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THE EFFECT OF GROUND-NUT (*Arachis Hypogaea, L.*) SEED CAKE SUPPLEMENTATION ON PERFORMANCE OF DESERT SHEEP UNDER DRY LAND CONDITIONS IN NORTH KORDOFAN, SUDAN

Basheer Adam FADUL[1], Mohammed Khair ABDALLA[2], Abd-ELnasir MOHAMED[2], Ikhlas NOUR[2], Ahmed IDRIS[1]✉ and Hamza ELTAHER[3]

[1] Faculty of Natural Resources and Environmental Studies, Peace University, P.O. Box 20, El Fulla, Sudan
[2] University of Khartoum, Faculty of Animal Production, Sudan
[3] Nyala University, Animal Production, Sudan

ABSTRACT: This study was conducted in north Kordofan state-Sudan to evaluate the effects of feeding ground-nut cake supplement on lambs body weight changes and body measurements as an alternative to ground-nut hay plus natural grazing. Twenty four heads of lambs were used (16 males and 8 females) with 6 animals in each group (4 males and 2 females). All the groups were left to graze on natural pasture, and then supplemented by ground-nut hay and ground-nut cakes. Experimental animals allowed drinking water every two days. Groups (1 and 3) were supplemented with ground-nut cake at the rate of 150 g per head /day. The body weights and body measurements were recorded weekly. Range grasses were sampled and analyzed for proximate chemical analysis and for in vitro digestibility trails. The results indicated that the body weight, height at withers, heart girth and body length in males were higher, also the animals supplemented with ground nut cake during autumn season recorded higher values. In vitro digestibility coefficient for ground-nut seed cake was 65.7% and 62.7% for range grasses which were significantly ($P < 0.05$) higher than the ground-nut hay (49.8%) at 72 hrs. It was recommended that the supplementary feeding is the best strategy to improve lambs performance on the natural pastures during the dry season.

Keywords: Supplementary Ground-Nut Cake, Lambs, Body Measurements, Sudan

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INTRODUCTION

The Sudan national sheep flock is estimated to be 50.9 million heads (FAO 2009). More than 65% of the sheep in Sudan are of the Sudan desert type, they are kept mainly in the northern parts where they are maintained under rangeland conditions.

Sheep population in Sudan has an annual growth rate of about 3% (MARF, 2007). The share of livestock in the national income is about 22.3%, constituting about 18.2% of total exports and about 38% of agricultural exports. In spite of the importance of sheep they are still raised under nomadic conditions using traditional methods of management and natural grazing. Sheep flocks in north Kordofan are raised on rangelands under traditional agro-pastoral systems. One of the major constraints under rangelands conditions in the tropics is the lack of good quality grazing resources on a year-round basis, where animals face a prolonged dry season (February-June). This induced the seasonality of production, high mortality rates in both young and mature animals and low reproductive performance (El-Hag et al., 2001). The low levels of protein in natural range lands under tropical conditions is the dominance of annual grasses, this is reflected in the ruminant animals raised on such range lands do not ingest sufficient nutrients necessary for good performance (El-Wakeel and Abu Sabah, 1993). Therefore, this research work was prepared to evaluate the effects of feeding ground-nut cake supplement on lambs body weight changes and body measurements as an alternative to ground-nut hay plus natural grazing.

MATERIAL AND METHODS

The Study Area

The study was conducted in north Kordofan State, Sudan. This lies within latitudes 11.5-13.75 N° and longitudes 27-29.5 E°. Average annual rainfall is 300 mm in the north and about 400 mm in the southern parts. The dominant vegetation is a variable mixture of mainly annual grasses, the dominant grasses species in the area include Dactyloctinium aegyptiun (Abu-Asabi), Cenchrus biflorus (Haskaneet), Echnochloa colonum (Difra), Eragrostis tremula (Banu), Andropogon gayanus (Abu Rakhies), Zornia glockidata (Shiline), and Ipomea cordiosepala (Tabar), as described by Yehia (2002).

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Experimental procedures

Twenty four (16 males +8 females) 6 months old desert lambs were selected. The animals were randomly divided into four groups (treatments) of six each (4males+2females) matching in age and weight. The experimental animals were given access to water every two days. The four groups were allowed to graze natural grasses available on pasture. However, the other two groups were supplemented with additional concentrates, consisting of ground-nut seed cake; each animal in these two groups was individually fed 150g concentrates at 8:00 daily commenced with short adaptation period for two weeks. During this period, the animals were injected with Ivomec subcutaneously against external and internal parasites. Moreover; Albendazole was drenched orally for de worming.

Range grasses, ground-nut cake and ground-nut hay were collected in gunny bags then milled through a 2.0mm screen for in-vivo digestibility, and a sub sample taken and milled further through 1.0mm screen for use in gas production trial, mineral assay and proximate analysis.

In-vitro gas production

The gas production technique was used in the in-vitro gas production assessment. The net gas volumes data was then fitted in the following equation as described by (Ørskov and McDonald, 1979):

$G = a + b\ (1 - e^{-c\ t})$

Where:

G = the volume of gas produced (ml) at time t,

a = the gas production from the immediately soluble fraction (ml),

b = the gas production from the insoluble but degradable fraction (ml),

a + b = the potential gas production (ml),

c = the rate constant of gas production (fraction/h)

OMD48= organic matter digestibility at 48 hours.

In-vitro organic matter digestibility calculated from the equation: OMD (%) = 18.53 + 0. 9239 gas production (at 48hrs) + 0.0540 CP, (Menke and Steingass 1988).

Data Collection

Body weight and body measurements

The animals were weighed and body measurements were taken at the beginning of experiment after the adaptation period. Measurements were taken for two seasons on lambs, animal body weights were recorded every week and body measurements were taken using a measuring tape according to (Owen et al., 1977). The body condition score (BCS) was determined according to 1 to 5 scale (Russel, 1991).

Statistical analysis:

The data were analyzed using a completely randomized block design (CRBD). In treatments were arranged factorials (statistix 8) and LSD test was used for mean separation. The results of gas volume recordings were fitted to the exponential equation $P = a + b\ (1 - e^{-c\ t})$, where p is the gas volume at time t and a, b, and c are constants describing gas production with time: the constants 99 are based on gas volume recordings at 3, 6, 12, 24, 48, 72 and 96 h. Significant differences between means with respect to gas volume readings were tested using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

The results of chemical composition and digestibility coefficients of the supplements are presented in Table 1. The results revealed that the ground-nut cake, ground-nut hay and natural grasses have higher nutrient contents and digestibility coefficients compared to dry season grasses crude protein. Their respective energy and digestibility estimates were 11.8, 9.4 and 9.8 (ME, MJ/kg DM) and 56.3, 58.6 and 62.5 % for ground-nut cake, hulls and grasses-residue. One of the most important constraints to livestock production under rangeland conditions is the scarcity of nutritious grazing on a year-round basis (Cook and Fadlalla, 1987; El-Hag, 1992). The situation is particularly critical during the long dry season that extends from February to June. Rangelands grasses quality drops sharply during this time of the year. However, protein is considered the most affected nutrient (Van Soest, 1982); one of the major causes for low levels of protein in natural rangelands under tropical conditions is the dominance of annual grasses and absence of perennials (El-Wakeel and Abu Sabah, 1993). Consequently, ruminant animals raised on such rangelands do not ingest sufficient nutrients necessary for good performance. It is therefore, imperative, that other feed sources such as cakes should be used to supplement the deficient nutrients.

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The gas production methods of estimating nutritive value of experimental ingredients have been used to assess the rumen fermentation of ingredients. The total gas production (ml/200mg DM) at 48 hrs as shown in table 2 indicates variations in the grasses, ground-nut cake and ground-nut hay. The results showed that ground-nut cake reflected the greater ($P<0.05$) gas volume at different time intervals. However, the grasses showed the lowest gas volume during incubation time, this may be reflecting the presence of more anti-nutritional factors. These findings are in complete agreement with (Ahmed and El-Hag, 2004, Bahatta et al., 2002 and Idris, 2011).

As shown in Table 3, male lambs scored significantly ($P<0.05$) higher body weight gain compared to the female lambs. Also, it was found that sex of lamb had a significant effect on birth weight. Males were heavier than females (Idris et al., 2011). In contrast, Arther and Ahunu (1989) indicated that differences in breed, type and sex of lambs were not significant.

Analla et al., (1998) reported that the sex had significant ($P< 0.05$) effect on birth weight and lamb survival. It was noted that male lambs were heavier than females in lamb survival age, birth weight. Similarly, (Idris et al., 2011) reported that male lambs were significantly ($P<0.05$) heavier than females at birth, weaning and 6 months of age. The same traits were reported by (Boujenane and Kansari, 2002) to be significant to 70 days of age. On the other hand, (Rastogi, 2001) reported that sex of lamb was not a significant source of variation, also (Hassen et al., 2002) found that male and female lambs had similar weights at birth and until 30-60 days of age, then after that they differed.

Like-wise, (Suleiman, 1976) studied the weaning weight of Sudanese desert sheep and found that the weaning weights were (24.75 and 21.9 kg) for the male and female lambs respectively. It is well documented that sex of lamb had direct effect on weaning weight and male lambs were heavier at weaning than female lambs (Alama, 1987). Desert sheep gain more body weight during autumn season compared with those during summer; this might be attributed to the declaiming of the pasture herbage in term of quality and quantity with the onset the dry season. Mohamed and Salih (1991) have demonstrated that sheep grazed during the dry season on low rain woodland savannah pasture lost body weight, they have also stated that the inability of dry season grazing to sustain livestock production was a result of a decline in intake of dry matter and inadequate digestible nutrients. As expected, animals supplemented with ground-nut cake were higher ($P<0.05$) weight compared to unsupplemented animals. The same results were reported by (Lutfi, 1983) he found that the average daily gain was 126.31 g/day and the feed conversion ratio was 7.6.

Effects of supplementation, seasons and sex on lambs body measurements

Sex of lambs had significantly affected height at wither, heart girth, body length, head length, ear length and neck length (tables 3 and 4) .The results shown that, male lambs scored higher ($P<0.05$) values compared with female lambs. Animals during autumn season were recorded better body measurements compared with those during summer. Height at wither, heart girth, ear length, tail length and body condition score of animals supplemented with ground-nut seed cake were had high values compared with unsupplemented animals. The interaction (sex x seasons) was significantly affected body heart girth and body length (table 3). The subclass male x autumn recorded the higher ($P<0.05$) heart girth and body length followed by the other subclasses.

Table1. Chemical composition (%DM-basis) and in vitro digestibility coefficients (%) of ground-nut cake, ground-nut hay and natural grasses and calculated energy content.

Ingredients [Nutrient (g/kg DM)]	Ground nut cake	Ground nut hay	Grasses
Dry matter	93.7	92.6	95.3
Crude protein	44.2	11.2	6.4
Crude fibre	6.6	29.3	45.9
Crude fat	6.3	1.8	0.79
Ash	6.7	12.9	7.3
Energy density (ME, MJ/kg DM)*	11.77	9.35	9.76
In vitro OM digestibility (%)	56.25	58.61	62.48

*ME: Metabolizable Energy was calculated from literature values.

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Table 2 - Gas production (mean ± S.E) ml per200 mg dry sample from incubation of natural grazing, ground-nut cake and ground-nut hay at different time intervals.

Natural grazing, ground-nut cake and ground nut hay	Incubation time(h)							Constants*			
	3	6	12	24	48	72	96	a	b	C	a+ b
Grasses	3.7±0.17	5.5±0.29	9.0±0.29	19.3±0.33	52.7±0.33	62.7±0.33	67.5±0.58	-4.16	96.02	0.02	91.86
Ground-nut cake	12.3±2.40	21.8±2.67	35.3±3.57	39.3±2.12	43.8±1.10	65.7± 1.10	87.6±1.10	-5.7504	48.16	0.1565	42.4096
Ground-nut hay	10.3±033	15.0±0.33	29.8±0.33	43.2±0.17	47.7±0.44	49.8±0.17	49.8±0.33	-1.88	51.70	0.08	49.82

*a, b a, b and c represents constants in equation $P = a + b\ (1 - e^{-ct})$ describing gas production with time: the constants are based on gas volume recordings at 3, 6, 12, 24, 48, 72 and 96 hour.

Table 3 - Effect of sex, seasons, GNC supplementation and interactions sex x season, sex x supplementation on lambs body weight, weight gain and body measurements (mean± S.E).

Factors	Treatments and subclasses	Body weight Kg	Weight gain Kg	Height at withers Cm	Heart girth Cm	Body length Cm	Head length Cm
Sex	Male	35.00 ±0.34	18.26 ± 2.62	73.60 ±0.21	74.84 ±0.24	61.92 ±0.23	29.90 ±0.12
	Female	30.28 ±0.48	8.40 ± 3.64	72.40 ±0.30	72.15 ±0.34	59.88 ±0.33	28.80 ±0.17
Seasons	Autumn	35.83 ±0.36	31.95 ± 2.70	75.77 ±0.23	76.48 ±0.26	63.14 ±0.25	30.08 ±0.13
	Summer	29.45 ±0.43	-5.28 ± 3.46	70.23 ±0.27	70.51 ±0.30	58.65 ±0.29	28.62 ±0.15
Ground-nut seed cake	GNC	33.87 ±0.39	32.54 ± 3.02	73.82 ±0.25	74.65 ±0.28	61.06 ±0.27	29.53 ±0.14
	No GNC	31.41 ±0.39	-5.87 ± 3.00	72.18 ±0.25	72.34 ±0.28	60.73 ±0.27	29.17 ±0.14
Sex × Seasons	Male autumn	38.83 [a] ±0.44	40.35 ± 3.31	76.51 ±0.28	78.22 [a] ±0.31	64.56 [a] ±0.30	30.78 ±0.15
	Female autumn	32.83 [b] ±0.63	23.54 ± 4.65	75.02 ±0.40	74.74 [b] ±0.45	61.72 [b] ±0.43	29.38 ±0.22
	Male summer	31.17 [c] ±0.52	-3.82 ± 4.29	70.69 ±0.33	71.46 [c] ±0.37	59.27 [c] ±0.36	29.02 ±0.18
	Female summer	27.74 [d] ±0.74	-6.73 ± 5.84	69.77 ±0.47	69.56 [d] ±0.53	58.03 [d] ±0.51	28.23 ±0.26

[a b c d]: Means with different superscript within the same column and same factor are significant different (P<0.05); **No GNC** = not supplemented with ground-nut cake; **GNC** = supplemented with ground-nut cake

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Table 4. Effect of sex, seasons, GNC supplementation and their interactions on lambs body measurements (mean± S.E).

Factors	Treatments and subclasses	Ear length Cm	Neck length Cm	Tail length Cm	Body condition score
Sex	Male	17.24 ±0.04	25.17 ±0.09	60.01 ±0.27	3.49 ±0.01
	Female	16.91 ±0.05	24.76 ±0.13	60.09 ±0.39	3.42 ±0.02
Seasons	Autumn	17.19 ±0.04	25.32 ±0.10	62.34 ±0.29	3.80 ±0.02
	Summer	16.96 ±0.05	24.61 ±0.11	57.76 ±0.34	3.12 ±0.02
Ground-nut seed cake	GNC	17.19 ±0.04	25.02 ±0.10	61.25 ±0.32	3.56 ±0.02
	No GNC	16.96 ±0.04	24.91 ±0.10	58.85 ±0.32	3.35 ±0.02
Sex × Seasons	Male autumn	17.32 ±0.05	25.54 ±0.12	62.60 ±0.36	3.87 ±0.02
	Female autumn	17.06 ±0.07	25.11 ±0.17	62.08 ±0.51	3.72 ±0.03
	Male summer	17.15 ±0.06	24.80 ±0.14	57.43 ±0.42	3.11 ±0.02
	Female summer	16.76 ±0.09	24.42 ±0.20	58.09 ±0.60	3.12 ±0.04
Sex × Ground-nut seedcake	Male GNC	17.28 ±0.05	25.32 ±0.13	61.43 ±0.39	3.67 ±0.02
	Male No GNC	17.19 ±0.05	25.02 ±0.13	58.60 ±0.39	3.30 ±0.02
	Female GNC	17.10 ±0.08	24.72 ±0.18	61.08 ±0.55	3.45 ±0.03
	Female No GNC	16.73 ±0.08	24.81 ±0.18	59.09 ±0.55	3.39 ±0.03

[a b c d]: Means with different superscript within the same column and same factor are significant different (P<0.05); **No GNC** = not supplemented with ground-nut cake

CONCLUSION

The final body weights and body measurements of lambs supplemented with ground-nut seed cake revealed better performance compared to those un-supplemented. Furthermore, male lambs found to be heavier than female lambs and animals' body condition during autumn was better compared to it during summer.

Competing interests

The authors declare that they have no competing interests.

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