FEEDLOT GROWTH AND EFFICIENCY OF THREE-WAY CROSS LAMBS AS AFFECTED BY GENOTYPE, AGE AND DIET

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SUMMARY

One hundred and eight early weaned lambs (8 weeks of age), 36 each from the Naeemi x Border Leicester Merino, Naeemi x Dorset Merino and Naeemi x Suffolk Merino were fed low, medium and high energy diets (11 .0, 11.9 and 12.7 MJ/kg, respectively) in a feedlot for 20 weeks. Average daily gain (ADG), average daily feed intake (ADFI) and feed conversion ratio (FCR) were recorded at 9- 13, 13-17, 17-21, 21-25 and 25-29 weeks of age. Overall ADG (202 g) was the same across all the genetic groups and diets but differed significantly ($P<0.01$) between ages. Overall ADFI was 1073 g and varied significantly ($P<0.01$) between genetic groups, diets and ages. Overall mean FCR was 6.10 with significant differences between ages ($P<0.01$) and diets ($P<0.05$).

Although lambs fed high energy diet ate less than the lambs fed low and medium energy diets, the former were the most efficient in feed conversion. Effect of age was significant for ADFI, ADG and FCR. Differences between genetic groups for ADG and FCR were not significant.

Keywords: gain, intake, feed conversion, lambs, genotypes, feedlots

INTRODUCTION

Australian crossbred ewes have been used in the Arabian Gulf countries for terminal crossing with fat-tailed sires of the local breeds (Najdi, Naeemi or Awassi). The 3-way cross lambs produced in this manner retain many of the breed characteristics of the local sire. Moreover, they can be produced at a lower cost than using local breeding ewes and are very acceptable in the local market both as live lambs and as dressed carcasses (Brightling and Lightfoot 1994). In Kuwait, weaned lambs are usually reared for 3-4 months in feedlots and sold at 35-45 kg liveweight. However, little data from controlled studies are available with regard to the feedlot growth and efficiency of feed conversion of the lambs. These parameters are of great economic significance to sheep producers.

The aim of the present study was to determine the effects of breed, age and diet on weight gain, feed intake and feed efficiency of Naeemi x (Border Leicester x Merino), Naeemi x (Dorset x Merino) and Naeemi x (Suffolk x Merino) lambs in the feedlot.

MATERIALS AND METHODS

Experimental design

The experiment was a completely randomized design with a 3x3 (genetic groups x diets) factorial arrangement of treatments. The lambs of the 3 genetic groups used were Naeemi x Border Leicester Merino (NxBLM), Naeemi x Dorset Merino (NxDM) and Naeemi x Suffolk Merino (NxSM). The 3 planes of nutrition imposed were low, medium and high energy diets. The lambs were 9 ± 1 weeks old and weighed approximately 18 kg at the beginning of the trial. The experiment was carried out over a period of 20 weeks in a commercial feedlot without any provision for grazing. The trial was conducted during January-May, 1990 when the mean diurnal temperatures ranged 8-18°C in January to 24-38°C in May.

The lambs were divided according to the genetic groups and housed in 27 pens of 4 animals represented equally by 2 sexes as far as possible. There were 9 replicate pens per diet or per genetic group. Thus, 108 lambs in total were used in this study. All animals within a pen were of the same genetic group and received the same type of diet. The experiment was conducted in an enclosed but adequately ventilated lamb fattening shed with concrete floor. Wheat straw bedding was used and replaced daily in order to keep the pens dry. All lambs were vaccinated against clostridial infections. There was no incidence of sickness or mortality in lambs during the study period.

Diets

The lambs were fed *ad libitum* diets with 18% (17-18.2%) crude protein, and of low, medium and high energy (11 .0, 11.9 and 12.7 MJ/kg, respectively). The diets were composed of 80% concentrate and 20% alfalfa hay (Table 1). Lambs were allocated randomly with 36 lambs of each breed assigned per diet.

Feeding was *ad libitum*. Mineralized salt blocks were provided in the feeding troughs and fresh water was available in the pens.

Table 1. Composition of low, medium and high energy diets fed to lambs from 9 to 29 weeks of age

	Diet		
	Low energy	Medium energy	High energy
Ingredient			
Soybean meal	14.0	16.0	18.5
Corn	22.5	39.5	39.5
Barley	12.0	16.0	16.0
Oats	29.0	6.0	
Vegetable oil			3.5
Vit. & min.	0.5	0.5	0.5
Salt	0.8	0.8	0.8
Limestone	1.2	1.2	1.2
Alfalfa hay	20.0	20.0	20.0
Chemical composition			
Dry matter	94.9	92.0	92.6
Crude protein	17.9	18.2	17.0
Ash	7.6	7.8	11.3
Ether extract	2.0	2.0	5.5
Metabolizable energy (MJ/kg)	11.0	11.9	12.7

Measurements

Individual average daily gain (ADG) was calculated using weekly measurements of body weight. Feed intake by pen was recorded weekly to calculate individual average daily feed intake (ADFI), assuming that the 4 lambs in a pen had the same daily feed intake. Feed conversion ratio (FCR)for each individual lamb was calculated from feed intake and weight gain (ADFI/ADG).

Statistical analyses

Data on ADFI, ADG and FCR at 5 ages (9-13, 13- 17, 17-21, 21-25 and 25-29 weeks) were analysed by least squares procedures (Harvey 1990). The statistical model included the fixed effects of age, genetic group, diet and 2-way interactions among the main effects. Initial weight was included as a covariate to remove any variation due to the small differences in initial weights of the lambs. Due to the serial slaughter of 27 lambs each at 17, 2 1, 25 and 29 weeks, feedlot data are presented for all lambs available at the time measurements were made. No correction was used for repeated measures of growth and feed intake.

RESULTS

Least squares means for ADFI, ADG and FCR by age, genetic group and diet are presented in Table 2. Significant differences were observed between ages ($P<0.01$) for ADFI, ADG and FCR, between genetic groups for ADFI ($P<0.01$) and between diets for ADFI ($P<0.01$) and FCR ($P<0.05$). Regression on initial body weight (kg) was small and significant only for ADG ($b = 5 \pm 1$ g; $P<0.01$).

Effect of age of lamb

Average daily feed intake, irrespective of the genetic group or diet, increased almost linearly from 9 to 21 weeks, remained constant during 21-25 weeks and declined sharply from 25 to 29 weeks. ADG was similar for 9-l 3 and 13- 17 weeks, increased during 17-2 1 weeks and showed a sharp decline from 2 1 to 29 weeks. Younger lambs had better feed conversion than the older lambs (441 l-5735 g for 9-17 weeks cf. **6.37-7.36** g for 17-29 weeks).

Age x diet interaction was significant for ADFI ($P<0.05$) and was caused by relatively lower intake of the lambs fed the high energy diet as compared to the lambs offered medium and low energy diets during 9-13 wk (high energy: 711, medium energy: 820 and low energy: 827 g) and 25-29 wk (high energy: 1005, medium energy: 1090 and low energy: 1056 g). At other ages, ADFI was similar for the three diets. Age x genetic group interaction was not significant for ADFI. For both ADG and FCR, age x diet interaction

was significant and was caused by comparatively higher ADG and FCR during 9 to 17 weeks and lower during 17-29 weeks.

Table 2. The effects (mean values ± SE) of age, genetic group and diet on average daily feed intake (ADFI, g), average daily gain (ADG, g) and feed conversion ratio (FCR)

Factor	ADFI	ADG	FCR
Overall mean	1071 ± 07	202 ± 04	6.10 ± 0.163
Age			
9-13	786 ± 07	211 ± 06	4.41 ± 0.271
13-17	1040 ± 07	211 ± 06	5.74 ± 0.266
17-21	1256 ± 08	232 ± 07	637 ± 0.307
21-25	1224 ± 10	182 ± 09	7.26 ± 0.376
25-29	1051 ± 14	176 ± 12	6.73 ± 0.532
Significance	**	**	**
Genetic group			
NxBLM	1098 ± 07	212 ± 07	5.97 ± 0.282
NxDM	1044 ± 07	204 ± 07	5.75 ± 0.283
NxSM	1073 ± 07	191 ± 07	6.58 ± 0.283
Significance	**	n.s.	n.s.
Diet			
Low energy	1093 ± 07	200 ± 07	6.43 ± 0.283
Medium energy	1093 ± 07	202 ± 07	6.28 ± 0.282
High energy	1028 ± 07	205 ± 07	5.59 ± 0.283
Significance	**	n.s.	*

**P<0.02; *P<0.05; n.s. = not significant.

Effect of genotype

Overall mean ADFI was 107 1 g. The NxBLM lambs consumed the highest amount of feed per day (1098 g) and NxSM consumed the least amount (1044 g), a significant difference (P<0.05). Overall mean ADG and FCR were 202 and 6100 g respectively, with no significant differences between genetic groups for either trait.

Genetic group x diet interaction was significant (P<0.05) for ADFI and resulted from comparatively lower feed intake by NxSM lambs fed high energy diet and higher intake by the NxSM lambs fed medium and low energy diets. There was no interaction (P>0.05) between genetic groups and diets for ADG and FCR.

Effect of diet

Effect of diet was significant for ADFI (P<0.01) and FCR (P<0.05) but ADG was not affected by diet. The ADFI averaged 1093 g for lambs fed low and medium energy diets and 1028 g for lambs fed the high energy diet. Increasing diet energy from medium to high increased efficiency of feed use from 6.28 to 5.59 g. Low and medium energy diets were similar for FCR.

DISCUSSION

Results of this experiment showed that lambs sired by Naeemi rams and differing in dam breeds (GLM, DM and SM) grew at similar rates and had similar feed conversion ratios. The FCR was lower for lambs fed high energy diet than for lambs fed low and medium energy diets as a result of similar ADG on all diets and a lower intake of lambs fed the high energy diet. There was no interaction between genetic groups and diets for ADG, in agreement with Fahmy *et al.* (1992) and Petit and Castonguay (1994), who observed that lambs of different genetic backgrounds responded similarly to various diets. There was a trend for ADG to increase from 9 to 21 weeks (214-237 g) and decrease from 2 1 to 29 weeks (237- 174 g).

Feed conversion ratio of 5.75-6.58 obtained in the present experiment was better than the 6.2-6.8 reported by Sakul *et al.* (1993) for Australian Merino and U.S. sheep breeds. In Iran, Nik-Khah (1984) reported even poorer feed conversion ratio of 6.2-8.3 in fat-tailed lambs of the local breeds. The lambs used in the

above studies were older and heavier than the lambs in the present study which is consistent with our finding that the efficiency of feed conversion declines with increasing age.

In conclusion, significant differences in feed conversion ratio existed between diets and between various ages of the lamb, but differences between genetic groups were minor. The results suggest that it may be beneficial to market lambs at 21 weeks (5 months) when the growth rate has peaked rather than to feed them up to 29 weeks (7 months) when the growth rate has slowed down significantly. Early finishing of lambs will allow their faster turnover from the feedlot and possibly higher profits.

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