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Nutritional Ecology of African Buffalo (*Syncerus caffer nanus*)

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Abstract: Nutritional ecology including feed utilization, selection and quality of grasses utilized for food by African Buffalo (*Syncerus caffer*) in Kainji Lake National Park were examined. Feed plants and parts grazed by *Syncerus caffer* were identified using standardized procedures. A total of 192 h of direct observations were made on several groups of *Syncerus caffer*, while grazing between 7:00-12:00 h and 16:00-18:00 h. The results revealed that 20 grass species were utilized as feed by *Syncerus caffer* population in the Park in both wet and dry seasons. Wet season forage utilization included *Andropogon gayanus*, *Andropogon pseudapricus*, *Hyparrhenia rufa*, *Hyparrhenia involucrata*, *Hyparrhenia dissoluta* and *Andropogon smithiana* with 9.50, 8.59, 7.75, 6.43, 5.24 and 4.86% utilization, respectively. Young leaves, mature leaves and flowers had the following utilization 71.12, 26.60 and 2.28%, respectively. There was no significant difference ($p<0.05$) in the species of grasses utilized as feed by *Syncerus caffer* population in the Park in both wet and dry seasons. However, a significant difference ($p<0.05$) was recorded in the parts of grasses grazed by *Syncerus caffer*. Measures to improve the feed resources of *Syncerus caffer* populations in the Park are also discussed.

Key words: Feed, buffalo, national park, season, nutrients, grazing, rangelands

INTRODUCTION

The vegetation structure of African savanna is in a continuous state of transition, leading to shifting mosaic of woodland and open grassland (Sinclair and Arcese, 2000). It reflects the most wide spread development of a functional relationship with climate, coupled with the grazing herbivores and the effect of man, fire and livestock. In these rangelands, the important functional element is the grass dominated ground layer associated to low shrub cover. Sub Saharan African grasses are grouped into about 620 genera with nearly 10,000 species (Willis and Shaw, 1993). They have a wide range of adaptability than any other family (Metcalfe and Nelson, 1985). Browse species equally stands to offer a real opportunity including higher dry matter yield, biological nitrogen fixation, improved soil fertility and better performance due to improved nitrogen supply in their diet (Kariuki *et al*., 1998a, b; Mwangi *et al*., 1999).

Herbivores rely entirely on plant materials to meet their nutrient and energy requirements (Waterman and Kool, 1994). They face special challenge in selecting optimal diet. Plants and parts are not simply discrete packets of nutrients, they also contain a range of metabolites that are variously refractory to digestion and capable of lowering the efficiency with which nutrients can be obtained or actually harmful to the animal through interference with normal physiological processes (Van Soest, 1992).

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African Buffalo (*Syncerus caffer*) belongs to the family Bovidae, shoulder height is between 1.0 and 1.67 m, head and body length is between 2.1 and 3.0 m, tail length is between 0.75 and 1.1 m and the weight of an dull bull is between 600 and 900 kg, with life expectancy of between 18 and 29 years. Its habitats ranged from forest to open savanna (Jean and Pierre, 1990; Field, 1996). Buffalo could complement quantity of animal protein derived from domestic animals to a great extent most especially if domesticated. The animal is presently classified as endangered species due to lost of habitats, limited food resource and poaching which resulted to decimation of its population in conservation areas (Aremu, 2005). There is therefore, the need to document findings that could facilitate adequate conservation of the animal in the wild and probably under domestication so that man could continue to benefit from another African large mammal like Buffalo. The objectives of the study are to determine nutritional ecology of *Syncerus caffer* including forage utilization, feed selection and feed quality. The study also intends to provide measures to improve feed resources of *Syncerus caffer* in the Park.

MATERIALS AND METHODS

Kainji Lake National Park ($9°40^1$-$10°\ 30^1$; N; $3°\ 30^1$-$5°\ 50^1$ E) has a total land area of 5,340.83 km^2 with Borgu sector comprising 3,970.83 km^2 (74.3%) and the Zugurma sector covering an area of 1,370 km^2 (25.7%). The vegetation of the Borgu sector has been described as Northern Savanna. The six main vegetation communities in Park are (i) *Burkea africana/Detarium microcarpum* woodland savanna (ii) *Diospyros mespiliformis* dry forest (iii) Riparian forest and woodland (iv) *Terminalia macroptera* tree savanna (v) *Isoberlinia tomentosa* woodland and (vi) *Isoberlinia doka*, savanna woodland (Afolayan, 1978).

The Oli river flows from the Republic of Benin through Borgu sector into the Niger river. In the dry season, the river breaks into pools that hold water throughout the year and serve as the only source of water for the wild animals. Long term average annual rainfall is between 900 and 1,100 mm. The Park is blessed with diverse fauna resources including *Papio anubis*, *Kobus kob*, *Hippopotamus amphibus*, *Syncerus caffer*, *Panthera leo*, *Panthera pardus*, *Hippotragus equinus* and *Alcelaphus buselaphus* amongst others. Woody resources in the Park include *Burkea africana*, *Terminalia avicennoides*, *Diospyros mespiliformis*, *Anogeissus leiocarpus*, *Entanda africana* and *Vitex doniana* amongst others. Forage species in the Park include *Hyparrhenia dissoluta* , *Andropogon gayanus*, *Braciliaria brachyiopha*, *Hyparrhenia rufa*, *Adropogon perligulatus*, *Andropogon tectorium* and *Beckeropsis uniseta* amongst others (Ayeni *et al*., 1982).

Buffalo (*Syncerus caffer*) were identified as described by Jean and Pierre (1990). Feed plants and parts eaten by Buffalo were identified through direct observations with the aid of Zeiss Dialyt Binoculars (10×40). Feeding observations followed the scanning focal point techniques as described by Altman (1994). The procedure initially involved general observations of all group members before focusing on one individual seen to be most stable and easily identified. Observations were made on several groups of Buffalo that comprised between 10 and 18 individuals from an average distance of 70 m. The following parameters were recorded as food items species, young leaves, mature leaves and flowers, a total of 192 h of direct observations were made from 4×4 km transect constructed in each of the six vegetation communities identified in the Park. Each transect was traversed twice in a month for a period of 24 months between January 2003 and December, 2004.

Feeding observations were usually made between 07:00-12:00 h and 16:00-18:00 h, which was considered to be the peak activity period. Feed items were collected after the group had finished feeding and moved out of the site, an herbarium was prepared from them and later identified as described by Stanfield (1970), Lowe (1989) and Keay (1989). Percentage plant and parts utilized as feed was calculated for each plant species as recommended by Alika (2006) as follows:

$$F_k = \Sigma Y_i / n \times 100$$

where, F_k is the frequency for species K, Y_i is the incidence (presence or absence) of species K, n is the total number sampled.

Feed materials were analyzed for proximate, minerals, vitamins and amino acids contents as recommended by AOAC (2000). All data collected were subjected to two ways Analysis of Variance (AVOVA) at ($p<0.05$) significant level as recommended by Alika (2006).

RESULTS AND DISCUSSION

Wet and Dry Seasons Feed Utilization

Twenty grass species were identified as feed components for Buffalo population in the Park in both wet and dry seasons. Wet season forage utilization showed that *Andropogon gayanus* was the most utilized grass species with 9.50% utilization, followed by *Andropogon pseudapricus*, *Hyparrhenia rufa*, *Hyparrhenia involucrata*, *Hyparrhenia dissoluta* and *Hyparrhenia smithiana* had 8.59, 7.75, 6.43, 5.24 and 4.86% utilization, respectively (Table 1). While, the least preferred grass species was *Echinocloa obtusiflora* (1.06%). Young leaf material was the most preferred part of grass species (82.14%), followed by matured leave material (16.49%), while flower was the least preferred part of grasses (1.37%).

Dry season forage utilization by *Syncerus caffer* equally followed the same trend when compared with wet season forage utilization, in which 15 grass species were utilized as feed by *Syncerus caffer*, *Andropogon gayanus*, *Andropogon pseudapricus*, *Hyparrhenia chinensis*, *Hyparrhenia involucrata* and *Hyparrhenia dissoluta* had 8.49, 8.23, 7.55, 7.38, 6.01 and 5.92% utilization, respectively. Young leaf, matured leaf and flower had 71.12, 26.60 and 2.28% utilization, respectively (Table 2). There was no significant difference ($p<0.05$) in grass species utilized as feed by *Syncerus caffer* populations in the Park in both wet and dry season. There was significant difference ($p<0.05$) in parts of grasses grazed by *Syncerus caffer*.

Table 1: Plants and parts utilized as feed in wet season by *Syncerus caffer* in Kainji Lake National Park

	Parts eaten			Utilization (%)		
Plant species	YL	ML	F	YL	ML	F
Hyparrhenia dissoluta	+	+	+	5.24	2.49	0.34
Hyparrhenia involucrata	+	+	0	6.43	1.35	0.00
Hyparrhenia smithiana	+	+	+	4.86	1.01	0.18
Hyparrhenia suplomosa	+	0	0	4.48	0.00	0.00
Hyparrhenia rufa	+	+	+	7.75	2.14	0.14
Hyparrhenia cyanescens	+	0	0	3.16	0.00	0.00
Hyparrhenia glabriuscula	+	+	0	3.16	1.94	0.00
Andropogon gayanus	+	+	+	9.50	2.93	0.37
Andropogon pseudapricus	+	0	0	8.59	0.00	0.00
Andropogon chinensis	+	0	0	2.03	0.00	0.00
Andropogon tectorium	+	0	+	3.97	0.00	0.16
Andropogon perligulatus	+	+	0	4.64	1.82	0.00
Andropogon monotes	+	+	0	2.03	0.45	0.00
Ctenium newtonii	+	0	0	2.97	0.00	0.00
Beckropsis uniseta	+	+	0	2.03	0.45	0.00
Cymbopogon gigianteus	+	0	0	2.59	0.00	0.00
Braciliaria branchylopha	+	+	0	2.14	0.62	0.00
Monocymbium ceresiiforme	+	0	+	2.21	0.00	0.03
Schoenefeldii gracilis	+	0	0	1.27	0.00	0.00
Echinocloa obtusiflora	+	0	0	1.06	0.00	0.00
Total				82.14	16.49	1.37

YL: Young Leaves, ML: Mature Leaves, F: Flower, +: Utilized, 0: Not Utilized

Table 2: Plants and parts utilized as feed in dry season by *Syncerus caffer* in Kainji Lake National Park

	Parts eaten			Utilization (%)		
Plant species	YL	ML	F	YL	ML	F
Hyparrhenia dissoluta	+	+	+	5.92	3.32	0.79
Hyparrhenia involucrata	+	+	+	6.01	3.74	0.24
Hyparrhenia smithiana	+	+	0	4.68	2.62	0.00
Hyparrhenia suplomosa	+	0	0	5.94	0.00	0.00
Hyparrhenia rufa	+	0	0	7.55	0.00	0.00
Hyparrhenia cyanescens	+	+	0	4.39	1.99	0.00
Andropogon gayanus	+	+	+	3.49	1.74	0.64
Andropogon pseudapricus	+	+	0	8.23	4.82	0.00
Andropogon chinensis	+	0	0	7.38	0.00	0.00
Andropogon tectorium	+	0	0	2.01	0.00	0.00
Andropogon perligulatus	+	0	0	3.04	0.00	0.00
Andropogon monotes	+	+	+	4.00	3.21	0.34
Ctenium newtonii	+	+	0	2.84	1.72	0.00
Braciliaria branchylopha	+	+	+	2.90	2.10	0.27
Echinocloa obtusiflora	+	+	0	2.74	1.34	0.00
Total				71.12	26.60	2.28

YL: Young Leaves, ML: Mature Leaves, F: Flower, +: Utilized, 0: Not utilized

Table 3: Proximate composition of feed items eaten by *Syncerus caffer* population in the Park

	DM	CP	CF	FAT	ASH	NFE
Plant species	(%)					
Hyparrhenia dissoluta	35.1	6.40	30.68	5.10	7.83	49.99
Hyparrhenia involucrata	37.4	6.00	34.13	4.13	6.91	48.83
Hyparrhenia smithiana	38.5	5.00	30.11	4.47	6.00	54.42
Hyparrhenia suplomosa	34.9	5.20	34.74	3.48	8.13	48.45
Hyparrhenia rufa	39.1	9.03	32.50	4.11	812.00	46.17
Hyparrhenia cyanescens	48.7	6.84	31.63	3.21	6.84	49.47
Hyparrhenia glabriuscula	51.1	5.49	34.99	3.21	6.84	47.47
Andropogon gayanus	33.5	7.60	35.10	5.11	9.42	42.77
Andropogon pseudapricus	40.3	7.52	33.44	4.92	7.32	46.80
Andropogon chinensis	51.3	7.37	41.12	4.11	6.88	40.52
Andropogon tectorium	39.4	6.26	32.11	4.77	8.65	48.21
Andropogon perligulatus	36.9	7.26	32.78	4.77	5.94	49.25
Andropogon monotes	41.3	6.11	32.19	4.11	5.97	51.62
Ctenium newtonii	37.9	6.02	30.74	3.91	6.11	53.22
Beckropsis uniseta	42.3	5.47	34.72	4.78	7.42	47.61
Cymbopogon gigianteus	51.1	6.83	32.64	4.70	6.77	49.06
Braciliaria branchylopha	39.4	7.13	29.99	3.89	5.98	53.01
Monocymbium ceresiiforme	37.8	6.11	33.33	4.10	5.67	50.79
Schoenefeldii gracilis	44.4	6.72	41.37	4.72	8.94	38.25
Echinocloa obtusiflora	48.3	7.21	42.31	4.91	7.42	38.15

%DM: Percentage dry matter, %CP: Percentage crude protein, %CF: Percentage crude fibre, %NFE: Percentage nitrogen free extract

Feed Quality

Proximate composition of grass species utilized as feed by *Syncerus caffer* in the Park indicated that crude protein and fat contents ranged between 5.0-7.6 and 3.21-5.11%, respectively while, crude fibre content ranged between 29.99 and 42.31% (Table 3). Mineral contents such as calcium, phosphorus and iron ranged between 6.0-25.01, 24.1-81.0 and 0.04-2.74 mg/100 g of feed, respectively. While, the vitamin contents such as vitamin A, vitamin C and thiamine ranged between 0.11-9.41, 7.0-35.2 and 0.03-0.92 mg/100 g of feed, respectively. Also, amino acids such as Isoluecine, Leucine and Lysine ranged between 174-672, 244-607 and 106-402 mg/100 g of feed, respectively (Table 4).

Table 4: Some minerals, vitamins and amino acids (mg/100 g of feed) of plants eaten by *Syncerus caffer* in the Park

Plant species	Ca	P	Fe	Va	Vc	Th	Ri	Ar	Hi	Is	Le	Ly
Hyparrhenia dissoluta	25.00	52.7	0.91	1.21	13.00	0.09	0.04	412	120	181	311	210
Hyparrhenia involucrata	19.60	24.6	2.74	2.94	26.20	0.06	0.03	383	113	250	293	209
Hyparrhenia smithiana	18.70	32.1	0.93	0.84	22.40	0.03	0.03	340	141	303	244	310
Hyparrhenia suplomosa	7.32	26.3	0.55	0.37	25.10	0.11	0.05	414	219	363	371	237
Hyparrhenia rufa	10.00	34.2	2.00	1.14	38.20	0.53	0.14	622	98	225	482	241
Hyparrhenia cyanescens	14.00	40.0	0.40	0.11	7.00	0.22	0.07	700	187	174	561	384
Hyparrhenia glabriuscula	6.00	81.0	0.60	0.13	10.00	0.12	0.23	842	148	251	487	311
Andropogon gayanus	16.00	33.0	0.90	3.00	3.50	0.13	0.02	309	200	327	501	225
Andropogon pseudapricus	5.00	54.0	0.80	0.42	3.00	0.08	0.04	432	217	491	302	363
Andropogon chinensis	37.00	41.0	0.93	9.41	15.70	0.10	0.08	874	294	505	428	106
Andropogon tectorium	21.20	61.7	1.48	1.88	24.70	0.77	0.06	191	174	294	520	222
Andropogon perligulatus	12.30	44.0	2.22	2.11	33.20	0.18	0.34	224	211	307	471	287
Andropogon monotes	22.00	54.7	2.14	3.73	7.40	0.09	0.07	362	181	672	274	361
Ctenium newtonii	30.00	47.3	2.13	1.45	12.80	0.47	0.26	549	78	483	361	402
Beckropsis uniseta	18.70	29.6	1.11	2.51	18.30	0.38	0.04	494	94	331	402	107
Cymbopogon gigianteus	34.10	37.8	0.64	2.21	22.90	0.26	0.21	807	234	306	581	408
Braciliaria branchylopha	19.20	42.3	0.71	3.47	18.00	0.92	0.41	902	300	292	607	364
Monocymbium ceresiiforme	15.00	39.0	4.00	4.60	25.00	0.24	0.75	794	291	433	411	209
Schoenefeldii gracilis	13.70	24.1	0.82	1.23	14.70	0.19	0.07	349	111	347	401	168
Echinocloa obtusiflora	15.30	48.1	0.77	2.01	17.10	0.63	0.13	421	137	439	382	189

Ca: Calcium, P: Phosphorus, Fe: Iron, Va: Vitamin A, Vc: Vitamin C, Th: Thiamine, Ri: Riboflavin, Ar: Arginine, Hi: Histidine, Is: Isoleucine, Le: Leucine, Ly: Lysine

Feed Selection

Young leaf was the most referred part of grasses in both wet and dry seasons 82.1 and 71.12%, respectively when compared to matured leaf (16.49 and 26.60%), respectively. This may not be unconnected to the fact that young leaves are more palatable, succulent and easy to digest making the feed nutrient easily available to animal for growth, maintenance of pregnancy and lactation (Voeten, 1999). Also, this may explain why ungulate preferred new flush of grasses from newly burnt rangelands (Adegeye and Ayodele, 1992; Mwangi *et al*., 1999; Aremu, 2001). Mature leaves were less preferred by *Syncerus caffer* population due to the fact that they are dry and coarse thereby hindering digestibility. These observations followed that of Holechek (1994) and Stoddart *et al*. (1995). *Andropogon gayanus* was the most preferred grass species due to the fact that it contains high percentages of crude protein and fat 7.60 and 5.11%, respectively when compared to other grass species utilized for feed by *Syncerus caffer* population.

CONCLUSION

In order to increase the rangeland potentials and to improve grazing opportunities for the *Syncerus caffer* population in the Park, most especially during dry season when the rangeland resources are usually over stretched. There is therefore, the need to improve habitats quality through application of controlled burning programmes, planting of desirable grasses and prohibit illegal grazing by livestock within Park boundaries, to eliminate competition for limited habitat resources between wild and domestic animals. It was noted that *Andropogon gayanus* was the most preferred plant species containing 7.60, 35.5, 5.11% crude protein, fibre and fat, respectively. It also, contains 16.0, 33.0, 0.90 and 3.0 mg/100 g of feed of Calcium, Phosphorus, Iron and Vitamin A, respectively.

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