

Diet selection by goats on rangeland of North Kordofan State, Sudan

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Abstract

This study was conducted at El Demokeya forest, North Kordofan State, Sudan. The objective was to evaluate goat diet botanical composition as indicator for pasture quality. Bite counts were obtained from seven goats in protected and open rangeland sites. Percent plants in the two range sites were 81.9% and 87.5% respectively. Density was 260.9 and 181.9 plants / m² respectively ($P < 0.05$). At flowering, goat diet contained $10.8\% \pm 1.12$ and $11.8\% \pm 5.94$ CP in protected and open sites respectively. At seed set CP% was 8.1 ± 1.32 and 8.2 ± 3.01 respectively ($P > 0.01$). Diet CP% was higher in diet than in forage biomass vegetation. At flowering, in protected range *Acacia senegal* (26.6%), *Echinocloa colonum* (11.34%) and *Zaleya pentandra* (9.08%) were the browse, grasses and forbs most selected, respectively. In the open range site *Acacia senegal* was 22.58%, *Eragrostis tremula* 13.78% and *Zaleya pentandra* 11.05% of the diet. At seed set, in the protected range site, the diet contained 18.36% *Justica kotschyi*, 15.02% *Acacia senegal* and 4.28% *Eragrostis tremula*. While in open range site *Eragrostis tremula* was 52.92%, *Acacia senegal* 25.58% and *Chrozophora brocchiana* 1.62%. Grasses and forbs with highest relative preference indeces (RPI) at flowering in protected range site were *Cenchrus biflorus* (RPI=2.05) and *Justica kotschyi* (RPI=7.93). In open range site the grass and forb with highest RPI were *Echinocloa colonum* (RPI=1.17) and *Zornia glochidiata* (RPI=6.7) respectively. Diet botanical composition is an indicator of plant preference and is useful in selecting plants for reseeded of deteriorated range and in identifying key species for range management.

Key Words

Semi-arid, herbage biomass, bite-count, preferred plants

Introduction

In semi-arid subtropical savannas, the diet selected by goats varies with season. For example, during the wet season, goats select a more mixed diet of browse, grasses and forbs. However, during the dry season they spend more time browsing because many species of browse are evergreens that provide good quality forage during the dry season (Raats *et al*, 1996). This study was carried out at El Demokeya Forest Reserve, North Kordofan State, Sudan. The objectives were to assess the plant species selected by goats and development of preference indexes for use as indicators when managing the rangeland.

Methods

Seven healthy, male goats with average body weight 29.1 ± 5.7 Kg were used in this study. The loop method (Parker and Harris, 1959 NILR) was used to measure botanical composition of the vegetation. Goat diet botanical composition was estimated using the bite-count technique (Van Dyne, 1968). Goats were sampled individually in two sites, twice a day for three days, with species of plant ingested / bite, recorded for each animal. Grazing goats were observed for the same length of time in the morning and in the afternoon.

Relative preference indices (RPI) were calculated according to (NRPH, 2003). Plant species were ranked into preferred, desirable, undesirable, unconsumed and toxic plants according to (Rosier *et al.*, 1975 NILR).

Chemical and data analyses

Some common grasses, forbs and leaves of browse species were analysed according to (A.O.A.C, 1980). Cell wall contents were determined in the diets selected according to Goering and Van Soest (1963). *Data was analysed* using T-test.

Results and discussion

Plants in the two range sites formed 81.9% and 87.5% respectively. Plant density in the protected range was 260.9 plants/m² while for the open range it was 181.9 plants/m² ($P < 0.05$). *Zaleya pentandra* had highest frequency in the protected range while *Fimbristyls dichotoma* dominated the open range 85.0 and 85.2%, respectively.

The grasses and forbs with highest crude fibre (CF) were *Aristida mutabilis*, *Cenchrus biflorus* (grasses) and *Ipomoea blepharosepala* (forb) (33.1%, 32.9% and 33.7%, respectively). While the over- storey vegetation with highest CF was *Acacia senegal* and *Ziziphus mucronata* (19.4% and 20.5% respectively). Grasses and forbs with highest CP% were *Echinochloa colonum* (grass), *Ipomoea blepharosepala* and *Zaleya pentandra* (forbs) (13.4%, 18.7% and 14.7% respectively).

The chemical composition of the diets selected by grazing goats is shown in table 1. Goats selected a diet of similar CP% in both protected and open sites at flowering stage. The diets selected were also similar in CP% between the sites at seed setting stage. Compared to seed setting stage goats selected a significantly ($P < 0.01$) superior diet with respect to protein content at the flowering stage irrespective of range site. The mean CP of the diet selected at flowering (10.8%) and seed setting (8.1%) stage in protected rangeland was greater than that of herbage biomass (6.8 and 5.7%). Also CP in open rangeland at flowering (11.8%) and seed setting (8.2%) was greater than that of herbage biomass (3.5% and 3.2%). The CP content of the goat diet was slightly greater than that in the herbage biomass during the seed set stage. This might be due to the fact that after seed set stage the available herbage was mostly post-mature, and with the high intensity of grazing at this time the chances for diet selection were low. The higher mean CP content of the diet selected by goats might be because goats depend on leaves of woody species such as *Acacia senegal* and *Ziziphus mucronata* which contain high CP. This result agrees with Yiakoulaki and Papanastasis (2000) who reported that goats select greater amounts of woody species than sheep, which preferred to consume grasses.

Table 1. Chemical composition of the diets of goats in protected and open sites

Parameter (%)	Flowering Stage	Seed setting stage	Sig.
Protected site			
Crude protein	10.8 ± 1.120	8.1 ± 1.32	**
Neutral Detergent Fibre (NDF).	54.5 ± 1.211	60.7 ± 1.021	***
Acid Detergent Fibre (ADF).	38.3 ± 1.032	35.0 ± 0.451	***
Acid Detergent lignin (ADL).	7.3 ± 0.21	10.0 ± 0.123	***
Open site			
Crude protein.	11.8 ± 5.943	8.2 ± 3.01	**
Neutral Detergent Fibre (NDF).	54.4 ± 0.733	60.8 ± 1.021	***
Acid Detergent Fibre (ADF).	38.4 ± 0.544	36.9 ± 3.753	***
Acid Detergent lignin (ADL).	7.3 ± 0.20	10.0 ± 0.243	***

Significant at 0.01 level, *Significant at 0.001 level

Botanical composition, RPI and plant classification of the diets of goats on the two sites at flowering for herbaceous species are shown in table 2. The diet selected by goats at the seed set stage in protected rangeland site comprised *Justica kotschyi* (18.4%) and *Acacia senegal* (15%), while in open range site it encompassed *Eragrostis tremula* (52.9%) and *Acacia senegal* (25.6%).

Table 2. Botanical composition, RPI and plant classification of the diets of goats at flowering stage

Scientific name	Protected range site			Open range site		
	% in Diet	RPI	Plant Class**	% in Diet	RPI	Plant Class**
<i>Acacia Senegal</i>	26.60	--	--	22.58	--	--
<i>Echinochloa colonum</i>	11.34	0.50	DP	10.98	1.17	PP
<i>Ziziphus mucronata</i>	09.35	--	--	03.21	--	--
<i>Zaleya pentandra</i>	09.08	0.51	DP	11.05	1.87	PP
<i>Fimbristyls dichotoma</i>	07.27	0.60	DP	08.77	0.27	UP
<i>Acacia tortilis</i>	07.25	--	--	00.00	--	--
<i>Gyndropsis gynandra</i>	04.18	2.61	PP	00.00	--	--
<i>Corchorus olitorius</i>	04.18	4.64	PP	00.46	--	PP
<i>Justica kotschyi</i>	02.38	7.93	PP	00.00	--	--
<i>Polycarpea corymbosa</i>	02.36	3.93	PP	00.83	--	PP
<i>Sesamum alatum</i>	02.09	3.48	PP	01.73	1.92	PP
<i>Oxygonum atriblicifolium</i>	01.95	--	PP	00.00	--	--
<i>Crotalaria spp.</i>	01.47	--	PP	00.04	--	PP
<i>Aristida mutabilis</i>	01.44	0.20	UP	00.61	0.13	UP
<i>Chrozophora brocchiana</i>	01.36	2.27	PP	00.18	0.30	UP
<i>Cenchrus biflorus</i>	01.23	2.05	PP	07.69	0.52	DP
<i>Eragrostis tremula</i>	00.97	1.62	PP	13.78	1.13	PP
<i>Balanites aegyptiaca</i>	00.70	--	--	00.35	--	--
<i>Tribulus terrestris</i>	00.65	0.72	DP	00.00	--	--
<i>Heliotropium supinum</i>	00.65	--	PP	00.00	--	--
<i>Cadaba glandulosa</i>	00.49	--	--	00.00	--	--
<i>Tephrosia spp.</i>	00.36	0.60	DP	03.70	6.17	PP
<i>Monsonia senegalensis</i>	00.32	--	PP	00.00	--	--
<i>Indigofera spp.</i>	00.30	--	PP	06.87	--	PP
<i>Citrullus lanatus</i>	00.30	--	PP			
<i>Elytrophorus spicatus</i>	00.29	1.00	DP	00.01	--	PP
<i>Cucumis sativus</i>	00.28	--	PP	00.03	--	PP
<i>Solanum dubium</i>	00.21	0.35	UP	00.00	--	--
<i>Acanthus spp.</i>	00.19	0.31	UP	00.00	--	--
<i>Ceratothera sesamoides</i>	00.17	0.85	DP	00.01	--	PP
<i>Dactyloctenium aegypticum</i>	00.17	0.06	UP	00.15	0.25	UP
<i>Commelinia kotschyi</i>	00.16	--	PP	00.01	--	PP
<i>Polygala erioptera</i>	00.12	01.09	PP	02.01	1.24	PP
<i>Ocimum basilicum</i>	00.10	--	PP	00.36	1.20	PP
<i>Geigeria alata</i>	00.04	--	PP	00.00	--	--
<i>Zornia glochidiata</i>	00.00	--	--	02.01	6.70	PP
<i>Ipomoea blepharosepala</i>	00.00	--	--	01.29	1.43	PP
<i>Euphorbia aegyptiaca</i>	00.00	--	--	00.62	2.07	PP
<i>Calotropis procera</i>	00.00	--	--	00.61	--	--
<i>Chloris prieurii</i>	00.00	--	--	00.14	0.07	UP
<i>Hygrophila spinosa</i>	00.00	--	--	00.04	--	PP
<i>Farsetia longisiliqua</i>	00.00	--	--	00.01	0.03	UP
Total	100.0					

* Relative preference index (RPI) % = Species in Diet% ÷ Species botanical composition%

** Plant classification: PP = Preferred Plant (RPI > 1.0); DP = Desirable Plant (RPI = approximately 1.0); UP = Undesirable Plant (RPI < 0.5)

At flowering stage in protected rangeland site goat diet composition (%), as indicated in table 2 contained 22.4% grasses 33.2% forbs and 44.4% browse. While in open rangeland site

grasses, forbs and browse were 41.9%, 31.4% and 26.7% respectively. At seed setting stage in protected rangeland site goat diet contained 4.3% grasses, 51.5% forbs and 44.2% browse. In open rangeland the proportions of grasses, forbs and browse were 52.9%, 2.5% and 44.6% respectively. This disagreed with Elnour (2007) who reported that goats usually eat grasses during rainy season but in the dry summer, 60% of their diet was composed of grasses (where is the contradiction between 52.9 and 60%?) and the rest reflects the amount of forbs and succulent browse. In this study it is noticed that, goats selected plants with high protein like *Acacia senegal* (20.9% CP) and their diet contains higher protein (table 1). This agreed with Rutagwenda *et al.* (1990) who reported that goats selected a diet with a higher protein and lower fiber content.

Conclusion

Information obtained on the botanical composition of the grazing animals' diets is essential for reseeding on deteriorated rangelands, predicting the outcome of overgrazing, in identifying key species on which to base management and in determining the suitability of exotic animals for particular range types. The diet botanical composition of livestock reflects a direct species composition of the natural rangelands, but it differs to some extent according to the livestock preferences in selecting these species.

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