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Original article

Effect of plant maturity stage on digestibility and distance walked for diet selection by goat at north Kordofan state, Sudan

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ABSTRACT

The main objective was to study grazing behavior of goats; diet selection, nutritive value, digestibility of range plant and body gained at flowering and seed setting stage at September and November 2010 respectively in El-khuwei locality (El Rosa). A completely randomized design was used (CRD). Sampling was done by two stage flowering and seed sating stage were selected diets and feed intake locating a 2000 x 2000 m plots. The average weights gains during the flowering and seed setting stage were 17 and 18.28kg respectively. Goats during the flowering stage was preference on bite counts of the different species, however highly ($P < 0.0001$) at the flowering and least during the seed setting stage. Goat preference ranked *Bano (Eragrostis tremula), Huskneet (Cenchrus biflorus), Difra (Echinocloa colonum), leflef (Luffa aegyptiaca), Gaw (Aristida spp.), Fisiya (Fimbristyls hispidula), Himeira (Hymenocardia acida), Nuida (Sida cordofolia), Tmrfar (Oldenlandia senegalensis) and Aboelrakhus (Andropogon gayanus), while Gadgad (Geigeria alata), Buid (Commelinia subulata), Simeima (Sesamum alatum), Abodaib (Ceraotheca sesamoid)* and *Rabaa (Zalea spp)* least than that. A significant higher ($P < 0.001$) goats selective feed intake, in vitro dry matter digestibility, dry matter, organic matter and crude protein

higher at flowering stage and lowers during the seed setting stage. However; ash contents and crude fiber of plants were significantly higher at the seed setting stage. Body weight gain was significantly highest during the flowering stage, while the distance walked by goats for diet search was significantly longest during the seed setting stage. It was concluded that flowering stage beneficially goats highly preference and selectivity different species, feed intake and inviter dry matter digestibility and body weight gained. The seed setting stage was highly ash contents, crude fiber distant walked.

1. Introduction

Sudan is the largest country in Africa, with an area of 1.88 million Km2. It has a population of 33.42 million (CBS, 2011) and has the second largest animal population in Africa. In 2006, there were 138.2 million livestock, of which 50.39 million sheep, 42.76 million goats, (Ministry of Animal Wealth and Fisheries, 2006). Western Sudan has the most livestock (40%), followed by southern Sudan (27%) and central Sudan (23%). The majority of breeds is raised within tribal groups and often carries the name of the tribe. They are well adapted to the harsh environment and often trek long distances in search of feed and water. Productivity is low but can be improved with good management in more favorable conditions. Cattle are mainly descended from boss Taurus, or zebu. In central Sudan they are generally kept for milk, and in western Sudan for meat production. Sheep are of the Sudan Desert type, with live weights up to 70 kg and excellent meat and carcass characteristics. Goats, mostly of the large, black Nubian type, are found in central Sudan and are kept for milk. There are two types of the single-humped camel, one kept for riding and the other as a pack or baggage animal. Camels are exported mainly for meat. Forage produced from natural pastures represents 86.6% of national animal feed requirements, and about 14% of the population is involved in livestock production activities on the rangelands (MAW, 2005). North Kordofan amounts to almost 25 million ha, out of this area; 14.5 million ha are rangeland (AFRICOVER, 2004). The State is considered among the leading regions of Sudan in terms of animal and range resources, where more than 13 million heads of sheep, goats, camels and cattle are present (RPA, 2005). Animal production in the State is mainly practiced under traditional extensive systems, depending on natural rangeland (Cook and Fadlalla, 1987). Cattle dominate the southern part of the State, while sheep, goats and camels are present in larger numbers in the northern and drier part (El-Hag, 1993). The main objective of this paper was to investigate effects of grazing behavior on the various distances walked and digestibility from a diet selection by goats.

2. Materials and methods

2.1. Study area

This study was conducted at El-khuwei locality (El Rosa). It lies between longitudes 28˚:33' to 28˚:30'N and latitudes 12˚:14' to 14˚:12'E, about 105 Km west of El Obeid town, North Kordofan State lies between latitudes 11˚:20' to 16˚:36'N and longitudes 27˚:13' to 32˚:24'E. The close range system was established in 2007 in an area of about 500 ha, El-khuwei locality own large export market of animals (Hammer sheep) in west Sudan according to (MAWF, 2009). The long term average annual rainfall is about 300-mm, consisting of storms of short duration between July and September with the highest rainfall generally occurring in August. The soil of the site lies within the sand dune area locally known as “Goz” soil. The site is naturally dominated main grasses include namely Huskneet (Cenchrus biflorus), Shuleny (Zornia glochidiata) and Bigual (Blepharis linarifolia). The trees Humied (Sclerocarya birrea), Higlig (*Balanites*), Arad (Acacia etbaica) and Sider (Zizuphus spina). The Shrubs include Kursan (Boscia senegalensis), Usher (*Calotropis*), Mereikh (*Polygala eriotera*) and Aborakhus (Andropogon gayanus) according to (MAWF, 2009).

2.2. Sampling and experimental animals

Sampling was done on two stages of plant maturity at flowering and seed setting in selected locations (2 km2 each). Within each stage twenty goats randomly selected, their average weights gains were 17.00 and 18.28kg, respectively (Fadlalla and Cook, 1985).

2.3. Nutritional value of range quality

2.3.1. Feed or diet selection

The parameters measured diet botanical composition was estimated using the bite-count techniques, (Fadlalla and Cook 1985). The parameters measured included diet botanical composition and voluntary intake of dry matter. Within each season twenty goats was kept for this study. The first goat was followed for five times, and then the second one followed for another five minutes and so on for all goats. The procedure was repeated tine times, thus each goats followed for one hour in the first day, was also followed by observer for three days and 600 bites, and species of plant ingested and bite were recorded.

2.3.2. Voluntary feed intake and in vitro dry matter digestibility

The total fecal collection and in vitro dry matter digestibility techniques were used to measure voluntary intake. In this technique, the total faces produced by grazing goat were collected into appropriately designed collection bags attached to animals. Collection bags attached to goats were emptied at least twice a day and weighted. In vitro DM and In vitro dry matter digestibility determined (Tilly and Terry, 1963). The sample for flowering and seed setting stages was obtained by observing plant species and plant parts selected by goats during grazing and then collecting similar material for analysis by Tilley and Terry (1963). In vitro dry matter digestibility INVDMD was calculated according to the following formula:

INVDMD% = {Sample DM – (Residue sample-Mean.resid DM inoc.blank)}*100

Sample DM

The voluntary intake of DM was determined according to Fadalla and Cook, (1985).from the following formula:

$$\text{Dry matter intake (DM)} = \frac{\text{Total fecal output /24 hr} * 100}{100 - \text{DM digestibility (in vitro)}}$$

2.4. Measuring parameters

2.4.1. Average distance walked

Distance from the goats search to voluntary feed intake. The first goat was followed for five minutes, and then the second one followed for another five minutes and so on for all goats. The procedure were repeated distance walked at five minutes of bite count by matter, thus each goat followed for one hour in the first day, ware also followed by observer for the total of distance walked under four days. However measured distance refers to the distance grazing area as measured by meter per hour according to Fadlalla and Cook (1985).

2.4.2. Average body weight gains

Two stages flowering and seed setting were measuring body weight gains (2 km2 each). Within each season twenty goats was kept for this study. The procedure was repeated initial and final body weight of goats before and after grazing. The weight between initial and final equal weight change gram/day were recorded at three weeks on two stages Fadlalla and Cook (1985). Weight and body condition, for instance, provide a measure of the nutritional response, integrated over weeks or months (Lambourne et al, 1983).

2.4.3. Laboratory analyses

Dry-matter weight (DM) is determined by drying the feed in the oven at 105°C for 12-15 hours and weighing. Organic matter (OM), crude protein (CP) was determined by (AOAC, 1980). Crude fiber (CF) was determined by (Van Soest, 1982). In vitro dry matter digestibility (INVDMD) was determined (Tilley and Terry, 1963).

2.4.4. Statistical analysis

Completely Randomized Design (CRD) was used in this experiment. Data were subjected to analysis of variance and means were estimated. Chi Square test was used to compare diet selection (Steel and Torrie, 1960). SPSS (Statistical Package for Social Sciences) computer software was used for the statistical analysis.

3. Results

3.1. Bite Counts

Table 1 shows the bite counts of range species by goats during the flowering and seed setting stages. Goats during the flowering stage was preference on bite counts of the different species, however highly ($P < 0.0001$) at the flowering stage and least during the seed setting stage. Laca et al (2001) indicated that rates of nutrient intake

Table 1
Bite counts (%) ♀ of the different range species by goat during the flowering and seed setting stages at El-Khuwei locality, north Kordofan, Sudan.

Plant species		Bite count (%)	
Latin names	**Local name**	**Flowering stage**	**Seed stage**
Eragrostis tremula	Bano	74.25	34.67
Cenchrus biflorus	Huskneet	48.46	30.56
Echinocloa colonum	Difra	33.85	29.99
Luffa aegyptiaca	Leflef	31.71	24.10
Aristida sp	Gaw	29.55	20.82
Fimbristyls hispidula	Fisiya	23.20	19.00
Hymenocardia acida	Himeira	21.09	14.07
Sida cordofolia	Nuida	18.18	13.89
Oldenlandia senegalensis	Tmrfar	17.99	11.21
Andropogon gayanus	Aborakhus	16.50	8.86
Geigeria alata	Gadgad	14.98	-
Commelinia subulata	Buid	10.14	-
Sesamum alatum	Simeima	4.00	-
Ceraotheca sesamoid	Abodaib	2.86	-
Zalea sp	Rabaa	2.86	-
Zornia glochidiata	Shuleny	2.50	-

Chi Square test =37.11*

are reduced at too low or too high levels of plant biomass. Intake is influenced by bite size; bite rate, and grazing time. Goat and sheep differed significantly ($P<0.001$) in selection of different range plants supporting the findings of (Hodgson, 1979).

3.2. Voluntary feed intake and digestibility

Voluntary feed intake and in vitro dry matter digestibility were presented in table 2. Feed intake was significantly ($P<0.001$) higher at the flowering stage compared to the seed setting stage. The results revealed that the goats had significantly ($P< 0.0001$) better in vitro dry matter digestibility during the flowering stage compared to seed setting stage. The decreasing digestibility of dry matter during seed setting stage may be due to age of grasses. McDonald et al (1973) who reported 50-80% dry matter digestibility was higher for young grasses. The animals' feed preferences are influenced by feed availability, plant structure, nutrient deficiencies (e.g. salt) and appetite and, of course, different species of animals prefer different types of feed Chacon et al (1978). For instance, seasonal rainfall is often assumed to be an indicator of feed conditions while stocking rate has been used as a substitute for feed intake (Abel et al, 1987).

3.3. Live weight gains

Table 3 shows the live weight gains of goats during two stages of plant maturity. During the flowering stage goats significantly (P<0.0001) gained more body weight (25.00 g/day), when compared to seed setting stage (0.47 g/day). Devendra et al (1970) reported the forage intake of the goat has been taken as 2.5% of body weight, based on a range of 2.1 to 3.2%. When making comparisons between animals of different size to determine the importance of nutrition as a constraint, DM intake should be expressed in relation to the live weight (and preferably the metabolic weight, i.e. LW0.75) of the animal (Graham, 1972).

Table 2
Feed intake and in vitro dry matter digestibility during the flowering and seed setting stages at El

Parameters	Flowering stage	Seed setting stage	±SE
Feed intake (g/day)	0.54	0.36	0.04**
IVDMD (%)	67.46	60.15	1.05***

Means in the same column under the same factor with different letters are significantly different.
* = significant (P < 0.05), ** = high significant (P < 0.01) and *** = highly significant (P < 0.001).

Table 3
Body weight gains of goats, during the flowering and seed setting stages at El-Khuwei locality, north Kordofan, Sudan.

Parameter	Flowering	Seed setting	±SE
Body weight gains (g/day)	25	0.47	1.58***

Means in the same column under the same factor with different letters are significantly different.
* = significant (P < 0.05), ** = high significant (P < 0.01) and *** = highly significant (P < 0.001)

3.4. Distance walked

Table 4 shows the distance walked per hour (m/hr) by goats. Also the results revealed that the goats significantly (P<0.0001) walked more distance during the seed setting stage (92.63 m/h) compared to the flowering stage (44.50 m/h). De Leeuw and Chara (1985) used the technique to compare goat and sheep browse preferences in mixed Maasai flocks in Kenya. Range condition is based on density and production of native, palatable, perennial grasses. A better criterion might be the diversity of palatable forage species. It might be desirable if up to 20% of yearly forage production is composed of palatable annuals (Holechek, 1984).

Table 4
Distance walked (m/hr) by goats at the flowering and seed setting stages at El-Khuwei locality, north Kordofan, Sudan.

Parameter	Flowering	Seed setting	±SE
Distance walked (m/hr)	44.50	92.63	2.34***

Means in the same column under the same factor with different letters are significantly different.
* = significant (P < 0.05), ** = high significant (P < 0.01) and *** = highly significant (P < 0.001).

3.5. Nutritive value of diet

Table 5 shows the nutritive value of diet intake. The nutritive values of diet such as dry matter (DM), organic matter (OM) and crude protein (CP) were significantly higher during the flowering stage compared to seed setting stage. However; ash content and crude fiber (CF) were significantly (P<0.0001) higher during the seed setting stage than the flowering stage. Leaves of grasses from forbs and shrubs are generally higher in protein, crude fiber, dry matter, organic matter and ash content than the grass leaves and stems at comparative stages of growth (Vansoest, 1982).

4. Conclusion

It was concluded that flowering stage beneficially goats highly preference and selectivity different species, feed intake and inviter dry matter digestibility and body weight gained. The seed setting stage was highly ash contents, crude fiber distance walked.

The prevalence of infectious coryza in layer chicken of Bangladesh was 47.54%. Certain risk factors such as age, breed, geoclimatic situation, and stress, other respiratory pathogens and managemental practice associated with field cases of layer chicken in Bangladesh influenced the prevalence of infectious coryza in chicken. Our present findings suggest that application of broad spectrum antibiotic could be an effective way to control the disease with some modification in the farm management system but it does not eliminate the carrier status of chickens. It is advisable to vaccinate the chickens with inactivated coryza vaccine to prevent economic losses. Considering this fact the research work will also extends for the production of vaccine candidate from the field isolate to control infectious coryza in layer chicken of Bangladesh.

Table 5

Nutritive value of diet (%) during the flowering and seed setting stages at El-Khuwei locality, north Kordofan, Sudan.

Parameter	Flowering	Seed setting	±SE
DM	0.96	0.95	0.10***
OM	0.86	0.83	0.18***
Ash	0.09	0.12	0.35***
CF	0.31	0.37	0.47***
CP	0.14	0.10	0.12***

Means in the same column under the same factor with different letters are significantly different. * = significant ($P < 0.05$), ** = high significant ($P < 0.01$) and *** = highly significant ($P < 0.001$).

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