Growth in the Sultanate of Oman of Small Ruminants Given Date Byproducts-Urea Multinutrient Blocks

M. G. El Hag*, M. A. Al-Merza and B. Al Salti
Rumais Livestock Research Center, MAF, Muscat P.O.B. 432, P.C. 111, Sultanate of Oman

ABSTRACT : This study investigated the use of multinutrient blocks (MNB) composed of 35% date syrup, 35% date syrup byproducts, 10% date fronds, 7% urea, 7% cement and 6% common salt for growing small ruminants, as partial substitute for the roughage component of the diet (Rhodes grass hay) and its effect on feedlot performance and economics of feeding. Eight growing local Omani goats and 8 sheep (each about one year old) were used in this study. Mean body weights for goats and sheep (kg), respectively were 21.1±4.5 and 25.5±4.1. The goats and sheep were subdivided into two sub-groups of more or less equal body weights for each species. Each sub-group in both species was either fed on 0.5 kg concentrate+*ad libitum* Rhodes grass hay or the same diet+restricted hay (about 0.2 kg/head/day) and *ad libitum* amount of MNB. Sheep significantly ($p<0.05$) consumed greater amounts of MNB (36±17 g/head/day) than goats (6±2.5 g/head/day). Feeding of the MNB was effective in sparing about 40% of the roughage Rhodes grass hay for goats (from 240 to 140 g) and about 42% for sheep (from 252 to 146 g) or approximately 100 g/head/day for both goats and sheep. This reduction (or sparing) in the consumption of Rhodes grass hay was coupled by an improvement in daily liveweight gain (g/head/day) in both goats (from 29 to 46 by 58.6%) and sheep (from 26 to 39 by 50%) and also by an improvement in the feed conversion efficiency (g feed/g gain) of both goats (from 25 to 13.8 by 45%) and sheep (from 28.7 to 17.2 by 40%). Cost of daily consumed feeds as well as cost/kg gain (or cost of meat) were both reduced due to feeding of MNB. They were both respectively reduced by 7.5% (from 53 Baisa/day to 49) and 38% (from 1,828 Baisa/kg to 1,140). It was economically viable to feed MNBs containing date by-products and urea to small ruminants in the Sultanate of Oman. ***(Asian-Aust. J. Anim. Sci. 2002. Vol 15, No. 5 : 671-674)***

Key Words : Multinutrient Blocks, Roughage, Growth, Small Ruminants

INTRODUCTION

Small ruminants constitute the majority of animals in the Sultanate of Oman, there being about 860,000 goats and 240,000 sheep in a total of about 1.4 million cattle, goats, sheep and camels (MAF, 1993). Goats were estimated to increase annually by about 2.1% and sheep by about 7%. Small ruminants are the chief source of meat for the Omani people but, unfortunately, the steady increase in their numbers is not matched by an increase in the feed resources in the country. Feed shortage, which also presents difficults for large ruminant production (El Hag and El Khangeri, 1992; El Hag, 1995; El Hag and El Shargie, 1996) is particularly severe during the dry summer months. Large amount of date byproducts (date fronds, fiber, syrup, date syrup-Dibis, pits, and inferior quality dates) are available and appear to be valuable sources of energy and nitrogen as supplements to low quality roughages. Multinutrient blocks (MNB) manufactured from date byproducts and urea proved successful as an energy and nitrogen supplement for dairy cattle (El Hag, 2000). The study described here examined the value of MNB for small ruminants as a partial substitute for the roughage component (Rhodes grass hay) of their diet, the effect on the feedlot performance of goats and sheep, and the effect on the economics of feeding.

* Corresponding Author: M. G. El Hag. Dept. of Animal Production, Faculty of Agriculture El Zaim Al Azhari University, Omdurman, P.O.B. 1933, Sudan. Tel: +24913-3444511, Fax: +24913-344510, E-mail: casein@sudanmail.net
Received January 27, 2001; Accepted November 24, 2001

MATERIALS AND METHODS

Eight growing local Omani goats, about one year old with a mean body weight of 21.1±4.5 g, and eight growing local Omani sheep also about one year old with a mean body weight of 25.5±4.1 kg, were used in this study. The goats and sheep were subdivided into two sub-groups of more or less equal body weight for each species: 21.1±4.8, 21.1±4.2 and 25.5±3.8, 25.5±4.4 for goats and sheep, respectively. Two feeding regimens were randomly assigned for each sub-group of goats and sheep. In one of the feeding regimens the goats and sheep were each individually fed on a restricted amount of a commercial concentrate diet (14% CP) at a rate of 0.5 kg concentrate/head/day plus *ad libitum* amount of Rhodes grass hay (*Chloris guyana*) at a rate of about 300 g/head/day. In the second regimen both goats and sheep were also individually fed on a restricted amount of the commercial concentrate diet at a rate of 0.5 kg concentrate/head/day plus a restricted amount of Rhodes grass hay, about 200 g/head/day and with *ad libitum* MNB for each head of goat or sheep in this regime. The experimental design was thus a complete random design arranged in a 2×2 factorial with 4 animals/treatment (two animal species: goats and sheep; two feeding regimens). Table 1 summarizes the composition of the MNB which was made up of 80% date by-products and 7% urea. The material was thus made up of date by-products which are relatively abundant in the Sultanate and with cheap prices. Composition of the MNB and the other feeds used in the study are shown in table 2. The lick block is very rich in CP (25%) and minerals (20.7% ash), compared to the other feeds (commercial concentrate: General Ruminant-14% CP and Rhodes grass hay) The experiment lasted for 84 days. Daily feed intake and fortnightly body weight changes were recorded. Feed samples were collected and analysed at the start and two weeks prior to the end of the trial, using proximate analysis (AOAC, 1984). Data for feed intake, daily liveweight gain and feed conversion efficiency were analysed as a 2×2 factorial, according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

Performance of the goats and sheep on the diets as affected by feeding of the MNB is summarized in table 3. Sheep significantly ($p<0.05$) consumed greater amounts of MNB (36±17 g/head/day) than goats (6±2.5 g/head/day). Goats and sheep consumed similar amounts of the concentrate diet, although in general sheep consumed significantly ($p<0.05$) greater total net amounts of feed (Concentrate+Rhodes grass hay+MNB). Differences between diets were also significant ($p<0.01$). Intake of Rhodes grass hay was significantly ($p<0.01$) low for the animals fed on the MNB and this was expected since both goats and sheep were intentionally fed on restricted amounts of the hay with MNB. Both goats and sheep received lesser amounts of hay (96 g for goats and 105 g for sheep), but performance was still better than on the control groups. They had better daily liveweight gain (g/head/day) and better feed conversion efficiency (g feed/g gain). Intake of MNB seem to improve efficiency of utilization of ME and CP for gain or growth (as evidenced by both lower

Table 1. Ingredients composition (% as-fed) or formulation of the Multi Nutrient (date syrup-Urea) Block (MNB)

Ingredients	% As-fed
Date syrup (Dibis)	35
Date syrup by-product (DSBP)	35
Date fronds (date Leaves +Rachis) ground	10
Urea	7.0
Cement	7.0
Salt	6.0
Total	100

* Cost of 1 kg MNB was calculated by considering the following: cost of 1 kg (DSBP)=70 Baisa; cost of 1 kg Urea=70 Baisa; cost of 1 kg cement=28 Baisa; cost of 1 kg Date fronds=2 Baisa; cost of 1 kg Dibis=100 Baisa; cost of 1 kg salt=25 Baisa, accordingly cost of 1 kg MNB=70 Baisa or 70 O.R/ton of MNB.

Table 2. Proximate composition and ME content of the feeds consumed by goats and sheep during the trial

Parameters	Feeds		
	MNB* (test diet)	Commercial GR-Ruminant	Rhodes grass (hay)
DM	87.6	91.0	89.8
CP	25	12.0	7.2
CF	9.0	12.3	34.3
EE	1.0	2.2	1.0
Ash	20.7	6.7	9.8
NFE	44.8	66.8	47.7
ME* (MJ/kg DM)	10.0	12.1	8.5

* ME was calculated using *in vitro* dry matter disappearence (IVOMD), determined by Tilley and Terry (1963) and the equation described by MAFF (1980): ME (MJ/kg DM)= (0.152 CP+0.342 EE+0.128 CF+0.159 NFE (<u>D- value)</u>
100 -TA
where as TA = % total ash and D-value=% IVOMD.

amounts of ME and CP needed per g gain for animals fed on the MNBs vs animals not receiving the MNB-control group). Feeding the MNB decreased the cost of the consumed feed/day (Baisa/day) from 53 to 49 (by 7.5%) and cost/kg gain (or cost of meat) from 1,828 to 1,140 (By 38%). The improvement in performance of small ruminants receiving MNB in this study was in agreement with the findings of Hinojosa et al. (2000), Morales et al. (2000) and El Khidir et al. (1989) who all reported a beneficial effect to the feeding of MNB (containing mollases and urea) to goats and sheep receiving poor quality forages or roughages. In this study intake of both concentrate and forage (Rhodes grass hay) were restricted in the test group to mimic or simulate drought conditions where feed is scarce or insufficient for ruminants. Indeed feed intake was significantly lower for both goats and sheep (by about 100 g for the roughage portion of the diet). Although feed intake was significantly decreased, performance of both goats and sheep was markedly improved as evidenced by the better daily liveweight gain and better feed conversion efficiency. It seems that efficiency of utilization of both ME andd CP for gain was improved. Date syrup-urea MNB probably provided continuous adequate and steady levels of ammonia-N from the urea and sugars (or glucose) from the date syrup or the Dibis to meet changing requirements as animals consumed these supplements as needed. The continuous and adequate supply of ammonia-N and sugars to the rumen microbes will optimize rumen fermentation and provide adequate conditions for the growth of rumen microbes which in turn will utilize fibrous feeds and roughages more efficiently for synthesis of energy and microbial proteins (Preston, 1995). The limited or restricted intake of the concentrate had probably created an

Table 3. Effects of type of diet and animal species on feed intake and animal performance

	Goats		Sheep		Significance level		
	Conc. GR-diet+ MNB	Conc. GR-control diet	Conc. GR-diet+ MNB	Conc. GR-control diet	Diet	Species	Diet×Sp.
Period	84	84	84	84			
Number of animals	4	4	4	4			
Initial body weight (IBW), kg	21.1	21.1	25.5	25.5			
Final BW, kg	25	23.5	28.8	27.7			
Average BW, kg	23	22.3	27.2	26.6			
Liveweight gain (g/day)	46	29	39	26	NS	NS	NS
Feed intake (Rhodes grass hay), (g/day) as-fed	144	240	146	251	0.01	0.05	0.05
Feed intake (conc. GR-diet) g/day	485	487	490	495	NS	NS	NS
Feed intake (MNB), g/day	6±2.5	-	36±17	-	0.01	0.05	0.05
Total feed intake (hay+conc. diet+MNB) g/day	635	727	672	746	0.01	0.05	0.05
Conc.: Roughage ratio %	76:24	67:33	73:27	66:34			
Feed conversion efficiency (g feed/g gain)	13.8	25	17.2	28.7	NS	NS	NS
Feed intake, as % BW	2.76	3.26	2.5	2.8			
Feed intake (g/kg $BW^{0.75}$)	60.5	70.8	56.4	63.7			
ME intake (MJ/day)	6.5	7.2	6.8	7.4			
ME intake (MJ/g gain)	0.141	0.248	0.174	0.285			
CP intake (g/day)	65.6	68.7	70.7	70.3			
CP intake (g/g gain)	1.43	2.37	1.81	2.7			

NS=p>0.05.

Table 4. Economics of feeding as affected by type of diet and animal species

Parameter	Diet		Species	
	Concentrate GR+MNB-diet	Commercial concentrate-GR diet (control)	Goats	Sheep
Amounts of daily consumed feeds (g/head/day)	653	736	681	709
Amount of consumed concentrate	487	491	486	493
Amount of consumed Rhodes grass hay	145	245	192	198
Amount of consumed MNB	21	-	3	18
Cost* of consumed feed/day (Baisa)	49	53	50	52
Cost/kg gain (Baisa)	1,140	1,828	1,316	1,592

* Cost of the consumed feeds/day were calculated according to the prevailing costs of the ingredients at the time of conducting the experiment. Cost of the MNB diet (O.R. / ton), commercial general ruminant-diet, and Rhodes grass hay were 70, 80 and 55, respectively.

inadequate rumen environment, particularly in terms of the supply of readily fermentable sources of energy and non-protein-N (ammonia) which were apparently supplied by the date syrup-urea MNBs. It seems that feeding of MNB created an optimal rumen environment for microbial growth. The first priority in feeding ruminants is to ensure that there are no deficiencies in the diet of nutrients for microbial growth in the rumen by providing easily digestible high energy feeds (Morales et al., 2000). On most diets based on crop residues and low digestible forages, the primary limitation to the growth of rumen micoorganisms is probably the concentration of ammonia in the rumen fluid. The second limitation is deficiencies of minerals, particularly sulphur, phosphorus, magnesium and certain trace minerals (Qi et al., 1994). Date syrup, in addition of being a rich source of sugars, also contains a good supply of minerals such as: Na, K, Mg, Ca, Fe, Zn, Mn and Cu (Mikki and Al-Taisan, 1987). Nitrogen, sugars and minerals were all available and supplied by the date syrup-urea MNBs and this will help explain why both goats and sheep performed better when fed MNB, despite the restrictions made on feeding the roughage diet (Rhodes grass hay). It was quite economical to feed small ruminants in the Sultanate on diets containing MNB manufactured from date syrup and urea.

REFERENCES

AOAC. 1984 . Official Methods of Analysis. 14th Ed. Association of official analytical chemists, Washington, DC.

El Hag, M. G., M. A. Al-Merza and H. H. El Khanjari. 2000. Processing of Multi Nutrient Blocks (MNBs) from date by-products and urea for feeding ruminants in the Sultanate of Oman. I-Effect of partial replacement of the concentrate dairy ration with date syrup-urea MNB on milk production, quality and economics of feeding. Unpublished Departmental research report, Ministry of Agric. and Fisheries, Muscat-Sultanate of Oman.

El Hag, M. G. and H. H. El Khanjari. 1992. Dates and sardines as potential animal feed resources. World Animal Review No. 73 (FAO).

El Hag, M. G. 1995. Production of animal feeds from dates and date by-products in the Sultanate. A review. International J. Anim. Sci. (1995) 10:195-201

El Hag, M. G. and K. M. El Shargi. 1996. Feedlot performance and carcass characterstics of local (Dhofari) and exotic (Cashmere) goats fed on a high fiber by-products diet supplemented with fish sardines. Asian-Aus. J. Anim. Sci. 9:389-396.

El Khidir, O. A., A. M. Khalafalla and F. I. Murgos. 1989. Molasses urea blocks as an emergency diet for sheep in the Sudan. Sudan J. Anim. Prod. 2:9-17.

Hinojosa, O., A. Stemmer and A. Valle Zarate. 2000. Effect of multinutrient blocks on growing of kids at the end of the dry season in Bolivia. Proceedings of the 7th International Conference on Goats, France, 15-21 May 2000. p. 173.

Mikki. M. S. and S. M. AL-Taisan. 1987. Incorporation of date pulp for the manufacture of Tomato ketsup. Date Palm J. 5:215-226.

Ministry of Agriculture, Fisheries and Food. Booklet 2087. 1980. Nutrient Allowances and Composition of Feedingstuffs for Ruminants, Hmso, London.

Ministry of Agriculture and Fisheries, Muscat Sultanate of Oman. 1993. Animal census. Unpublished Departmental report.

Morales, A. R., M. A. Galina and G. F. W. Haenlein. 2000. Nutritional and economic effects of using non protein feed supplementation to dairy goats on low quality forage. Proceedings of the 7th International Conference on Goats, France, 15-21 May 2000. pp. 145-149.

Preston, T. R. 1995. Tropical Animal Feeding: A Manual for Research Workers. Animal Production and Health paper-126. Food and Agriculture Organization of the United Nations, Rome, Italy.

Steel R. G. and J. H. Torrie. 1980. Principles and Procedures of Statistics. A Biometrical Approach. 2nd. Ed. McGraw Hill Book Co.Inc. New York.

Tilley, J. M. A. and R. A. Terry. 1963. A two-stage technique for the *in vitro* digestion of forage crops. J. Br. Grassl. Soc. 18:104.

Qi, K., C. D. Lu and F. N. Owens. 1994. Effects of sulfate supplementation on performance, acid-base balance and nutrient metabolism in Alpine kids. Small Rumin. Res. 15:9-18.