, 13 % forbs and 45.2 % trees and shrubs in the wet season August, 2015 (Table 1). The high percentage of grass species in fecal pellet were *Cyperus imbricatus* followed by *Beckeroposissp* and *Echinochloasp*, *Setaria verticillata* and *Setaria sp*. The highest percentages of forbs were *Ipomoea aquatic* and *Polygonum argyocoleon*. The high percentages of trees were *Acacia comphycantha*, *Acacia seyal*, *Acacia seberiana* and lastly *Vernonia sp*. and *Cissussp*.

**Table I** Dominant plant species and percentage of foraging preferences of Uganda kob *Kobus kob* in the wet season in Nimule National Park, 2015

Plant species		Average percentage of fecal pellets	
		August	September
Grasses	Echinochloasp	5.2	5.4
	Setariaverticillata	4.9	4.5
	Seteria sp	4.8	4.2
	Serpiasincinatus	1.1	1.8
	Rottobeliaexlatta	1.6	2.2
	Ludwigialeptocarpa	2.5	2.1
	Kyllingasp	2.9	2.3
	Haparrhenia	3.3	2.9
	Variables		
	Feckeropsissp	2.1	2.4
	Eragrosticsp	2.7	2.6
	Cyperusimbricatus	5.4	5.4
	Beckeroposissp	5.2	5.2
	Hptiaenethebaica	3	2.8
	Forbs	Ipomoea aquatica	4.9
Polygonum		4.5	4.7
Argyocoleon			
Polygonum		2.7	3.2
Coceineum			
Trees and Shrubs	Panicum	3.1	2.7
	Acacia	5.7	5.2
	Comphycantha		
	Aciacaseyal	5.5	5.2
	Acacia seberiana	5.2	5.6
	Vernonia sp	3.7	3.5
	Cissussp	3.7	3.2
	Neptuniaaleracea	2.6	2.6
	Zizphusethiopic	3.8	4.2
	Datura stramonium	2.6	2.5
	Balanitesaegyptica	1.7	2.2
	Sainumincanum	0.5	1.5
	Cratevaadansonii	1.5	1.2
	Fseudocedrata	1	1.3
	Katscyhi		
	Amanannia	0.5	0.4
	Senegalensis		
	Combretum	2.1	2.2
hartmannianum			
Unidentified items	-	0.3	
Total	100%	100%	

Thirty-two of plant species were identified in the fecal pellets of Uganda kob *Kobus kob* comprising 63%grasses 79% forbs and 41% trees and shrubs in the wet season in September 2015 (Table 1). The highest percentages of grasses in the fecal pellets were *Echinochloasp* followed by *Cyperus imbricatus*, *Beckeroposissp* and *Setaria verticilliata*. The highest percentages of forbs in the fecal pellets were *Ipomoea aquatic*, *Polygonum argyocoleon* and *polygonumcoceineum*. The highest percentages of trees in the fecal pellets were *Acacia comphykantha*, *Acacia seyal* and *Acacia Seberiana*.

Thirty-one of plant species was identified in the fecal pellets of Uganda kob *Kobus kob* in the dry season in January 2016 (Table 2) comprising of 40% grasses 27% forbs and 78% trees and shrubs. The highest percentages of grasses in the fecal pellets of Uganda kob *Kobus kob* were *Echinochloasp* followed by *Setaria verticilliata*, *Setariasp* and *Cyperus imbricatus*. Apparently, forbs were not well selected in the dry season, which means *kob Kobus kob* appears to depend on trees and shrubs. The highest percentages of trees are *Acacia seyal*, *Acacia comphykantha*, *Acacia seberiana* and *Vernonia sp*.

**Table 2** Dominant plant species and percentage of foraging preferences of Uganda kob *Kobus kob* in the dry season in Nimule National Park, 2016

Plant species	Average percentage of fecal pellets		
	January	February	April
<b>Grasses</b>			
Echinochloasp	5.1	4.7	4.8
Setaria	4.6	5.2	4.5
Verticilliata			
Seteria sp	4.3	4.3	4.3
Serpiasincinatus	1.8	2.2	2.3
Rottobelia	2.3	2.4	1.8
Exlatta			
Ludwigia	2.3	2.8	2.8
leptocarpa			
Kyllingasp	1.8	1.5	3.2
Haparrhenia	3.4	3.6	4.7
variables			
Feckeropsissp	1.9	2.1	3.9
Eragrosticsp	2.2	2.6	3.5
Cyperus	3.5	3.8	4.4
imbricatus			
Beckeroposissp	2.6	2.5	1.3
Hptiaene	1.5	1.2	3.6
Thebaica			
Ipomoea	2.7	2.4	2.3
Aquatica			
Polygonum	2.4	1.8	1.7
argyocoleon			
Polygonum	1.9	1.5	2.4
coceineum			
<b>Forbs</b>			
Panicum	0.8	0.5	4.2
Acacia	6.4	7.2	4.5
comphykantha			
Aciacaseyal	6.8	6.4	3.4
Acacia seberiana	5.9	5.8	4.5
Vernonia sp	4.8	4.3	5.2
Cissussp	4.7	3.4	1.2
Neptunia	2.7	2.7	3.4

Table Continued...

Plant species		Average percentage of fecal pellets		
		January	February	April
<b>Grasses</b>				
<b>Trees and shrubs</b>				
	Aleracea			
	Zizphusethiopia	3.6	4.3	2.2
	Datura	2.3	2.5	1.2
	Stramonium			
	Balanites	2.7	1.8	0.5
	Aegyptica			
	Sainumincanum	2.8	2.1	2.3
	Crateva	3.4	2.2	2.6
	Adansonii			
	Fseudocedrata	2.5	1.5	1.5
	katscyhi			
	Amanannia	2.1	2.7	2.4
	Senegalensis			
	Combretum	4.2	4.5	4.4
	Hartmannianum			
	Unidentified	-	-	0.2
	Items			
<b>Total</b>		100%	100%	100%

Thirty-two of plant species were identified in the fecal pellets of Uganda kob *Kobus kob* in April, 2016 (Table 2) comprising 63% grasses, 79% forbs and 41% trees and shrubs. The highest percentages of grasses in the fecal pellets were *Echinochloasp* followed by *Setaria verticilliata* and *Haparrhenia variables*. The highest percentages of forbs in the fecal pellets were *Polygonumcoceineum*, *Polygonum argyocoleon* and *Ipomeoa aquatic*. The highest percentages of trees in the fecal pellets were *Vernonia sp*, *Acacia comphygantha* and *Acacia Seberiana*.

Table 3 Shows summaries of the diet selected by Uganda kob in wet and the dry seasons. Plant species mostly preferred were *Echinochloasp* and *Acacia comphygantha* and the other selected plant species were two grass species from *Setaria verticilliata*, *setairasp*, two forb species from (*Ipomeoa* , *Hibiscus pandoniformis* and

*Polygonum sp*) and tree species from (*Acacia seberiana*), this result is agreed with studies from western Africa to central East Africa area, that determined grasses preferred by kobs were *Hyparrhenia* species, *Brachiaria brizantha*, *Setariagayanus*, *Chlorisgayana*, *Echinochloa* and *Digitaria spp*. Bindernagel<sup>8</sup> results from fecal pellets analysis determined food items utilized by Uganda Kob *Kobus kob* in wet and dry seasons were mostly from Dicotyledonous compared to Monocotyledonous. The study proved that Uganda Kob *Kobus kob* is a browser animal in the dry season and mixed feeder under favorable circumstances when there is availability of food resources in the wet season, this agrees with Westoby.<sup>9</sup> Fibrous plants may be the only food found during the dry periods or in arid environment, as Uganda Kob *Kobus kob* defecates hard and more compact fecal pellets during the dry periods or in the tropical rain forest ecosystem.

**Table 3** Plant species and percentage of foraging preferences of Uganda kob *Kobus kob* in Nimule National Park 2015, 2016

Plant species	Percentage of foraging preferences		
	100 -75%	50 -74%	1 -49%
<b>Grasses</b>			
Echinochloa	√	—	—
Setairaverticilliata	—	√	—
Setaria	—	√	—
Eragrosticsp	—	—	√
Haparrhenia variables	—	—	√
<b>Forbs</b>			
Ipomeoa equatica	—	√	—

Table Continued...

	Percentage of foraging preferences		
Hibiscus pandoniformis	—	√	—
Polygonum sp	—	√	√
Panicum	—	—	—
Woody trees			
Acacia compyhcantha	√	—	—
Acacia seberiana	—	√	—
Combretum	—	—	√
Hartmannianum			
Zizhpusehiopica	—	—	√
Datura stramonium	—	—	√
Cissussp	—	—	√

The peak of foraging activity of Uganda kob *Kobus kob* in the morning was from 9:00- 10:00 am followed by 7:00-8:00 am then decreasing from 8:00- 9:00am and from 6:00- 7:00 pm which is the end of the daily activities of the day. The peak of walking activity was from 10:00- 11:00am then decreases from 8:00-9:00 am, 7:00-8:00 am and 1:00 - 2:00 pm then by the time 3:00- 4:00 pm the

activity decreases to the lower point due to the heat of the sun which let Uganda Kob *Kobus kob* to leave for shading. The peak of resting activity was at 6:00-7:00 pm followed by 3:00-4:00 pm, 11:00-12:00 am and 2:00-3:00 pm. The resting activities during the day time was due to the high temperature while in the latest hours is for sleeping (Table 4).

**Table 4** Number of plant species, Relative frequency, Relative abundance, Relative density and important value index of grasses collected in NNP, 2015

Season	Location	Grass species	Number	Relative frequency	Relative abundance	Relative density	Important value index
I	3	Seteriapall	137	7.95	7.75	8.03	23.75
I	3	Echionchloa	129	7.95	7.3	7.57	22.83
I	3	Rottoboleia	127	8.21	6.96	7.45	22.63
I	3	Dactylocten	146	8.13	8.09	8.56	24.79
I	3	Brachiari	122	7.78	7.06	7.15	22
I	3	Vossia Cusp	150	8.13	8.31	8.8	25.24
I	3	Beckeropsis	145	7.78	8.39	8.5	24.68
I	3	Seripusinc	123	8.13	6.81	7.21	22.16
I	3	Kyllingasp	135	7.35	8.27	7.92	23.55
I		Eragrostis					
I	3	sp	104	7.09	6.6	6.1	19.8
I		Cyperus					
I	3	imbri	139	7.87	7.95	8.15	23.9
I	3	Feckerosis	123	6.4	8.66	7.21	22.28
I	3	Hyparrhenia	124	7.17	7.78	7.27	22.24
<b>Total</b>				100	100	100	300

The high activity was due to the low temperature or cool weather. Uganda Kob *Kobus kob* is diurnal but inactive during the heat of the day. They move together and are more social in territories at the time of mating. Females move at the front in the daily movements to

water. However, in larger herds the females take their signals from other females where males are also present in the migratory herds following the females, Male herds that may be numbered in hundreds accompany females as they travel during the dry season (Table 5).

**Table 5** Diurnal activity pattern of Uganda kob *kobus kob* in Matar area, Nimule National Park, 2015

Time	Activities / minute		
	foraging %	Walking %	Resting %
7:00 - 8:00 am	29	26	4
8:00 - 9:00	27	28	5
9:00 - 10:00	30	23	7
10:00 - 11:00	15	35	9
11:00- 12:00	13	21	26
12:00 - 1:00 pm	19	21	22
1:00 - 2:00	15	24	21
2:00 - 3:00	14	21	25
3:00 - 4:00	13	16	27
4:00 - 5:00	15	23	22
5:00 - 6:00	13	24	23
6:00 - 7:00	8	22	28

## Conclusion

Most active time of Uganda Kob *Kobus kob* was from 9:00 1:00 am followed by 7:00: 8:00 am because of low temperature in the morning hours. Uganda kob feeds on grass species intensively and shift to become browser. *Acacia seiberiana* and *Crateva adansonii* were observed in the diet composition of kob in the two seasons. This indicated that the plants are dominant in the area and are selected and preferred by Uganda kob *Kobus kob*. *Vernonia sp*, *Acacia comphygantha*, and *Acacia seiberiana* were found in high frequency in the diet composition of Uganda kob *Kobus kob* in the dry season with percentage of 78% for *Acacia comphygantha*, 68% for *Acacia seiberiana* and 57% for *Vernonia*. Uganda kob *Kobus kob* feeds on wood trees in the dry season in all locations sampled, hence has strong correlation to habitats composition that consists of trees mainly *Acacia seiberiana*, *Acacia comphygantha* and *Acacia nilotica*. It is clear that the composition of habitat becomes higher during the rainy season where many of plant species are available. Uganda Kob *Kobus kob* is facing two decimating factors, first is illegal hunting carried by communities living around the Park and some of armed forces living around the protected area for their local consumption in adjacent locations of South Sudan- Uganda border. Second, is the ambush of python during resting hours at night in the wet season.

## Recommendation

- i. Further studies should be carried out to avail more information on Uganda kobs *Kobus kob* for preparing effective management and conservation plans.

- ii. Uganda kob *Kobus kob* population distribution in the park should intentionally find protection from illegal hunting activities carried during the dry season.
- iii. Habitats composition of Uganda kob *Kobus kob* should be conserved from human destructions to meet appropriate requirements during all seasons of the year.

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## Conflicts of interest

The author declares there is no conflicts of interest.

## References

1. Jerry L, Bryan Gross, Sira Mady Dabo, et al. Effects of Sample Preparation, Growth Stage, and Observer on Micro histological Analysis of Herbivore Diets. *The Journal of Wildlife Management*. 1982;46(2):502–505.
2. Abdalla RY. large mammals census and management problems in Nimule National Park. A report to the Directorate of Wildlife conservation and National Parks forces. E1/16 Equatorial Region Juba. 1988.
3. Lebon JHG. Land use in Sudan Geographical publication Ltd. Bude, Cornwall, England. 1965.
4. Altman J. Observational study of behavior sampling methods. Behavior Academic press, New York 236. 1974.
5. Awad, NM, SM Adel hamed, R.M Hasen. Keys to the identification of plant fragments from Dinder National Park, Sudan Range science Dept, Science series No.34 Colorado State University Fort Collins. 1983;58.
6. Stewart DRM. Analysis of plant food preference of grazing herbivores S. *Journal of Applied Ecology*. 1967;4:82–111.
7. Ward AL. Stomach content and fecal analysis in Range and Wild L. Habitat evaluation, A Res Symp US Dep Agr. *Forest Serv Misc*. 1970.
8. Bindernagel JA. Game cropping in Uganda. Canadian International Development Agency, Ottawa. 1968.
9. Westoby. An analysis of diet selection by large generalist herbivores *Amer Natur*. 1974;108(961):290–304.