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PRODUCTIVITY OF DESERT SHEEP UNDER GRAZING CONDITION IN NORTH KORDOFAN, SUDAN

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ABSTRACT: *This study was conducted in North Kordofan State, with the objectives of studying performance of desert sheep (Hamari) on natural grazing during the dry season, and to investigate the nutritional value for the rangelands prevailing in the region. To achieve the objectives chemical analysis was done for some plants and trees to determine the nutrients and mineral content according to (AOAC, 1990). In vitro dry matter digestibility and organic matter digestibility were also determined according to Tilley and Terry (1963). Animal digestibility trial was successfully done, when ten rams were reared on natural rangelands for three consecutive grazing periods (30, 60 and days) to study the performance. The data was analyzed as completely randomized block design via analysis of variance with the assistance of SPSS and statitix8 software. The results of chemical analysis showed that CP, CF, ash, EE and NFS were in the range from 6-10, 35-45, 7-10, 1.1-2.1 and 36.7-46.7% respectively. The chemical analysis for selected browse trees were CP5.1%, CF 31-33%, EE 0.4-0.9%, ash 7-8.1% and NFE 53-56.9%. Mineral contents ranged from 0.0144-0.075 ppm for P, 0.002-0.063 ppm for K and 1-2.9 ppm for Iodine. In vitro DM and OM digestibility ranged from 52-59 and 52-62%, respectively. Rams grazing on natural rangelands recorded weight gains during the first grazing period (December), and then they lost weight at the second period (January) and recorded a high weight loss during the third period (February, January-July). Based on the findings it can be concluded that rangelands in the region were deteriorating in quality and quantity as a result which negatively affects livestock performance due to negative effect on animal weight gain leading to weight loss during the period January-July. There is a high need for introducing supplementary feeding and mineral additives.*

Key words: *North Kordofan, animal performance, In vitro, Digestibility, Rangelands*

ORIGINAL ARTICLE

INTRODUCTION

North Kordofan State area amounts to almost 25 million hectares, out of which 14.5 million hectares are rangelands. The State has a total population of 2.9 million people (5th population and houses census, 2009)

Although the state has vast natural rangelands, it suffers from acute shortage of feed resources, especially in a period of prolonged dry season from January to mid-July, with less pasture and the deterioration of the nutritional value, so it is important to know the impact of the dry season on the performance of the animal to put the necessary measures to address in order to ensure optimal productivity and sustainability.

MATERIALS AND METHODS

The Study Area

This study was conducted in North Kordofan State which lies between latitudes 11°:20'-16°:36'N and longitudes 27°:13'-32°:24'E. The grazing trial was done at Errahad area 80 KM south East of Elobeid the capital of state. While: *In vitro* digestibility was undertaken at range-livestock research laboratory, El-Obeid Agricultural Research Station. Selected samples were analyzed for CF, CP and minerals (P, K, I, Na, Mn) according to (AOAC, 1990).

In vitro Digestibility

The method used in this study was done according to Tilley and Terry (1963). 250 mg from each sample were taken to a 50ml centrifuge tube. Ten ml of buffer-nutrient solution were added to them. The contents were then gently mixed. The tubes were allowed to stand at 39°C for a short period to permit saturation of the

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substrate. The rumen fluid was filtered through two layers of cheese cloth to remove detached fragments then kept in thermos ready for incubation. The ph of the buffer-nutrient solution was carefully maintained at 6.8-7.0. Five ml of rumen fluid inoculums were added to each tube, and then the tube surface was flushed with CO_2 for approximately 10 seconds before stopped with gas release valve, and then incubated at 39°C for 48 hours. The tubes were gently rotated approximately 2, 4, 20, and 28 hours after initiation of incubation to disperse the forage particles. After 48 hours incubation 1ml $HgCl_2$ solution, 2ml of Sodium carbonate solution were added, and then centrifuged for 15 min at 2000 x gravity to sediment the suspended dry matter. Then 25 ml of acid-pepsin solution were added and mixed gently rotated to re-suspend the residue at approx, 2, 4, 20, and 48 hours after the beginning of incubation. After 48 hours, the tube contents were filtered through tarred fritted glass crucibles, and then dried to a constant weight at 102°C. The residue retained on the filter is indigestible dry matter; crucibles were weighted after cooling in desiccators. Then *In vitro* dry matter and organic matter digestibility were calculated using the following formula.

In vitro dry matter digestibility (IVDM) =

100 x Sample DM-(Resid.DM Sample – Mean.resid DM inco.blank) X100
Sample DM

In vitro Organic matter digestibility ((IVOMD)) =

100 x Sample OM-(Resid.OM Sample – Mean.resid OM inco.blank) X100
Sample OM

In vitro dry matter digestibility (IVDM) =

100 x SAmple DM-(Resid.DM Sample – Mean.resid DM inco.blank) X100
Sample DM

In vitro Organic matter digestibility ((MVOMD)) =

100 x _S`mple OM-(ResidnOM_Sa.ple – Mean.resid oM incox100
Sample OM

Grazing trial

Ten rams of same breed (Hamari) and similar age (12 months) were allowed to graze for 90 days for three grazing periods. The rams were treated against internal and external parasites using ivomec drug (dose 0.5 ml/head). Rams allowed to graze under traditional grazing system .The treated animals were watered once every two days.

Body weights were recorded at 30 days intervals. The animals were weighed at the beginning of the experiment and monthly to the end of the experimental period. Parameters measured were body weight. The trial Lasted for three months (90 days).

RESULTS

Chemical analysis of selected range vegetation

Table 1 displays chemical composition and minerals content of over- and understory vegetation. The understory vegetation analyzed included the grasses *Cenchrus biflorus* (Huskneet), *Fimbristylis dichtomo* (Um fissiat), *Eragrostis tremula* (Banu) and *Aristida sp* (Gaw), and the legumes *Zornia glochidiata* (lisseg), *Zalea pentandra* (Rab'a), *Crotalaria pycnosthya* (tagtaga), while the overstorey vegetation included the dominant trees.

Zornia glochidiata (lisseg), *Cenchrus biflorus* (Huskneet) and *Fimbristylis dichtomo* (fissiat) had the highest crude fiber content (41%, 40% and 38%, respectively) while *Eragorstis tremula* (Banu) and *Zalea pentandra* (Rab'a) *Crotalaria pycnosthya* (tagtaga) recorded the highest crude protein content (11%). *Fimbristylis dichtomo* (fissiat), *Cenchrus biflorus* (Huskneet), *Eragrostis tremula* (Banu) and *Aristida sp* (Gaw) had the lowest crude protein content (6.2 %, 6.7%, 6.8%, and 6.6%, respectively).

Acacia Senegal (Hashab) had the highest crude protein (7%) and CF (31%) while *Ziziphus spina-christi* (sidir) contained the lowest CP and CF content with the other two trees recording intermediate contents

Table 1 showed that the phosphorus content was 0.0149 ppm for *Fimbristylis dichtomo* (fissiat) while *Zalea pentandra* (Rab'a), *Aristida* sp (Gaw) and *Eragorstis tremula* (Banu) were 0.097ppm, 0.08 ppm and 0.075 ppm, respectively. Table(6) also showed that the potassium content was 0.063 ppm for *Eragorstis tremula (Banu)* while *Fimbristylis dichtomo* (fissiat), Aristida sp. (Gaw) and *Zalea pentandra* (Rab'a) were 0.055, 0.045 and 0.020 p.p.m, respectively. For Iodine content *Zalea pentandra* (Rab'a) and Aristida sp (Gaw), showed high content of 2.9 and 2.8 ppm, respectively, while *Fimbristylis dichtomo* (fissiat) and *Eragorstis tremula (Banu)* were 1.95 and 1.88 ppm,

In vitro digestibility for some selected grasses

Table 1 illustrate the In *vitro* digestibility (DM and OM) for the grasses *Aristida sp* (Gaw), *Eragorstis tremula* (Banu), *Cenchrus biflorus* (Huskneet), *Crotalaria pycnosthya* (Tgtaga) and *Zalea pentandra* (Rab'a) The in vitro dry matter digestibility of *Zornia glochidiata* was higher than that other grasses (59%) followed by *Cenchrus biflorus* (55), while *Fimbristylis dichotomo*, *Eragorositis termula* and *Aristida sp* had respective values of 52, 52 and 50%. Again *in vitro* OM digestibility for *Zornia glochidiata* was the highest (62%) followed by *Fimbristylis dichotomo* (61%) and *Cenchrus biflorus* (60%), while *Eragorostis termula* and *Aristida sp* had the lowest *In vitro* OM digestibility (58 and 56%, respectively).

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Ram performance under different grazing periods

Table 2 shows ram performance under different grazing periods. The highest body weight gain was recorded after 30 days from grazing (first period, 3.9 kg) while the second and third periods weight change were 1.03 kg and -1.52 kg, respectively. The results indicated that there were significant differences in body weight gain between periods ($P<0.05$). The body weight gain declined at second and third periods.

DISCUSSION

Chemical Analysis and Nutritive Value of Rangeland Vegetation

In this study it was observed that Zornia glochidiata (lisseg), Cenchrus biflorus and Fimbristylis dichtomo (fissiat) had high crude fiber content while Eragrostis termula, Zalea pentandra (Rab'a) and Crotalariat pycnosthya (tagtaga) had crude fiber content of 37, 37, 35%, respectively. Zalea pentandra (Rab'a) had high crude protein content of 11% while Fimbristylis dichtomo (fissiat), Cenchrus biflorus (Huskneet), Eragoristis tremula (Banu) and Aristida sp. (Gaw) had crude protein content of 6.2, 6.7, 6.8 and 6.6%, respectively. This means that the Crude Protein of these grasses is sufficient for maintenance (Milledford and Mison, 1954). A critical value of about 3.6% crude proteins in feed is required (NRC, 1981), below which the apparent crude protein digestibility declines. It was obvious from the analysis that these species were not poor in nutritive value although they grow in the semi arid areas. However, the most critical time for livestock in the area is the dry season (Feb-June) when the nutritive value of range grasses decline sharply and reach CP levels of below 2% (El-Hag and El Wakeel, 1998).

Acacia Senegal (Hashab) had crude protein and crude fiber contents of 7% and 31%, respectively, while Ziziphus spina-christi (sidir) had respective values of 5 and 31%. Other trees in the two studied zones had values lying between these means. Trees and shrubs are estimated to contribute 20-30% of livestock feed sources in greater Kordofan (Darag and Suliman, 1988).

The dry matter digestibility of Zornia glochidiata (legume) was significantly higher compared with other selected grasses (Fimbristylis, dichotomo, Cenchrus biflorus, Eragorositis termula and Aristida). No significant differences among the in vitro DM and OM digestibility of the grasses were found. This was expected due to the fact that these grasses belong to the same family with almost similar fiber content which is the main factor contributing to in vitro digestibility. Minson (1971) and Kalmbachr et al. (1980) reported that the organic matter digestibility decreased with decrease in leaf percentage and increased with age. These results agreed with Mc Donald and Whitten bury (1973), who reported a range of 50-80% organic matter digestibility for young grasses.

Mineral content for the dominant plants

Range plants in the area had lower mineral contents. This necessitates provision of supplementary mineral sources for livestock grazing these rangelands. K deficiency affecting the normal growth, also Tetanus symptoms will be observed. These deficiencies might be one of the major causes of the lower animal productivity in these areas. Iodine deficiency would lead to Endemic-goiter, reproductive failure, death and hairless of embryos. Also, toxic symptoms can be observed for calves of 100 kg wt when an iodine concentration of 500 mg/kg was offered Wilson (1980).

In vitro digestibility

The dry matter digestibility of *Zornia glochidiata* (legume) was significantly different compared with other selected grasses (*Fimbristylis, dichotomo Cenchrus biflorus*, *Eragorostis termula* and *Aristida sp.*), while the dry matter digestibility for grasses were not significantly different.

This may be attributed to the fact that, they belong to the same family with almost similar fiber content which is the main factor contributing to *in vitro* efficiency. In addition to the low protein content in the four grasses which was nearly similar.

The value for organic matter digestibility, for *Zornia glochidiata* was higher than the other selected grasses (*Fimbristylis dichotomo Cenchrus biflorus*, *Eragorositis termula* and *Aristida sp.*). This may be attributed to the differences of the mineral content. These results agreed with Mc Donald and Whitten bury (1973), the range of the organic matter digestibility of young grasses is between 50-85%.

Ram Performance under different grazing periods

Ram weight gain declined progressively with advancing dry season. Rams gained weight during the first period but the rate of gain during the second consecutive period was very low whereas rams lost weight during the third period. This may be attributed to high quality and quantity of forage during the first period of grazing. High quality forage may decline due to the selective grazing in the first period therefore decreasing in body weight for the second period, and negative body weight for the third period. Ellis and Swift (1988) stated that diet quality drops to maintenance level by the mid-dry season, and loss of condition, reduction of production continue for several months until the following rainy season. Wilson (1991) concluded that livestock production systems in Africa are influenced by the annual rainfall and its effect on main vegetation characteristics. Based on the findings it can be concluded that: Supplementary feeding is needed to overcome the prolonged dry season (January-July) in the term of concentrates and mineral sources. Strategically storage for forages should be considered when planning to reduce gaps of forage.

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Table 1 - Proximate chemical composition (%DM-basis) and *In vitro* digestibility of Range vegetation

Species dominant grasses	CP %	CF %	DM %	ASH %	E.E %	NFE %	P ppm	K ppm	I ppm	IVDMD %	IVOMD %
Aristida sp (Gaw)	6.2	38.8	93	7	1.2	46.7	0.08	0.05	2.8	50	56
Eragrositis tremula (Banu)	6.8	37	94.2	7.8	2.2	46.2	0.075	0.06	1.88	52	58
*Cenchrus*ai_ biflorus (Huskneet)	6	40	93.7	13	1.5	38.8	-	-	-	55	60
Zalea pentandra (Rab'a)	11	37	84	13	2.3	36.7	0.097	0.02	2.9	-	-
Zornia glochidiata (lisseg)	9	41	81	11	1.2	37.7	-	-	-	59	62
Crotalariat pycnosthya(gtaga)	10	35	80	11	2.2	37.8	-	-	-	-	-
Fimbristylis dichtomo (fisyat)	6.2	39	94	10	1.1	43.7	0.15	0.06	1.95	52	61
Dominant trees:						-	-	-	-	-	-
Balanites aegyptiaca (higleeg)	5.2	31	93.5	7.6	0.8	55.4	-	-	-	-	-
Acacia Senegal (Hashab)	7	31	93.7	8	0.7	53.3	-	-	-	-	-
Acacia tortillas (Seyal)	5.7	30.5	94.5	7	0.4	56.9	-	-	-	-	-
Ziziphus-spainna-christi (sidir)	5	31	93.4	7.5	0.9	55.6	-	-	-	-	-
Leptadenya pyrotechnica	5.1	33	94	8.1	0.54	53.3	-	-	-		-

Table 2 - Ram performance during different grazing periods

Parameter	1st period	2nd period	3rd period	SE±
No. of rams	10	10	10	0
Days on test	30	60	90	0.57
Av. initial body wt (kg)	35.34	36.6	35.5	0.39
Av. final body wt (kg)	36.6	35.5	33.93	1.58
Total wt change (kg)	3.9	-1.52	-1.57	1.58
Daily wt change (kg)	0.13	0.51	-.052	1.23
Av. Initial metabolic body wt ($wt^{0.75}$)	18.8	19.34	18.9	1.21
Av. Final metabolic body wt ($wt^{0.75}$)	19.3	18.9	18.27	0.44
Total $wt^{0.75}$ wt change	2.7	1.37	-1.40	1.2
Daily $wt^{0.75}$ wt change	0.22	0.60	-61	20.13

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