Nutritive value and acceptability by goats of selected indigenous browses from semi-arid areas of Kenya

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Abstract

The feeding value and palatability of five browses foliage's (*Balanites aegyptiaca, Maerua angolensis, Acacia brevispica, Grewia hostii and Berchemia discolor*from semi-arid area were evaluated for their potential as supplements to Rhodes grass (*Chloris gayana)* hay. The crude protein (CP) content ranged from 41.4 gkg^{-1}dry matter (DM) in Rhodes grass to 162 gkg^{-1}DM in *Berchemia discolor. Maerua angolensis* had the lowest fiber content. Total extractable phenolics (TEPH) and condensed tannin (CT ranged from 6.1 to 52.3 gkg^{-1}DM and 2.0 to 43.8 gkg^{-1}DM, respectively. Relative palatability indices were: *Acacia brevispica* > *Balanites aegyptiaca* >*Grewia hostii* > *Berchemia discolor* > *Maerua angolensis* > *Chloris gayana. Maerua angolensis* was of low palatability compared to other browse species.

Keywords: *crude protein, goats, Rhodes grass, supplement*

Introduction

Ruminant production in tropical regions such as Kenya is affected by inadequate supply of feeds in terms of quantity and quality (Osuga et al 2005). Fibrous feeds such as cereal crop residues and poor quality mature grasses cannot maintain animals during much of the year (Osuga et al 2008). To improve performance, animals consuming forages with less than 7% crude protein (CP) will require supplementation to achieve maximum production (Ondiek et al 2000). Browse fodder is generally rich in protein and minerals and can be used in the dry season to supplement poor quality natural pasture or fibrous crop residue to improve animal performance (Devendra et al 1990). However, the presence of tannins in shrubs and tree leaves hampers their utilization as animal feeds by exhibiting anti nutritional effects or poor nutritional merits (Osuga et al 2008).

It is possible and appropriate to supplement grazing with indigenous browse such as *Grewia hostii, Balanites aegyptiaca, Acacia brevispica, Berchemia discolor*and *Maerua angolensis* tto make up for deficiency of some nutritional components and to improve performance of goats in arid and semi-arid areas of Kenya.

Materials and methods

Browse foliages

Leaves from *Grewia hostii, Acacia brevispica, Balanites aegyptiaca, Berchemia discolor and Maerua*

angolensis, that grow in semi-arid regions of Kenya were harvested by hand stripping from trees on communal grazing ranges in Marigat sub-county of Baringo county during the dry season. The browse trees were selected based on local farmers' knowledge of the species consumed by animals in the region. The area is located at altitude of 1080m above sea level with an average annual rainfall and temperature of 700mm and 24^{o}CC, respectively.

Experimental procedures

Leaves were collected by hand stripping and spread on gunny sheets, and air dried under the shade for 2 to 4 days. The dried foliages were put in sacks and stored in a well ventilated shed. The basal diet consisted of Rhodes grass (*Chloris gayana)* hhay that was purchased from a farmer. The forage were milled to pass through a 4mm sieve for the feeding trial.

Chemical analysis

Chemical analysis procedure was used in the determination of dry matter (DM), Nitrogen and ash according to the standard methods of AOAC (1990).The crude protein(CP) was calculated as NÃ—6.25. Neutral detergent fiber (NDF),acid detergent fibre (ADF) and acid detergent lignin (ADL) was analyzed according to the procedure described by Van Soest et al (1991).Phenolics was extracted using 70% aqueous acetone following the procedures described by Makkar (2003).Total extractable phenolics (TEPH) was determined using Folin-ciocalteu reagent and tannic acid as the standard. The concentration of TEPH was calculated using regression equation of tannic acid standard. Condensed tannins were determined according to the method described by Porter et al (1986). Butanol-HCL (Butanol-HCl 95:5 V/V) and ferric reagent (2% ferric ammonium sulphate in 2N HCl) mixture was vortex and then placed on a heating block adjusted to 70^{o}C to 80^{o}CC for 60 minutes.

Palatability evaluation

Study site

The experiment was conducted at Egerton University Tatton Agriculture Park in Njoro, Kenya. The area is situated at an altitude of 2238 meters above sea level with the mean annual rainfall and temperature of 1000 mms and 20^{o}C respectively (Jaetzold and Schmidt, 2006).

Animals, housing and feeding

The selected leaves were offered together with the Rhodes grass hay as the control. A period of 14 days was allowed for adaptation to confinement during which the test forage was randomly fed. Four growing goats (23.0 kgÂ±0.2) of similar age (about 1 year old) housed individually with individual feeding trough subdivided into five separate sections to contain each of the test browses in addition to a separate feeding trough for a basal diet of chopped Rhodes grass were adopted. The test indigenous browse was offered at 200g each at the same time using suitable feed troughs for 60 minutes daily for a period of 14 days then fed 750g chopped Rhodes grass hay for the rest of the day. Mineral salt licks and water were provided *ad libitum* throughout the experimental time.

Each day, before feeding the position of browse foliages in the feed trough partitions were randomly changed. Feed offered and refusals (left overs) was recorded every day to determine the feed intake which was used to predict the palatability. The intake data was used to determine the relative palatability of the indigenous browse species. A relative palatability index (RPI) was calculated for each species by dividing the amount consumed by that of the highest value, and multiplied by 100 as

described by Abdulrazak et al (2001). Ranking of the indigenous browse species was based on intake and preference by the goats.

Results and discussion

Chemical composition

The OM content ranged from 873 gkg^{-1}DM in*Maerua angolensis* and 945 gkg^{-1}DM to *Berchemia discolor* (Table1). The CP content ranged from 41.4 gkg^{-1}DM in Rhodes grass and 162 gkg^{-1}DM to *Berchemia discolor.* The relative high CP content range (112 to 162 gkg^{-1}DM) of *Balanites aegyptiaca, Maerua angolensis, Berchemia discolor, Acacia brevispica and Grewia hostii*show the possible contribution as protein source important for the utilization of the growing goats especially in the arid and semi-arid regions. The high CP content and lower fibre portion make the tree species appropriate diet supplements to low value feeds (Abdulrazak et al 2001). Rhode grass*, Grewia hostii, Acacia brevispica, Balanites aegyptiaca* and *Berchemia discolor* had the highest ADF and ADL contents, respectively.

Table 1. Chemical composition (gkg^{-1}DM) of five browse species and Rhodes grass (*Chloris gayana)* as control

Sample	OM	CP	NDF	ADF	ADL	TEPH	C
Balanites aegyptiaca	874	114	279	218	243	16.4	9
Maerua angolensis	873	123	103	80.2	88.8	27.3	1
Berchemia discolor	945	162	171	155	144	49.2	4
Rhodes grass	921	41.4	693	503	478	6.1	2
Acacia brevispica	938	132	295	216	254	37.6	3
Grewia hostii	914	112	299	253	336	52.3	4

Maerua angolensis had the lowest fiber content of the species which agree with results of Osuga et al (2008) who also reported *Maerua angolensis* to be the lowest in fibre, NDF (205 gkg^{-1}DM), ADF (120 gkg^{-1}DM) and ADL (59.1 gkg^{-1}DM). The TEPH and CT contents ranged from 6.1 to 52.3 gkg^{-1}DM and 2.0 to 43.8 gkg^{-1}DM, respectively. These are also shown in figure 1 and 1a, respectively. Abdulrazak et al (2000) reported high total extractable condensed tannins (100-480$mgkg^{-1}$DM) and total extractable phenolics (104-512$mgkg^{-1}$DM) for *Acacia nilotica, Acacia*

tortilis and *Acacia seyal* used as livestock browse in the arid and semi-arid regions.

Figure 1. Condensed tannins in the forages

Figure 1a. Composition of total extractable phenolics in the forages.

The relatively high crude protein content of the browses (150-249g/kg DM) provides adequate ground for the use of the browse leaves to supplement crop residues such as straw and low quality natural pastures (Osuga et al 2006).The NDF content of the browse species was low to moderate, which indicates that the browses have high cell content, that is related to high digestibility (Osuga et al 2005). Browse fibre has been shown to be digestible more than crop residue and mature grass hence can be utilized by animal easily (El Hassan et al 2000).

The control had the lowest palatability compared to the browses (Table 2). It was also observed that *Maerua angolensis* leaves had a stronger smell than the other indigenous browse species even after drying. This suggests that smell, taste, or physical texture of feed may relate to the acceptability or liking by the animal (Ngwa et al 2003). Spines were present in *A. brevispica* but had little effect on the acceptability and preference for indigenous browse*.* Palatability differences in the indigenous browse species tested for the study were manifested in the variation in the dry matter intake of the tested browse foliages. It is noted that those browse species with the highest dry matter intake were most preferred by the goats. In the current study*A. brevispica* had the highest DM intake with *M. angolensis* having the least. This value was similar to those reported by Osuga et al (2008) who reported *A. brevispica* having the highest DM intake with *M. angolensis* having the least. The levels of anti-nutritive factors such as tannins affect the palatability of forage and hence preference by the animals (Osuga et al 2008). Although*M. angolensis* was low in condensed tannins compared to *A. brevispica* it still exhibited the lowest palatability. Total extractable phenolics were relatively higher in *A. brevispica* than *M. angolensis*. Therefore, the low palatability index can be as a result of tannins and other factors responsible for low palatability and hence preference to browse foliage by animals. Kalio et al (2006) reported that the intakes of forages are influenced by plant type, period of maturity, method of presentation, chemical components of the fodder and ways of processing. Although *A. brevispica and M. angolensis* had similar CP contents of 132 and 123 gkg^{-1}DM, respectively, *A. brevispica* was more palatable than *M. angolensis. Berchemia discolor* regardless of having highest CP was fourth in the preference ranking, lower than *A. brevispica, Balanites aegyptiaca* and *Grewia hostii* (Figure 2).

Table 2. DM intake, palatability index and preference ranking of browses relative to Rhodes grass

Species	Intake (g/DM)	Palatability index (%)	Preference ranking
Acacia brevispica	190[a]	96.7	1

Balanites aegyptiaca	108[b]	55.2	2
Grewia hostii	67.9[c]	52.2	3
Berchemia discolor	67.2[c]	33.62	4
Maerua angolensis	28.5[d]	33.57	5
Chloris gayana	29.8[d]	27.1	6
SEM	5.76	3.50	
p	<0.0001	<0.0001	

[abcd] *Means with different subscript in a column differ at P<0.05*

Figure 2. Ranked palatability indexes of the forages.

Conclusion

- The ative browse *A. brevispica* had high nutritive value, palatability and was preferred by goats.

- The low palatability index of some browse species may be attributed to anti-nutritive factors including smell.

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