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ORIGINAL ARTICLE

Feedlot performance of Sudanese desert lambs fed with mash or pelleted diet of varying energy levels

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Abstract This experiment was conducted using 18 Sudan desert ram lambs (22 ± 5.7 kg) to examine the effects of feeding with diets of different energy levels and physical forms on feedlot performance. These lambs were randomly divided into three feed groups of six animals each in a completely randomized design (CRD). Following an acclimatization period of three weeks, three experimental diets were offered, each for one group. High Energy Pellets (HEP) and High Energy Mash (HEM) diets (10.50 MJME/kg DM) of a pelleted and mash form, respectively and Low Energy Diets (LEP) was a pelleted and low energy diet (8.5 MJME/kg DM).

The experiment continued for all diets to an average 40 kg live weight lamb. Results revealed lower Dry Matter Intake (DMI) ($P > 0.001$), improved Feed Conversion Ratio (FCR) ($P < 0.01$) and higher Average daily gain (ADG) ($P < 0.01$) for the high energy groups compared to the low energy diet group. No significant ($P > 0.05$) differences were observed due to pelleting between the two higher energy groups. No significant ($P > 0.05$) differences were observed among treatment groups in the Metabolizable Energy (ME) required to put a unit of body weight gain.

1. Introduction

Energy is quantitatively the most limiting factor for livestock production where all feeding standards were based on it. However, protein is also a critical nutrient for young growing animals and is the most expensive part of the diet. Livestock owners in Sudan have a limited knowledge about energy and protein requirements of the various classes of animals to express fully their genetic potentials. In addition, the formulation of livestock diets in Sudan is based on information and data calculated for animals in temperate zones. Such data may not necessarily applicable to the animals of Sudan with its warm environment.

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In most feedlots in Sudan, concentrate supplementation was used, mainly sorghum grain and cottonseed cakes (CSC) in a ratio of 1:1. Such a ratio may provide excess energy and protein levels than required, besides being expensive to make the business profitable. Furthermore, the scarcity and high prices of sorghum grains have induced interest of finishing sheep and cattle on feed substitutes e.g. agro-industrial byproducts (AIBP). The use of total mixed ration (TMR) and complete diet system (CDS) is more economical; this puts more efforts on animal feed industry in Sudan to fill this gap.

The objectives of this study were to; examine the effects of feeding different energy levels and physical forms on feedlot performance of Sudanese desert lambs.

2. Materials and methods

The experiment was conducted at the Animal Production Research Centre (APRC), Hillat Kuku, Khartoum North, during the period of mid March – mid September 2005.

Eighteen Sudanese desert ram lambs (Watish breed) averaging 3.4 month of age and 22 ± 5.7 kg live body weight were randomly divided into three feeding groups in a completely randomized design of six animals each. The lambs were obtained from Elhuda Research Station, Gezira State south of Khartoum (135 km). The lambs were dewormed, vaccinated against enterotoxaemia and ear-tagged. At the commencement of the acclimatization period, the lambs were transferred to individual pens of 150 cm × 100 cm with overhead shades, each pen was provided with a 20 l calibrated water trough together with a 5 kg capacity feeder. Measurements of water evaporation were done by placing a water trough of a similar size in an adjacent empty pen.

Three iso-nitrogenous (16.5 CP%) rations were used, these were HEP (pelleted ration of 10.5 MJ/kg/DM ME), HEM (mash ration of 10.5 MJME/kg DM) and LEP (pelleted ration of 8.5 MJME/kg DM). All rations were formulated as complete diets. HEP and LEP ration were manufactured by Kenana Animal Feed Factory whereas ration HEM was prepared at APRC (Table 1).

Alfalfa was offered at the rate of 0.5 kg/head/day as a source of carotene. Experimental diets were offered once a day .The chemical analysis (Table 1) was done according to AOAC (1980). Metabolizable energy (ME) content of the diets was calculated as described by MAFF (1976).

Measurements collected were, weekly live weight changes, according to Brown et al. (1973) and daily water intake.

Data collected were subjected to analysis of variance (ANOVA) .Duncan's multiple range tests were used to detect differences between means (Snedcor and Cohran, 1989).

Table 1 The composition of the experimental diet (%).

Ingredients	HEM	HEP	LEP
Molasses	35.0	35.0	31.2
Sorghum grain	20.0	20.0	–
Sugarcane bagasse	15.0	15.0	34.3
Groundnut cakes	10.0	10.0	13.5
Wheat bran	15.5	15.5	13.0
Calcium carbonate	2.0	2.0	–
Urea	1.5	1.5	1.9
Common salt	1.0	1.0	1.2
Mineral mix	–	–	4.9
DM	87.6	87.6	90.6
CP	16.5	16.5	16.5
EE	2.1	2.1	1.8
CF	11.3	11.3	20.7
Ash	10.6	10.6	13.8
NFE	59.5	59.5	47.4
ME	10.5	10.5	8.5

Table 2 Feedlot performance of Sudan desert sheep fed the experimental diets.

Parameter/treatment	HEP	HEM	LEP	SE	LS
No. of animals	6	6	5*		
Initial weight (kg)	22.3	22.0	22.6	1.02	NS
Final weight (kg)	40.2	40.0	39.2	0.32	NS
Average live weight (kg)	31.9	31.5	31.3	0.64	NS
Period (days)	65.3	80.5	88.2	8.64	NS
DMI/day (kg)	1.525[a]	1.4[a]	1.7[b]	0.59	**
FCR (KgDM/kg gain)	5.5[a]	6.4[a]	9.0[b]	0.44	***
ADG (g)	282[a]	233[a]	193[b]	21.5	8
Water intake (L/day)	6.7	5.6	5.9	0.53	NS
L. water intake/kg DMI	4.4	4.0	3.4	0.30	NS
Daily DMI (% of live weight)	4.8[a]	4.5[a]	5.5[b]	0.17	**

SE = Standard error of treatment means.
[a, b] = Means in the same row with different letter were significantly difference.
LS = Level of significance.
** = Higher significant.
NS = Not significant.

3. Results

The results presented in Table 2 showed no significant ($P > 0.05$) differences in the feeding periods required to reach the target slaughter weight. However numerically lambs fed (HEP) diet reached the target weight (40 kg) earlier than those fed LEP diet. The DMI was significantly ($P < 0.01$) lower in HEP and HEM groups than that of the LEP group. The water intake in liters showed no significant differences in the three feeding groups. FCR showed significant ($P < 0.001$) improvement for the HEP and HEM over that of the LEP group. The ADG (g) was significantly higher in the HEP an HEM groups compared to that of the LEP group.

Table 3 showed that the ME ($MJ/kg^{0.75}$) intake was increased ($P < 0.01$) for the HEP and HEM groups compared to the LEP group. On the other hand, CP intake (gm/day) was found to be lower ($P < 0.01$) in the HEP and HEM groups compared to the LEP group; the calculated CP: ME ratio was also found to be higher ($P < 0.001$) in the LEP groups compared to the HEP and HEM groups. The same pattern was observed in the ME intake in relation to metabolic body weight, but equal values for the ME allowance for maintenance of the three groups was found. The ME for gain was significantly ($P < 0.01$) greater for lambs fed HEM and HEP diets. Live weight gain (gm) when related to the available ME (MJ) for gain was found to be not significant ($P > 0.05$).

4. Discussion

As shown in Table 2 lambs fed HEP diet reached the target weight earlier than the others fed HEM and LEP diets. This

Table 3 The energy and protein intake of experimental lambs.

Parameter/treatment	HEP	HEM	LEP	SE	LS
ME intake MJ/day	15.11[a]	14.68[a]	12.72[b]	0.7	*
CP intake gm/day	251.6[a]	231[a]	280.5[b]	11.98	**
gm CP/MJ ME	17.0	17.4	24.2	0.43	***
ME intake/kg $Lwt^{0.75}$	1.2[a]	1.1[a]	1.0[b]	0.03	**
ME (maintenance) MJ	4.1	4.1	4	0.05	NS
ME (gain) MJ	11.1[a]	10.2[a]	8.0[b]	0.67	*
MEP/gain (MJ/gm)	39.37	43.78	467	1.52	NS

SE = Standard error of treatment means.
[a, b] = Means in the same row with different letter were significantly difference.
LS = Level of significance.
** = Higher significant.
NS = Not significant.

suggests pelleting effect between the HEP and HEM diets and possible differences in energy level with regard to the LEP group. The lowered DMI as percentage of the average live weight and metabolic body weight in lambs fed HEP and HEM diets compared to the LEP diet, may be attributed to the differences in the energy levels of the diets. Ruminants are known to eat more low energy feeds in an attempt to satisfy their energy requirements (McDonald et al., 1985 and Mohamed (1985). Furthermore pelleting was found to increase DMI as investigated by Elhag et al. (1986). They reported that, pelleting improved intake by more than 20% at all levels of bagasse inclusion .The (ADG) and (FCR) reported in this study was noticeably affected by the level of energy content of diets. This is obviously seen in HEP and HEM diets where the inclusion of molasses and sorghum grains of these diets, provided a readily fermentable carbohydrates for the rumen microflora. No sorghum grains were included in the LEP diet. These results were supported with those of Muna et al. (2002) who attributed the findings to better digestibilities and to the physical nature of the diet (pelleted) which eliminates the selective feeding behavior of sheep and this is in line with Elhag et al. (1986).

As shown in Table 3, the CP intake was consistently higher in the low energy diet LEP. This increased CP intake was a retarding factor for the LEP group due to the loss of more energy by ruminal microflora which uses the protein carbon as a source of energy. As a result the CP is subjected to de-amination with subsequent release of ammonia that can be partially recaptured into microbial protein. These findings were consistent with Elkhidir et al. (1988). On the other hand, improved ADG in lambs fed HEP and HEM diets may be attributed to better digestibility of the different ingredients except (CF). FCR was consistently lower in lambs fed LEP and HEM diets compared to those fed HEP diet.

Results of the ADG reported in this study were spectacularly higher than most of the recent reports for Sudan desert sheep. These results were higher than those reported by Osman et al. (1968), Suleiman and Amin (1980) and Abdalla et al. (2003) for the same breed. Also Eltayeb et al. (1988) reported very low ADG values (122 and 145.7 g/day) and FCR values of 11.9 and 9.8 when fattened lambs of the same breed.

As shown in Table 3 the ME intake (MJ/day) and the ME (MJ) in relation to metabolic weight $(MJ/kg)^{0.75}$ were consistently higher ($P < 0.01$) in the lambs fed HEM and HEP diet over those fed LEP diet. This might be attributed to the inclusion of molasses and sorghum grains in both high energy diets. It was also reported by Ørskov (1983) that, the rapid rate of cereal fermentation in the rumen made fattening a relatively easy process, a phenomenon which was used to increase the utilization of feedstuffs of low quality. The ME energy for maintenance reported in the study was in close confirmation to those reported by Wilson and Brigstone (1983). The water intake values reported in this study, showed no significant differences in the three treatments.

This study concluded that, pelleting is useful in sheep feeding as it prevents the selective feeding behavior of this animal besides minimizing the feed waste.

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