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Research Article

Effects of *Alysacrpus Monilifer* fodder intake on feed consumption and performance of desert goats

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Abstract

This study was conducted to study the effects of the intake of the *Alysacrpus Monilifera* on dry matter intake, digestibility of nutrients and performance of Desert bucks. Twelve Desert goats bucks 4-5 years old with an average weight of 11 + 0.250 kg, were divided into three equal groups. The first group was fed *A. Monilifera* fodder, while the second group consumed the natural pasture free of *A. Monilifera* while the third group consumed the groundnut haulms. After observing the cases of deadly diarrhea in the first group, the feeding pattern was modified with 50% natural pasture and 50% *A. Monilifer* fodder. The fodder was analyzed as well as conducting *in vitro* digestibility. The experimental design was randomized and the data were analyzed using the analysis of variance and the detection of differences among means using least significant difference test. The results showed that feeding *A. Monilifer* alone resulted in fatal diarrhea in bucks without affecting appetite, and the dry matter digestibility and organic matter in vitro digestibility was significantly ($P<0.05$) higher in *A. Monilifer* than compared to the groundnut haulms or the natural grazing. The weight gain was significantly ($P<0.05$) higher for the group on groundnut haulms and the natural grazing than those on *A. Monilifer* alone but when 50% of the plant biomass was replaced by the natural grazing the gain was significantly higher. The study concluded that the intake of *A. Monilifer* at the growth stage was good quality roughage when fed as part of the diet.

Introduction

Sudan is characterized by multiple climates that impact the diversity of livestock where camels are concentrated in the northern belt and cows in the southern and western belts while small ruminants (sheep and goats) spread in all parts of Sudan. In addition to this, the country is endowed with fisheries, poultry and equine species according to the climatic conditions. Rainfall ranges in Sudan from almost zero to 75mm in arid areas to 1000 mm, at least while temperatures ranging between 45 degrees (in summer) to 10 degrees in winter and agricultural land represents more than a third of Sudan area, while exploited portion does not exceed 1/5 of agricultural area. Sudan has water resources with a variety of sources, including the possibility of water harvesting. The importance of the livestock sector is well recognized by economists and planners.

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Sudan food supplier animals (cattle, sheep, goats, camels) are estimated at 105 million heads [1]. There are as well other animals and wildlife. The importance of livestock is attributed to their economic and social contributions.

Animal resources in Sudan that comprise sheep, goats, cattle camel, poultry and wild game is mainly dependent on the natural rangelands as a source of feed. Less important feed sources are crop residues, agro-industrial by-products, feed of animal origin, fodder crops and synthetic feed. Establishing a competing and sustainable program for exporting live animals and good quality meat is required in order to enable Sudan to face the international trade standards and this entails a vital change to improve the livestock production systems based on natural feed sources mainly rangelands. This purpose needs to impose strict hygienic measures to provide healthy and wholesome meat to fulfill the international requirements and domestic needs. Natural grazing from rangelands provides a very good option for this purpose.

The rapidly growing livestock population imposes continuing pressure on this shrinking range resource. Agricultural areas, mining and urban residential places are expanding on rangeland. In this limited area, the livestock population is concentrated with communal continuous grazing. The eventual result is overgrazing where palatable species are excessively consumed leading to their disappearance. Since no systematic activities are carried out to collect seeds of such nutritive and palatable species, rangeland will be turned into areas covered with species that are known to be of little acceptance to livestock species with low nutrient contents.

To recommend for candidate species, those highly good qualities and palatable species must be determined, their nutritive value is accessed before being selected for conservation. Therefore the overall objective of this study was to assist in the conservation, rehabilitation and development of the rangelands and sustain their productivity and ensure proper utilization of the resource as main feed source for the national herd.

Materials and methods

The study area

The study was conducted in Elobeid, North Kordofan State, Sudan (longitude 29°-34¯, 30°-30¯ East) and the latitudes (12°-25¯, 13°-30¯ North). This City is the capital of Sheikan locality and North Kordofan State. Sheikan is characterized by undulating plains, depressions; sand covered with hilly areas and some mountain clusters. Three climatic regions cover North Kordofan State. These are dry, semi-arid dry and low rainfall savanna on sand areas. The long-term average rain is between 250-400 mm. The maximum temperature is 40-42°C mm and the minimum is 13°C. In the semi-arid region, rainfall is between 300-600 mm and the maximum temperature is 39°C. The humidity reaches 11%-15% during the dry season. In the autumn, the air humidity reaches 65%-67% [2]. Rainfall as sporadic showers in May and becomes regular from June to October. It is usually heavier in July and reaches a peak in August before declining in September to reach its lower pattern in October. Temperatures are modified by rain at this time though it is hot and humid in general. Temperature and precipitation drop from the amount of evaporation in July and August and the highest rainfall recorded in 2010 was 620 mm [3].

This city is also considered the largest market for gum Arabic, as a primary and important market of livestock brought from different parts of western and Southern Sudan in a continuous movement of the presence of different types of animals. There are some food industries and Agro-industrial companies such as vegetable oil production and flour mills [3]. Suburban and rural areas are farming and livestock producing areas [4].

The experimental animals

The understudy area is dominantly covered with Desert goat bucks where they are used in this study. The animals were divided into three similar groups each with four animals. The bucks were individually penned, equipped with feeding and drinking troughs. Prior to the commencement of treatments the bucks were ear-tagged, vaccinated against diseases endemic to the study area such as anthrax and Hemorrhagic septicemia and drenched with broad-spectrum anthelminthic (Ivomic) at 0.5cc/head. Ten days were allowed for bucks to be adapted for feed and treatments. The adaptation period was also necessary for the removal of the effects of the feed previously taken. The bucks were weighed at the beginning of the trial and once every 8 weeks at the end of the trial to monitor their weight changes as affected by the type of ration.

The experimental feed

Alysicarpus monilifer hay was harvested from the rangeland and used first as the sole diet for one group, the second group was fed with the natural grazing free of *Alysicarpus monilifer* and the third group was fed groundnut haulms. After a week it was observed that the first group got detrimental case of diarrhea recording mortality of two bucks that was why their feed regimen was changed by offering 50% of the experimental hay and 50% of the natural grazing that was also harvested from the rangeland in the area after adding another two buck.

Chemical analysis

The *Alysicarpus monilifer*, natural grazing and the groundnut haulms biomass was analyzed using proximate analysis as described by the Association of the Official Analytical chemists [5]. In Vitro dry matter and organic matter and in vivo nutrient digestibility was determined according to [6,7].

Statistical analysis

The experimental design was a Complete Randomized Design (CRD) that had three treatments with four replicates. The data was analyzed using analysis of variance [8]. The difference among treatment means were detected using least significance difference [9].

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Results

Chemical composition of the experimental feed

Chemical composition of natural grazing biomass hay harvested at late growth stages, natural grazing plus 50% of the studied plant biomass and groundnut haulms is presented in Table 1. Dry matter was highest when the natural grazing was offered as sole diet (95.51%) and decreased to 93.21 and 91.25 % upon replacing some of the *Alysicarpus monilifer* with natural grazing biomass hay at 50% and groundnut, haulms respectively. While organic matter reached 88.23 % for the natural grazing alone to 81.14 and 78.25% for inclusion of the tested plant biomass and that of groundnut haulms respectively. Hence ash was 7.28 % for the natural grazing and 11.07 and % 13.00% when natural grazing biomass hay constituted 50 % of the total feed intake or the groundnut haulms was used. The plant biomass was highest in crude protein for the natural grazing and 50% *A. monilifer* but decreased to 4.11% for *A. monilifer* grazing alone and to 13.34 % for the groundnut haulms when was consumed as sole diet respectively. Crude fiber was the highest in samples of the *A. monilifer* that was analyzed alone (37.25%) but decreased to 35.76 and 34.85 % respectively upon replacement of the Natural Grazing (NG) with 50 % of the study plant biomass and that of groundnut haulms. Ether extract was1.23, 3.25 and 3.53 % when the biomass of the natural grazing alone, natural grazing plus 50% *A. monilifer* or groundnut haulms, respectively and it was 1.2% in the natural grazing free of the studied plant. The differences were significant (P<0.01) for EE in the three diets. Ash percentage was 7.28, 11.07 and 13.00 % when the natural grazing was consumed solely, with *A. monilifer* and 50% NG and that of groundnut haulms compared nitrogen-free extracts reached highest 48.10% when the natural grazing was analyzed alone and 38.75 with biomass of *A. monilifer* and 50% NG compared with 30.06 for the groundnut haulms respectively.

In Vitro dry matter and organic matter digestibility

In Vitro dry matter and organic matter digestibility are presented in Table 2. The *In vitro* dry matter and organic matter digestibility (IVDMD) and organic matter IVOMD as affected by the level of *A. monilifer hay* is presented in Table 2. The coefficient of IVDMD was higher the natural grazing free of *A. monilifer but* it was the highest for the groundnut haulms 67.45 % and last biomass of the natural grazing plus 50% *A. monilifer* biomass (45.67%). Similarly, *In vitro* organic matter digestibility was highest when the groundnut haulms. Natural grazing alone had 56.45 % *in vitro* dry matter digestibility. The *In vitro* organic matter digestibility was 57.55, 48.61 and 69.65 % when the natural grazing was used alone, NG with 50% natural grazing biomass hay biomass and the groundnut haulms respectively.

Apparent digestibility of nutrients

Apparent digestibility of nutrients as affected by of intake of *Alysicarpus monilifer*, pure range grazing supplemented, *A. monilifer* plus 50% and the groundnut haulms is presented in Table 3. Dry matter digestibility found being 45, 41 and 65 % and it was the highest when the groundnut haulms ingested

Table 1: Chemical composition of natural grazing biomass hay.

		Nutrients					
Type of feed	DM	OM	CP	CF	EE	NFE	Ash
Alysicarpus monilifer	95.51	88.23	4.11	37.25	1.23	48.1	7.28
Plus Natural grazing 50%	93.21	82.14	15.45	35.76	3.25	38.75	11.07
Groundnut haulms	91.25	78.25	13.34	34.85	3.53	30.06	13

DM: Dry Matter; OM: Organic Matter; CP: Crude Protein; CF: Crude Fibre; EE: Ether Extraction; NFE: Nutral Fibre Extraction Ash: Inorganic Matter

Table 2: *In vitro* dry matter and organic Matter digestibility of the experimental feed.

Feed type	IVDMD	IVOMD	SE
Alysicarpus monilifer alone	56.45	57.55	±3.46
+50% natural grazing biomass hay	45.67	48.61	±2.46
Groundnut haulms	67.45	69.65	±4.46

IVDMD: *In vitro* Dry Matter Digestibility; IVOMD: *In vitro* Organic Matter Digestibility

Table 3: Apparent nutrients digestibility coefficients of natural grazing biomass hay biomass as supplement to *Alysicarpus monilifer* for bucks.

Nutrients	I	II	III	SE
Dry matter	45	41	65	±3.4
Organic matter	49	46	67	±1.5
Crude protein	55	50	70	±2.5
Crude fiber	34	30	45	±4.5
Ether extract	60	54	77	±2.6
Nitrogen Free extract	45	66	68	±1.5

I: Natural Grazing Biomass Hay II: Groundnut Haulms; III: *Alysicarpus Monilifer* plus natural grazing biomass hay; SE: Standard Error

followed by that of *A. monilifer* with natural grazing at 50 % and lastly those bucks which consumed *A. monilifer* alone. Organic matter digestibility similarly varied according to the level of the plant biomass ingested. At groundnut haulms, % OMD was the highest followed by values obtained from bucks fed the natural grazing alone and the NG with 50% *A. monilifer* hay when it was found to be 50 % compared to natural grazing alone the value were respectively 49. 46 and 67.% for the groundnut haulms and the natural grazing with % *A. monilifer* and NG alone. Crude protein digestibility reached to 70 % in bucks consumed groundnut haulms followed by those fed *A. monilifer* as half of the biomass consumed and that reached to 50% while for the natural grazing alone it was 50% only The differences were significant (P<0.01). Crude fiber digestibility has also shown similar trend. It was 30% when the level of natural grazing biomass hay biomass constituted 50% with *A. monilifer* and became 34% and when natural grazing was fed alone and upon feeding bucks with the groundnut haulms it was 45%. The digestibility of ether extract was 60, 54 and 77% when the bucks were fed the natural grazing alone, NG with 50 % *A. monilifer* and groundnut haulms respectively.

Bucks performance as affected by ingestion of different Levels of *A. monilifer* biomass hay

Bucks overall performance as affected by ingestion of different Levels of *A. monilifer* biomass is presented in Table 4. During the preliminary period the biomass of the plant

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Table 4: Bucks performance as affected by the level of Alysicarpus monilifer hay ration.

Parameters	I	II	III	SE
No of Animals	4	4	4	-
Days on trial	60	60	60	-
Initial weight	11.35	11.25	11.45	-
Final weight	12.85	11.8	13.5	±2.34
Total feed intake (kg)	45	35	35	2.55±
Daily feed intake (g)	750	583	583	±11.25
Daily weight gain (g)	11.25	45.3	23.45	2.350±

I: *Natural Grazing* Ration; II: Groundnut Haulms Ration; III: *A. Monilifer* +Natural Grazing

was given to one group as sole diet and after three days it was observed that bucks started showing good appetite and ingested a substantial amount of the biomass followed by diarrhea that could not be explained and all samples analyzed and treatments used were found ineffective. Two animals were lost as mortality started. At that moment the feeding pattern was then changed by reducing *A. monilifer* biomass to half and that stopped diarrhea.

Discussion

Chemical composition of *A. monilifer* hay

The feed ingredients used in this study have shown significant differences (P<0.05) in their dry matter content when they were analyzed after being shade-dried. This is attributed to their nature of growth as different plant species though on similar environmental conditions. However organic matter varied with type of biomass analyzed and so the ash fraction. The OM was higher in the *A. monilifer* hay that had lower ash content followed by the groundnut haulms and lastly the natural grazing. Similarly [10], has reported that forbs in Sudan were lower in their ash content than grasses. Protein content was higher in *A. monilifer* followed by the groundnut hay and then the natural grazing that was comprised mostly of grasses [11], reported that natural grazing at late maturity stage was low in its CP content reaching as low as 4 % and the groundnut haulms up to 7%. Crude fiber content was higher in the natural grazing and similar in *A. monilifer* biomass and groundnut haulms. Due to the high percentage of grasses in the natural grazing at late maturity stage, it was normal to observe such higher CF content in that biomass. Authors [12,13] concluded that natural grazing at late maturity stage had had highest CF. the ether extract was highest in the biomass of *A. monilifer* followed by the groundnut haulms and lowest in the natural grazing. Grasses are always low in EE fraction than in legumes and herbs.

Effects of ingestion of *A. monilifer* on *In vitro* dry matter and organic matter digestibility

The *in vitro* dry matter digestibility, IVDMD, was highest in groundnut haulms followed by the biomass that constituted 50 % *A. monilifer* and finally the natural grazing alone. Similar trend was observed for in *vitro* organic matter digestibility coefficients. The lower IVDMD The lower *in vitro* digestibility coefficient for *A. monilifer* biomass might be attributed to its higher content of tannins as reported by [14,15] who carried out an experiment for estimation of protein degradability in the rumen from incubation measurements weighted according to the rate of passage and found that tannin content could jeopardize *in vitro* dry matter and organic matter digestibility in ruminants. Tannin content was not determined in the studies biomass types but it is known that grasses do not contain any substantial amounts of tannins and the level of tannin in groundnut haulms was found to be only 4.3% tannin according to [16,17].

Effects of ingestion of *A. monilifer* on nutrients digestibility

Apparent nutrients digestibility coefficients in diet of *A. monilifer hay*, natural grazing and groundnut haulms varied significantly and were greater in the bucks that were on groundnut haulms. Consuming biomass of the studied plant showed lower coefficients and that could be attributed to higher anti-nutritional content of that biomass. Those substances were not detected in laboratory, but it was reported that it might contain such ingredients. The animals got diarrhea upon ingestion of *A. monilifer biomass* as sole hay and high mortality% was recorded in the group on that biomass and could be stopped when the feeding pattern was changed to include natural grazing containing dominantly grasses [18].

Effects of consuming *A. monilifer* on the performance of sheep

Changes in body weights of animals during the experimental period have shown that the group that was fed *A. monilifer* biomass as sole hay did not gain weight, all got diarrhea leading to mortality. When part of that biomass was replaced by the natural grazing of grasses, their performance improved and they gained weight. The weight gain was higher for the group on groundnut hay. There was a significant (P<0.01) increase in body weights of all groups along the experimental period with the exception after taking the tested biomass as a supplement. The feed intake was not significant (P>0.05) in the three groups and it seems that the biomass of *A. monilifer* was of good palatability to the two groups.

Conclusion

It was concluded that the Biomass of *A. monilifer* at the growth stage analyzed can be classified as good quality roughage from its chemical composition where its crude fiber content is 8.6 and nitrogen-free extract is 67.45%. So if further analyses prove it to be free of serious anti-nutritional factors, it can be used for ruminant feeding. In this study, it has been discovered that ingestion of *A. monilifer* hay as a sole diet could initiate diarrhea that might lead to mortality. Restricted use has shown that animals could eat more. In vitro dry matter and organic matter digestibility were depressed in biomass with higher levels of *A. monilifer.* In vivo digestibility was also affected similarly. That affects might be attributed to high tannin content.

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