

Original

Daily Activities of the Waterbuck *Kobus ellipsiprymnus defassa* in Dinder
National Park, Sudan

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Abstract:

Background: Daily activities of *Kobus ellipsiprymnus defassa* waterbuck in Dinder National Park were studied. Objectives: The aim of this study is to investigate the daily activities of the waterbuck. The study was conducted in five meadows from February to May 2018. It was repeated in 2019 during the same duration.

Methods: Direct observation methods were used to record the daily activities of herds. Recording started from 6:00am to 5:59pm. During each hour three observations were done each lasted 15min with a break of 5min between successive observations. **Results:** There was a variation in daily activities between years. Differences within and between months, and within and between years, and within and between meadows were observed ($p>0.05$ to $p<0.01$).

Keywords: Water buck, Daily Activities, Dinder Biosphere Reserve.

Introduction:

Africa harbors a large number of species of wild and captive Bovidae [1, 2], widely distributed throughout the African savanna [2, 3]. Water bucks disappeared from most of their original ranges due to poaching [4], and are thought to be declining especially the *Kobus ellipsiprymnus defassa* waterbuck at an alarming rate [5].

Daily activity patterns are important parameters in the ethological study of any animals [5, 6, 7, and 8]. The biology of animals is affected by feeding drinking, temperature and humidity, predators, competitors, biological cycle, moon phases and other minor factors [6, 7, 8, and 9]. Studying the activity pattern for a species is of significance in its sustainable management [9, 10, 11, 12, 13, 14, and 15]. Many methods were used to generate data on the activity patterns of animals [11, 12].

Daily activity of waterbucks in Dinder National Park (DNP) was studied by [13] and its feeding habits in Abdelgani meadow in DNP was studied by [14].

Waterbucks disappeared from most of its range due to poaching [15], and is thought to be declining especially *Kobus ellipsiprymnus defassa* waterbuck at an alarming rate [5].

Materials and Methods:

Study site:

The study was carried out in the DNP 11° 47' to 12°32'N and 35° 15' to 48° 15' E, [Map 1].

Observations:

Observations covered the daily activities of *Kobus ellipsiprymnus defassa* (fig.1) waterbuck with respect to foraging, resting, walking, drinking, resting, walking, suckling and fighting. Field surveys were executed from February to May 2018 and 2019. The ethogram was constructed following [16, 17]. Recording started from 6:00am to 5:59pm using (Deluxe 10 X 50) binoculars. *Acacia nilotica*, *Ziziphusspina-christi* and other large trees stands were used as a hide to avoid unduly disturbances. The daily observation was divided in the morning 6:00am to 11:59am, afternoon 12:00pm to 2:59 pm and evening 3:00pm to 5:59 pm.



Map 1: Dinder National Park Location

Source: https://en.wikipedia.org/wiki/Dinder_National_ParkResults (2020)

Results:

The comparison of the daily activities of *Kobus ellipsiprymnus defassain* (Fig.1) the DNP during 2018 and 2019 was given in Table 1

The table showed that:

1. Significant differences ($p < 0.00$) in foraging, browsing, walking, suckling, drinking and fighting.
2. Significant difference ($p < 0.001$) in resting.
3. Activity pattern of foraging and suckling were significantly higher in 2018. On other hand, the rest of activities were significantly higher in 2019.

Table 1: Comparison between daily activities of *Kobus ellipsiprymnus defassain* Dinder National Park during 2018 and 2019

Activity	2018	2019	Calcu.t	Significance
Foraging	13.82±11.762	10.38±7.460	6.648	0.000
Browsing	0.046 ± 0.226	0.093 ± 0.251	-3.808	0.000
Resting	4.601 ± 12.508	6.728 ± 11.418	-3.378	0.001
Walking	0.285 ± 0.761	0.497 ± 0.658	-5.659	0.000
Suckling	1.230 ±1.968	0.565 ± 0.976	8.085	0.000
Drinking	0.615 ± 1.127	1.725 ± 1.605	-15.190	0.000
Fighting	0.206 ± 0.704	0.563 ± 1.206	-6.891	0.000

The variation of daily activities between months:

Table 2 compared between the daily activities the *K. e. defassa* different months in DNP during 2018 and 2019. The table revealed that the mean activity patterns were high in 2018 compared with 2019 throughout the study period.

Table 2: Mean time of activities spend by *Kobus ellipsiprymnus defassa* waterbuck during different months during 2018 and 2019

Activities	Months	2018	2019
		Mean± SD	Mean± SD
Foraging	February	157.83±70.782	10.635±4.020
	March	228.88±90.895	8.418±2.515
	April	360.15±127.658	11.554±3.003
	May	95.90±24.997	9.290±2.954
Browsing	February	0.327±0.240	0.065±0.032
	March	0.626±0.346	0.077±0.032
	April	1.275±1.537	0.1386±0.099
	May	0.811±0.757	0.176±0.08
	February	84.19±109.33	6.919±10.04

Resting	March	103.70±115.07	4.297±2.406
	April	50.30±45.507	8.549±7.27
	May	32.823±9.732	8.831±8.366
Walking	February	5.2096±3.151	0.471±0.26
	March	2.789±1.279	0.287±0.18
	April	5.5467±4.654	0.593±0.317
	May	5.5840±3.221	0.854±0.409
Suckling	February	11.5063±9.418	0.812±0.366
	March	11.5693±9.478	0.471±0.166
	April	33.3717±12.916	0.568±0.409
	May	11.7057±8.27	0.613±0.36
Drinking	February	6.6587±4.288	1.135±0.51
	March	3.9117±1.396	0.949±0.20
	April	11.5597±3.525	2.144±0.685
	May	14.4207±4.65	2.757±1.008
Fighting	February	8.3697±7.53	0.689±0.60
	March	1.0957±1.245	0.334±0.29
	April	3.784±3.254	0.531±0.456
	May	1.3367±2.01	0.247±0.31

Table 3 Matrix of significant differences table 3 and 4 was showed various level of correlation in different activity pattern and months. $r \geq 0.650$ indicates high correlation, 0.654 to ≥ 0.400 indicates weak correlation and poor correlation is indicated by ≤ 0.40 .

The distribution of activities in 2018 was poor activity and moderate activity 28.6 and 16.7 respectively.

The distribution of activity in 2019 was poor and high 45.2% for both and moderate activities were 9.5%.

Table 3: Matrix of significant differences in activities during 2018

Months	February	March	April	May
	Foraging activity			
February	-	0.346	0.210	0.408
March	0.346	-	0.101	0.098
April	0.210	0.101	-	0.006
May	0.408	0.098	0.006	-
	Browsing activity			
February	-	0.689	0.225	0.520
March	0.689	-	0.394	0.803
April	0.225	0.394	-	0.538
May	0.520	0.803	0.538	-
	Resting			
February	-	0.780	0.629	0.469
March	0.780	-	0.452	0.325
April	0.629	0.452	-	0.802
May	0.469	0.325	0.802	-
	Walking			
February	-	0.395	0.904	0.893
March	0.395	-	0.336	0.330
April	0.904	0.336	-	0.989
May	0.893	0.330	0.989	-
	Suckling			
February	-	0.994	0.030	0.981
March	0.994	-	0.030	0.987
April	0.030	0.030	-	0.031
May	0.981	0.987	0.31	-
	Drinking			
February	-	0.388	0.142	0.033
March	0.388	-	0.035	0.008

April	0.142	0.035	-	0.370
May	0.033	0.008	0.370	-
Fighting				
February	-	0.070	0.225	0.078
March	0.070	-	0.463	0.947
April	0.225	0.463	-	0.503
May	0.078	0.947	0.503	-

Table 4: Matrix of significant differences in activities during 2019

	February	March	April	May
Foraging activity				
February	-	0.417	0.732	0.618
March	0.417	-	0.260	0.745
April	0.732	0.260	-	0.407
May	0.618	0.745	-	0.407
Browsing activity				
February	-	0.835	0.226	0.082
March	0.835	-	0.305	0.115
April	0.226	0.305	-	0.520
May	0.082	0.115	0.520	-
Resting				
February	-	0.683	0.799	0.765
March	0.683	-	0.511	0.484
April	0.799	0.511	-	0.965
May	0.765	0.484	0.965	-
Walking				
February	-	0.481	0.635	0.161
March	0.481	-	0.253	0.052
April	0.635	0.253	-	0.324
May	0.161	0.052	0.324	-

	Suckling			
February	-	0.321	0.469	0.536
March	0.321	-	0.773	0.692
April	0.469	0.773	-	0.913
May	0.536	0.692	0.913	-
	Drinking			
February	-	0.742	0.102	0.018
March	0.742	-	0.060	0.011
April	0.102	0.060	-	0.294
May	0.018	0.011	0.294	-
	Fighting			
February	-	0.347	0.368	0.248
March	0.347	-	0.964	0.811
April	0.368	0.964	-	0.776
May	0.248	0.811	0.776	-

The variation of daily activities between the periods of the day:

The results in the table state that most of the times of activities are spent in the evening except for browsing and resting irrespective of years. The least time spent in suckling and drinking was during the afternoon. Significant differences were observed in foraging 2019. Significant differences were observed in walking 2018. Significant differences were observed in fighting 2019 (fig.2) .

Table 5: Comparison of different activities during 3 periods of days in hours of *Kobus ellipsisprymnius defassa* in the Dinder National Park

Activities	Morning	Afternoon	Evening	p-value
Foraging 2018	179±75.035	149.98±113.62	248.79±166.596	0.342
Foraging 2019	105.68±1.414	65.97 ±11.83	127.57±18.02	0.001
Browsing 2018	0.451±0.37	1.40±1.22	0.427±303	0.137
Browsing 2019	0.475±0.238	1.41±0.62	1.550±0.8469	0.074
Resting 2018	47±21.43	119±115.7	37.605±46.53	0.276
Resting 2019	55±23.46	70±79.18	89.65±94.6986	0.798
Walking 2018	3±0.84	4±1.086	8.273±2.823	0.004
Walking 2019	5±2.44	4±1.4367	8.730±3.355	0.032
Suckling 2018	22±9.55	7±8.824	22.654±15.617	0.148
Suckling 2019	5 ±5.164	5.06±1.6077	8.020±3.361	0.483
Drinking 2018	9±4.678	5.877±4.768	12.612±5.886	0.210
Drinking 2019	19±.768	12±.5531	22.000±13.06	0.308
Fighting 2018	0.009±0.018	5±4.73	6.648±5.496	0.130
Fighting 2019	0.345±0.69	5±2.205	8.340±3.637	0.004

Discussion:

There was a statistically significant difference between year 2018 and 2019 in all activities, foraging and suckling was higher in 2018 than 2019, while browsing, resting, walking, drinking and fighting were higher in 2019. This may be due to fact that in 2018 the rainy season was heavier than in 2019. Suckling was higher in 2018 because the number of calves was higher in 2018 than in 2019. The suckling was higher in

2018 than in 2019. Energetic needs are higher when females are lactating because the production of milk is extremely costly [18]. Resting was lower in 2018; this may be due to the great number of calves seeking suitable habitat shelter. The behavior of mothers leaving the herd 2 weeks before parturition.

There is significant difference ($p < 0.039$) in foraging behavior between March and April.

April was significantly different than May ($p < 0.01$). This may be due to the changing of environmental factors affecting the time budgets [19, 20].

There was significant difference in browsing behavior between February and May ($p = 0.002$). Browsing was statistically different in March than May ($p = 0.006$). April was not significant different ($p > 0.05$) than May. This is in line with the peak of dry season. This is in line with [21, 22].

There was significant difference between February and April in resting behavior ($p < 0.024$). This may be due to the fact that when the dry season approaches the behavioral patterns start to change. Ungulates may also employ the alternative strategy of feeding longer to store energy when the quality and quantity of forage is reduced during the dry season. This is compatible with [23, 20].

There was significant difference ($p < 0.01$) in suckling behavior between February, and March. Significant difference ($p < 0.05$) was found between April and May. These variations may be due to Defassa waterbuck breeding along all the year and this leads to variation in calves' ages.

There was significant difference ($p < 0.05$) between all months in drinking behavior activity. This may be due to that variation in distribution of *K. e. defassa* waterbuck along the different meadows and variation in their needs to drink. The results are in agreement with [24, 25]. Both authors stated that in African savannas, the hottest hours of the day coincide with the period when large carnivores are less active, and ungulates drink during this period to reduce the risk of natural predation.

There was significant difference ($p < 0.000$) between February, March, April and May. These variations are probably due to fighting between the young, and adults fighting for mating.

There was significant difference ($p < 0.05$) in the time period and foraging behavior activity in the morning, afternoon and evening. The afternoon period was significant difference with evening ($p = 0.000$). The variation is due to that peak of foraging of *defassa* waterbuck in the morning, and evening. The *K. e. defassa* spent most of the afternoon period in the resting. These results are in line with [19, 20] who attributed this to exposure acute heat stress coupled with dehydration. According to [25, 26] pronghorn antelope

and cattle spend much of their time grazing and resting with peak foraging activities in the morning and evening.

The study shows significant difference ($p > 0.05$) in browsing in the morning and afternoon. The afternoon period was significantly different with evening ($p = 0.000$). The results are due to feeding strategies of the Defassa waterbuck, as it browses more during the afternoon period.

There was significant difference in the time period and resting behavior activity in the morning, afternoon and evening ($p = 0.000$ and 0.003) respectively. The afternoon period was significantly different from The Defassa waterbuck peaks of foraging was in the morning and the evening, as they spent most of afternoon period in resting. This confirmed [26] field observation.

Highly significant difference ($p < 0.00$) in time period and walking behavior activity between the morning, afternoon and evening was found. The afternoon period was significant difference with evening. These variations are due to strategies of *K. e defassain* selection of its feeding.

There was significant difference ($p < 0.00$) in the time period and suckling behavior between the morning, afternoon and evening

significantly ($p < 0.05$). The afternoon period was significantly different with evening ($p < 0.00$). Waterbuck have varying times for suckling of their calves, most of the suckling was observed during the morning and evening.

There was significant difference ($p < 0.05$) between drinking in morning and afternoon. There was variation between afternoon and evening. The similarities of the results in the morning and evening ($p > 0.05$) is due to *K. e defassa* drinking when they enter the meadows in the morning and when they leave the meadows in the evening.

Significant difference ($p < 0.05$) in fighting between morning and evening as well as in the afternoon period was found. This was due the variation of aggregation of herd during the day.



Fig 1: *Kobus ellipsisprymnius defassa*



Fig 2: Fighting behavior of

Recommendation:

Further studies of *Defassa waterbuck* in the entire park and the other meadows with the aid of new technology are recommended.

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