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Feed and Feeding Preferences of Captive Eland (*Taurotragus oryx*) in Sanda Kyarimi Zoological Garden Maiduguri Borno State Nigeria

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Abstract

An appraisal of the feeding pattern of Eland in captivity is crucial in obtaining reliable information in the feed and feeding preferences of the species. The study identify the various food types preferred by captive Eland, examine the duration of feeding and water intake and access the nutrient content of feed preferred by the species in Sanda Kyarimi zoological garden Maiduguri. On site assessment of the feeding habit of captive Eland was observed daily in the morning and evening. Variables such as feeding time and duration, type of feed, method of feeding and frequency of water intake were observed. Results obtained were subjected to descriptive analysis in forms of cross tabulations and percentages, feed samples were analyzed for dry matter, crude protein, crude fibre, ether extracts, ash and moisture content. The results revealed that Eland was solely fed with wheat offal. The highest feeding duration was 3hours and water intake rank the lowest with 2 minutes. The results from the proximate analysis of the wheat offal reveals that it contains crude protein of 11.90%, crude fibre of 18.00%, moisture content 8.30%, ether extract 1.50% and ash 2.00%. Wheat offal has a large amount of fiber which facilitates the digestive process. The study serves as baseline information on the overall feeding behaviour of captive Eland in the study area. The study serves as baseline information on the overall feeding behavior of captive Eland and provides guideline to animal's researchers for further studies and zoo managers and policy makers in designing policy that will strive to enhance the feeds and welfare of captive Eland.

Keywords: Feed; Feeding preferences; Captive eland; Zoological garden

Introduction

The eland is the largest African antelope of the order Tragelaphini (spiral-horned antelopes). Two species which are commonly recognised are the common eland Taurotragus which occurs throughout the southern, central and east African savanna and woodland and the giant eland derbianus which occurs discontinuously in Senegal (in fairly dense Guinean woodland) and with remnant populations in Cameroon, Chad, Zaire and Sudan.

Ungulate species like Eland survival depends on plants, which provide adequate nutrients. In natural environments, they survive by using their feeding skills and walking long distances to select feed that meet nutritional requirements for growth, maintenance and reproduction. In captivity, the availability of feed that is in commensuration with the natural environment is limited; therefore, for alternative dietary items they rely on feed supplied with adequate nutrients. Animals in captivity are fed various dietary items such pellets, grass hay, browse (seasonally available) and fresh produce that depends on market availability [1].

Eland are primarily browsing ungulates and eat grasses. Mainly during the rainy season, studies of the water balance of Eland have shown that their ability to select a diet of high calorific value and moisture content plays an important part in their survival in arid areas. Elands habitat is so versatile, so its diets include; grasses, grains, leaves, fruits and herbs. Eland are herbivores and graze mainly on grasses and foliage as well as other parts of a plant. In the rainy season they browse and feed on grasses. They can eat coarse, dry grass and weeds if nothing is else available. Eland need a high protein diet that comprises succulent leaves from a variety of flowering plants. Fruits from Securinega and Strychnos may also be eaten. Dominant grasses include Setaria and Themeda. Densely wooded forests are avoided. Elands are adapted to living independently of water supplies [2]. They don't have to drink regularly (although they do where water is readily available) but rather get the moisture they need from the food they eat or from other simple conservation technique. Eland feed during the day but they also feed at night when the moisture content of the foliage is higher. They produce very contracted urine and dry feaces so as not to discard of moisture unnecessarily. They will stand in the shade on very hot days and have the ability to allow their body temperature to rise by a few degrees dissipating the heat after dark when its cooler. Eland breathe deeply and slowly to conserve the moisture in their nasal passages [3].

Little information is available on the giant eland, but the common eland has been the subject of many studies

investigating the possibility of domestication. Elands are available in abundance in most African countries, but few under captivity. The knowledge of captive rearing of Eland provides insight on captive breeding of the species in captivity and enhances their survival and augments conservation and management strategies [4].

Materials and Methods

The study areas

Locat on of the study area: The study was carried out in Sanda Kyarimi zoological park, which is located between the latitude 11° E to 15° E and Longitude 10° N and 25° N. The study area is located within the Metropolis of Maiduguri metropolitan Council along Shehu Laminu way, opposite to it is the Borno Radio Television Cooperation (BRTV) and adjacent to it is the Borno State Agricultural Development Programme (BOSADP). Sanda Kyarimi Park Area was established in 1970 as a Communal forest reserve and also a neem plantation which serve as a picnic and relaxation area for the inhabitants of Maiduguri. It covers an area of 42 acres and houses a lot of animals species. It was first named after the former head of state general Yakubu Gawan by defund North-Easthern state [5]. The actual Zoo Commence in 1974 and there was donation of wild animals by Governors in 1976. The zoo was renamed after one of the past Shehu of Borno, Shehu Sanda Kyarimi. Maiduguri is inhibited by different tribes, however, the major ethic groups in the area are Kanuri and Hausa, some ethic group such as Shuwa, Babur, Marghi are commonly found.

The climate is hot for most part of the year, with low rainfall that ranges from 650-800mm annually. Three seasons have been identified, the cool harmattan season usually around (October-March) half dry season (April-June) and rainy season (July-September). Temperature is high during hot dry season of the year ranging between 39°C and 49°C and relative humidity between 42%-49% while evaporative is about 203 mm per year [6].

The vegetation of of the area is mainly Sahel Savanna type comprising mainly draught resistance thorny, grasses such as *Andropogus gayanus*, *Catastrophic procera*, *Stringa hermontica*, Elephant grass, *Pennisteumredicell atim* (kyaruwa) *Hyperhemia nita* (Zana) *Aritida* species. *Cenchrus bililorus* and scattered shrubs, drought resistance tree like *Adansonia digitata*, (baoboa) *Ziziplus spinachristi* (kurna), *Azadiracta indica* (Neem) *Eucalptus canaldulensus* (Turare), *Faidherbia albida*, *Ziziplus mouritania*, *Acacia senegal*, *Acacia nilotica*, *Khaya senegalensis* and desert date palm etc.

Data collection

On site assessment of the feeding behavior of Eland were observed. The study area was visited for a period of two weeks and observation was carried out morning and evening. Every time these animals are observed, the variable such as feeding materials, feeding time and duration, type of feed, method of feeding and frequencies of water intake will be observed and recorded [7].

Data analysis

The data obtained will be subjected to descriptive analysis which include frequency distribution tables and percentages, charts will also be used to present the percentage of observed variables on feeding pattern of Eland in Sanda Kyarimi zoological garden Maiduguri.

Chemical analysis

Samples were analyzed for dry matter, crude protein, crude fiber, ether extract or fat, ash, carbohydrate and Nitrogen Free Extract (NFE) according to AOAC method 15th edition.

Dry matter

The dry matter content of the samples were determined by weighing 10 g of samples into petri dish while placed in hot oven at 105°C for 24 hours. And then removed and placed in dessicator to cool, after cooling you reweigh for 15 minutes [8]. The dry matter content was calculated using the formula;

W_2-W_3/W_2-W_1 × 100

Where;

W_2=Weight of petri dish with sample in grams before oven dried

W_3=Weight of petri dish with sample in grams after oven dried

W_1=Weight in grams of empty petri dish

Crude protein

Crude protein content was analyzed using keljedal tablet and 1 g or 2 g of sample was weighed in to digestion tube and 1 or 2 keljedal tablets were added 10 ml or 20 ml of concentrated Sulphuric acid on to the (conc. H_2SO_4) was added onto the flask and digested at 420°C for 3 to 5 hours. After cooling 50 or 90 ml of distilled water was added into digested solution. About 50 ml of 40% Caustic Soda (NaOH) was added onto 50 ml of digested and diluted solution and then placed on heating section of the distillation chamber, 30 ml of 4% boric acid, plus bromocresol green and methyl red as an indicator was put on to conical flask and placed under Neath the distillation chamber for collection of ammonia, the solution changed from orange to green colour [9]. About 0.1 normal solution of Hydrochloric Acid (HCL) was measured into burette. The conical flask containing the solution was titrated until the colour changes from green to pink. The burette reading was taken. The crude protein was calculated using the formula:

%CP=(A-B) × N × F × 14.007 × 6.25/100 of samples/ms of samples

Where:

A=mls of acid used for titrating blank sample (0)

N=normality of acid used for titration

F=factor=14.007

6.25 is constant

100=Conversion to percentage

Crude fibre

Crude fibre was determined by weighing 2 g of samples was placed in a round or flat bottom flask and 50 ml of Tri-chloroacetic Acid Reagent (TCA) was added, the mixture was boiled and refluxed for 40 minutes. Filter paper was removed and cooled at room temperature. Filter paper was used to filter the residue. The residue obtained was washed 4 times with hot water and once with petroleum ether then the filter plus the sample were folded together and dried at (30°C-60°C) in an oven for 24 hours. Reweighed and then ashed 650°C extract and then cooled reweighed [10].

Formula:

%CF=Difference in weight/weight of sample on DM bases × 100

Ether extraction (Fat)

The ether extract was determined by using soxlet apparatus, 1 g or 2 g of the feed sample was weighed into a timbre and 200 ml petroleum ether was measured with measuring cylinder, the solution was put into round or flat bottom flask and was heated at 45°C for 1 hour interval for 2 hours. The flask was removed and then cooled into dessicator for 15 minutes and percentage fat sample is determined by using the formula below:

%fat >or=weight of fat/weight of sample × 100

Ash

To determine the ash content 1 g or 2 g of sample was weigh into crucible and dried at 105°C for 24 hours, then cooled in the dessicator for 15 minutes and reweighed.

Formula:

%ASH >or=loss in weight/initial weight × 100

Nitrogen free extract

Percentage free extract was determined by computing indirectly by difference using the formula:

%NFE >or=100-(%CP+%CF+%EE+%Ash)

Carbohydrate

Percentage carbohydrate was determined by computing indirectly by difference using the formula:

%carbohydrate=100-(%MC+%ASH+%CP+%CF

Results and Discussion

The feeding pattern of Eland was observed in Sanda Kyarimi park, of which the animal was fed directly with only wheat offal daily with highest feeding activity (duration) of (3 hours) during morning while water intake ranked the lower with (2 minutes) once or twice in the morning and evening with the minimum total of (7minutes) of water intake per day. **Table 1** shows the results of the feeding pattern of Eland in the study area [11-13].

Table 1: Feeding pattern of Eland in Sanda Kyarimi zoo.

Feed type, Water	Morning (am)	Evening (pm)	Total duration (hours)
Wheat offal,	8:00–10:00	3:00–3:40	2 hours, 40 minutes
Water intake	9:40–9:45	3:30–3:38	13 minutes
Wheat offal,	8:00–9:00	2:40–3:20	1 hour, 40 minutes
Water intake	9:25–9:28	3:05–3:15	13 minutes
Wheat offal,	8:00–10:30	3:10–3:35	2 hours, 55 minutes
Water intake	9:48–9:50	2:50–3:00	12 minutes
Wheat offal,	8:00–8:50	3:20–4:00	1 hour, 30 minutes
Water intake	---	2:36–4:44	8 minutes
Wheat offal,	8:00–9:10	---	1 hour, 10 minutes
Water intake	9:08–9:11	4:00–4:11	14 minutes
Wheat offal,	8:00–9:20	4:00–4:40	2 hours

Water intake	9:18–9:22	5:15–5:18	7 minutes
Wheat offal,	8:00–9:05	3:50–4:15	1 hour, 30 minutes
Water intake	8:58–9:00	4:30–4:40	12 minutes
Wheat offal,	8:00–9:40	4:40–5:00	2 hours
Water intake	----	4:55–5:05	10 minutes
Wheat offal,	8:10–9:15	3:30–4:00	1 hour, 35 minutes
Water intake	9:03–9:05	4:05–4:15	13 minutes
Wheat offal,	8:05–9:20	---	1 hour, 15 minutes
Water intake	9:15–9:18	4:00–4:17	20 minutes
Wheat offal,	7:55–9:10	3:13–3:41	1 hour, 43 minutes
Water intake	---	3:50–4:00	10 minutes
Wheat offal,	8:00–11:00	4:00–4:20	3 hours, 20 minutes
Water intake	10:20–10:25	3:10–3:12	7 minutes
Wheat offal,	8:00–9:30	3:45–4:15	2 hours
Water intake	8:40–8:45	4:20–4:30	15 minutes

Feeding activity, method, location and coordinates

Feeding activities and method were observed in feeding Eland at Sanda kyarimi park, at a particular location of feeding and water intake were observed. The coordinates of the location were obtained with the use of Gloal Postioning System (GPS) (**Table 2**).

Table 2: Feeding activities, method, location and coordinates.

Feeding activities	Feeding method	Coordinates
Wheat offal	Direct method	$N14.50^0$ $E16.11^0$
Water intake	Direct method	$N14.80^0$ $E16.12^0$

Proximate composition of wheat offal

The results in **Table 3** revealed that wheat offal contain Crude Protein (CP) of 11.9%. The high crude protein content of wheat offal may be due to the nature of weeds which is highly rich in protein content. Crude Fibre (CF) of wheat offal in 18.00% crude fibre makes plant to be tensile, strong, stand erect for exposure to needed sunlight, maturation of seed and easy harvesting. Wheat offal has Ether extract (Ee) of 1.50% found on the sample exposed to proximate component analysis. Ether extract assist in the formation of protective layer, constituent of many membrane and major source of stored energy which makes plant more efficient as animal feed. Ash content of wheat offal is 2.00%. This may be as a result of high adoptive capacity of mineral elements from the soil by the plant. Wheat offal Moisture Content (MC) is 8.30%. This may be as a result of hygroscopic nature of plants [14].

Table 3: Proximate composition of wheat offal.

Parameter	Percentage (%)
Crude protein (Cp)	11.90%
Crude fibre (Cf)	18

Esther extract (Ee)	1.5
Ash content (Ac)	2
Moisture content (Mc)	8.3

In the view of data collected on the assessment of feeding pattern of Eland in captivity, there is only one type of feed used in feeding Eland in Sanda Kyarimi park which is wheat offal which is in contrary to the research carried out on Eland captive diet at Taronga western plains the following diet is provided daily: Approximately 5 kg Lucerne chaff per individual, approximately 2.5 kg oats per individual and grazing available and exhibit. Direct method of feeding is used in feeding the Eland at Sanda kyarimi park which same method was used in feeding Elands in the Northern Kalahari sandveld; "The feed was placed in large worn truck tyres which were cut in half and filled in the centre with concrete to avoid wastage [15].

The proximate composition of the wheat offal shows that the crude protein contains 11.90%, crude fibre of 18%, ester extract of 1.50%, ash content of 2.00% and moisture content of 8.30% which contradicts that of Yin et al., where they stated 'that the Crude Protein (CP) of wheat offal 14.80-17.60'. About 10% crude fibre and 40%-6.40%.

Crude ash variations in chemical compositions have been noted among different vegetation types. In karoo vegetation, crude protein content varied from around 5% to 20%, and is generally about 3% higher (in the same species) in summer than it is in winter. Dambe, et al., reported in the second form of karroid vegetation, the valley bushveld showed crude protein levels to range from a minimum of 10.5% in September–November (early wet season) to 14.5% in February–May (late wet to early dry season) [16]. This might change due to effects of climate change on vegetation. Apart from season and edaphic factors that affect chemical composition of these trees, stage of maturity, plant parts and genetic predisposition are important. Fibre content increases due to accumulation of lignin. Consumable plant parts have been observed to have different chemical compositions. Wild ungulates obtain more nutritional benefits from consuming leaves than barks and stems.

Water intake ranked the lower with (2 minutes) once or twice in the morning and evening with the minimum total of (7 minutes) of water intake per day which goes similar to the research carried out by Megan Emmett on water intake in Elands. 'Elands are adapted to living independently of water supplies. They do not have to drink regularly (although they do where water is readily available) but rather get the moisture they need from the food they eat or from other or from other simple water conservation techniques [17].

Conclusion

The study is able to figure out the different type of feed used in feeding captive Eland in Sanda Kyarimi zoo. Wheat offal is an excellent feed source with nutritional values that serve as a source of energy for Eland. The high amount of protein together with a high energy value makes wheat offal a good alternative for feeding Elands. However, there is a need for alternative feed sources for the captive wild species in the study area due to insufficient supply and high prices of existing feed sources. The alternative feed source can be obtained from leaves of browse trees and conserved. The information on proximate chemical analysis on the feed provided valuable insight into determining the nutritional requirement of the species. The study serves as baseline information on the overall feeding behavior of captive Eland in Sanda Kyarimi zoological garden and a guide to animal's researchers for further studies that focus on improving potential of browse species as source of alternative feed and study relatively in responses of growth and reproduction of wild captive Eland.

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