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DRIED BEET PULP AS A BARLEY REPLACEMENT FOR FATTENING LAMBS OF TWO IRANIAN BREEDS OF SHEEP[1]

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ABSTRACT

Forty-eight winter born lambs of two fat-tailed Iranian breeds, Mehraban and Karakul were randomly assigned to six dietary treatments. Diets consisted of 40% hay (alfalfa and wheat straw), and 60% concentrate and mineral supplements. Concentrates consisted of dried sugar-beet pulp with molasses and barley in the following ratios; 0 :100, 21 :79, 41 :59, 62 :38 and 83 :17, respectively. Protein content of the fourth ration was partly substituted by urea (0.3% of feed) and assigned as the sixth ration.

The lambs were creep fed during the suckling period and weaned at 75 days of age. The diets were fed *ad libitum* in feedlot until 195 days of age. Due to unequal number of lambs in subclasses, the data were analyzed by the least squares procedure and partial regression of the trait on weaning weight was also included.

No significant difference was found in daily gain or feed conversion between different diets. Mehraban lambs gained significantly and more efficiently than Karakul lambs. The average daily gains in feedlot were 121.4 and 81.0 g and feed conversions were 7.6 and 8.6 for Mehraban and Karakul, respectively.

Analysis of the data at 30 day intervals indicated that Karakul lambs reached the finishing stage sooner as compared with Mehraban. Feedlot daily gain of lambs receiving different rations did not differ statistically in different periods. In the last period (166-195 days) lambs which were fed all barley concentrate consumed significantly less feed

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per unit live weight gain as compared with the group which was fed concentrate containing 80% dried beet pulp.

INTRODUCTION

Feed cost is one of the major factors contributing to the relatively high value of lamb meat in the market. Therefore it seems feasable to substitute as much beet pulp molasses as possible for grain in the ration of fattening lambs in the areas where beet pulp is relatively cheaper than fodder grains.

The fiber content of dried beet pulp is highly digestible and its energy is utilized as efficiently as that of corn (3,4). The net energy content of molasses dried beet pulp is not far from that of barley (12). Better growth of fattening lambs on diets containing dried beet pulp versus barley have been reported by Al-Azzawi *et al.* (1). Leroy *et al.* (11) reported that dried beet pulp could substitute for barley when fed up to 35% of the ration's dry matter. Hanke and Jordan (8) found that substituting dried beet pulp for corn at levels up to 35% of the ration concentrate did not have a significant effect on gain but lowered the feed efficiency at finishing stage.

The purpose of this study was to compare the nutritional effects of various levels of molasses dried beet pulp with barley on feedlot daily gain and feed conversion in fattening lambs. Comparison of feedlot performance of the two fat-tailed Iranian breeds of sheep Mehraban and Karakul, was also under consideration.

MATERIALS AND METHODS

Experimental animals: Forty-eight lambs from two fat -tailed Iranian breeds of sheep, Karakul and Mehraban were used in this experiment. Lambs were born single from January 6 through February 24, 1972. The Karakul breed is a dual purpose sheep and is raised for meat as well as fur production in the southern and eastern parts of Iran. The Mehraban breed is a relatively large size breed raised on the farms of western part of the country. No classical selection for meat, milk and wool has been so far performed on these breeds.

Experimental procedure: The lambs were creep-fed during the suckling period. The creep ration consisted of 50% barley, 10% sunflower seed meal, 20% wheat bran, 18%

dried beet pulp with molasses, 1% bone meal and 1% salt. Alfalfa hay was fed free choice and the lambs were allowed to nurse their mothers approximately 12 hr at night. All the lambs were weaned at 75 days of age and were randomly divided within breed and sex into six groups and were fed *ad libitum* one of the six rations for 120 days. Feed consumption and live–weight were measured individually at 15 -day intervals.

Table 1. Compositions and proximate analyses of the experimental rations.

	Ration					
	R_1	R_2	R_3	R_4	R_5	R_6
Composition %						
Barley	58	46	34	22	10	22
Dried beet pulp	0	12	24	36	48	36
Alfalfa hay	25	27	29	31	33	22
Wheat straw	15	13	11	9	7	18
Bone meal	1	1	1	1	1	1
Salt	1	1	1	1	1	0.7
Urea	0	0	0	0	0	0.3
Proximate analysis %						
Crude protein	8.5	9.2	8.7	8.5	8.3	8.6
Ether extract	1.6	1.8	1.2	1.2	0.9	1.1
Crude fiber	18.0	16.1	19.8	22.4	22.9	21.8
Ash	8.1	7.9	9.0	9.7	9.0	9.4
Dry matter	93.0	93.0	93.2	93.6	93.6	93.4

Experimental rations: Table 1 shows the compositions and proximate analyses of the experimental rations. The rations were composed of 58% concentrate (consisting of different percentages of barley and dried beet pulp with molasses), 40% hay (alfalfa hay and wheat straw) and 2% mineral supplements. The crude protein content of the 6th ration (R_6) was partly substituted by urea (0.3% of feed) but the concentrate part was similar to that of the 4th ration. All rations were formulated for a 27 kg fattening lamb according to the N.R.C. recomendations (14), so that each kg of feed contained 3000 kcal digestible energy and 82 g digestible protein. The rations were ground, mixed and sampled for proximate analysis by the method described by A.O.A.C. (2).

analysis of data: The data were analyzed by the method of least squares as outlined by Harvey (9). Constants were fitted for breed of sheep, ration and sex of lamb. Partial regression of daily gain or feed conversion on weaning weight was included in the model. Pairwise tests of significance among the least squares means were performed with the Duncan's Multiple Range Test as modified by Kramer (5,10). Standard errors of the different estimates were calculated from the appropriate terms of the variance-covariance matrix.

RESULTS AND DISCUSSION

Rations: Least squares means of daily gain and feed conversion in feedlot are presented in Table 2. Although there was an upward trend in gain and feed efficiency as the level of dried beet pulp was increased up to 40% of the concentrate, nevertheless there was no significant difference among rations for daily gain and feed efficiency. The results do not confirm the finding of Al–Azzawi *et al.* (1) who reported better growth of fattening lambs on diets containing different levels of dried beet pulp as compared to barley. The result of the experiment, however, is in agreement with that reported by Hanke and Jordan (8) who found that substituting dried beet pulp for grain at levels up to 35% of the concentrate did not have a significant effect on gain in fattening lambs.

In Tables 3 and 4, the daily gain and feed conversion from 75 to 195 days of age are given at 30 day intervals. No significant difference was found for daily gain between rations in the four different periods. Significant differences in feed conversion were found only during the last period (166 to 195 days of age). During this period the lambs which were fed concentrates containing no dried beet pulp consumed significantly less feed per

Table 2. Least squares means and standard errors by rations, breeds and sex groups in feedlot and the test of significance for differences among means.

Classification	No. of lambs	Daily gain, g	Feed conversion
Overall mean	48	101.2 ± 4.9	8.1 ± .2
Rations			
R_1	8	91.3 ± 9.9a*	8.2 ± .4a
R_2	9	105.9 ± 9.4a	8.0 ± .4a
R_3	7	116.0 ± 10.8a	7.6 ± .5a
R_4	9	100.6 ± 9.2a	8.2 ± .4a
R_5	7	97.8 ± 11.5a	8.5 ± .5a
R_6	8	95.7 ± 12.8a	8.5 ± .6a
Breeds			
Karakul	10	81.0 ± 8.8a	8.6 ± .4a
Mehraban	38	121.4 ± 4.4b	7.6 ± .2b
Sex groups			
Male	24	110.3 ± 6.8a	8.2 ± .3a
Female	24	92.1 ± 6.6a	8.0 ± .3a
Regression		0.63ns	.05ns

* Means in each group differ significantly ($P < .05$) except those followed by the same letter.

Table 3. Least squares means and standard errors by rations, breeds and sex groups for daily gain at 30 day intervals and the test of significance for difference among means.

Classification	76 to 105 days of age,g	106 to 135 days of age, g	136 to 165 days of age, g	166 to 195 days of age, g
Overall mean	71.1 ± 9.0	112.1 ± 6.8	137.2 ± 8.9	138.1 ± 9.1
Rations				
R_1	45.5 ±17.9a*	94.3 ± 13.9a	107.4 ± 18.0a	173.6 ± 18.4a
R_2	84.0 ±16.9a	99.5 ± 13.1a	144.4 ± 17.1a	141.3 ± 17.4a
R_3	108.0 ±19.4a	104.4 ± 15.0a	147.9 ± 19.6a	158.6 ± 19.9a
R_4	46.7 ±16.6a	125.6 ± 12.8a	143.6 ± 16.7a	143.7 ± 17.0a
R_5	64.8 ±20.7a	133.3 ± 16.0a	153.6 ± 20.8a	92.3 ± 21.2a
R_6	77.6 ±23.1a	115.5 ± 17.8a	126.4 ± 23.2a	118.7 ± 23.7a
Breeds				
Karakul	8.8 ± 15.9a	102.0 ± 12.3a	139.0 ± 16.0a	123.1 ± 16.4a
Mehraban	133.4 ± 7.9b	122.2 ± 6.1a	135.4 ± 7.9a	153.0 ± 8.1a
Sex groups				
Male	62.6 ± 12.3a	128.5 ± 9.5a	163.8 ± 12.4a	137.3 ± 12.7a
Female	79.6 ± 12.0a	95.7 ± 9.3b	110.6 ± 12.1b	138.8 ± 12.3a
Regression	3.1ns	1.0ns	1.2ns	5.2ns

* Means in each group differ significantly ($P < .05$) except those followed by the same letter.

Table 4. Least squares means and standard errors by rations, breeds and sex groups for feed conversion at 30 days intervals and the test of significance for differences between means.

Classification	76 to 105 days of age	106 to 135 days of age	136 to 165 days of age	166 to 195 days of age
Overall mean	8.5 ± .7	6.7 ± .4	8.8 ± .8	12.3 ± 1.8
Rations				
R_1	9.5 ± 1.4a*	7.4 ± .7a	9.5 ± 1.7a	8.3 ± 3.7a
R_2	7.6 ± 1.3a	7.5 ± .7a	8.4 ± 1.6a	10.3 ± 3.5ab
R_3	9.0 ± 1.5a	7.5 ± .8a	7.5 ± 1.8a	9.6 ± 4.0ab
R_4	7.9 ± 1.3a	5.9 ± .7a	7.4 ± 1.6a	13.6 ± 3.4ab
R_5	8.2 ± 1.6a	5.3 ± .9a	7.6 ± 1.9a	21.6 ± 4.2 b
R_6	8.6 ± 1.8a	6.5 ± .9a	12.3 ± 2.2a	10.8 ± 4.7ab
Breeds				
Karakul	10.1 ± 1.2a	6.0 ± .7a	7.7 ± 1.5a	14.6 ± 3.2a
Mehraban	6.8 ± .6b	7.3 ± .3a	9.8 ± .7a	10.1 ± 1.6 b
Sex groups				
Male	8.9 ± .9a	5.9 ± .5a	7.5 ± 1.2a	14.6 ± 2.5a
Female	8.1 ± .9a	7.5 ± .5b	10.0 ± 1.1a	10.1 ± 2.4 b
Regression	0.2	0.1 ns	0.1 ns	−.3 ns

* Means in each group differ significantly ($p < .05$) except those followed by the same letter.

unit live weight than lambs which were fed concentrate containing 80% dried beet pulp. The higher consumption of the ration composed of 80% dried beet pulp during the last stage of fattening can be attributed to the higher energy demand of animals in this peroid and the lower net energy content of dried beet pulp as compared with that of barley (12). Hanke and Jordan (8) reported a negative effect of dried beet pulp on feed efficiency at finishing stage even for rations composed of 35% dried beet pulp. It seems likely that other factors such as breed and age of the lambs and other constituents of the ration may also have some influence on feed efficiency.

Breed: Least squares means of daily gain and feed conversion are presented in Table 2. Mehraban showed significantly higher feedlot daily gain and feed efficiency as compared with Karakul breed. This is in agreement with the data reported by Makarechian *et al.* (13) who found that Mehraban lambs gained significantly more than Karakul and Naeini (a small size fat–tailed range sheep) breeds in feedlot. Similar results have also been reported by Demiruren *et al.* (6) in comparing small size range breeds and large size sheep.

Analysis of the data for daily gain and feed conversion from weaning to 195 days of age at 30 day intervals are presented in Tables 3 and 4. The results show that Mehraban gained significantly higher than Karakul only during the first 30 days of fattening period. Feed conversion was also significantly better for Mehraban at the first and the last periods as compared with Karakul. The lower feed efficiency of Karakul in comparison with that of Mehraban at the final stage might be due to the fact that Karakul reached the finishing stage sooner.

The standard errors of mean feed conversion at the last stage are more than that of the three previous stages which indicate that there is a relatively great variation among individuals within each breed in finishing age, and can be partly attributed to the fact that no selection has been applied on these breeds for feedlot performance.

The low daily gain and feed efficiency of the lambs in this experiment, especially in the early stage in the feedlot, could be partly due to the low protein content of the rations (about 8.5% crude protein). The rations were formulated for a 27 kg fattening lamb according to the N.R.C. recomendations (14), while the average weaning weight of the lambs was 19.2 kg. Apparently feed intake did not supply protein requirements of the

lambs, since some of them lost weight in the early stages. High summer temperature, which reached as high as 35 C inside the barn on some days, may be considered as another factor. Ghorban *et al.* (7) reported lower feedlot daily gain of Karakul lambs in summer as compared with those fattened during the winter season.

Sex group: Sex of lamb had no significant effect on feedlot daily gain and feed conversion (Table 2); but ram lambs were significantly superior to ewe lambs in daily gain at the 2nd and 3rd periods (Table 3) and in feed efficiency at the 2nd and 4th periods (Tables4).

The partial regression of the traits on weaning weight was included in the model (the average weaning weight of the lambs was 19.2 kg). Partial regression of feedlot daily gain and feed conversion on weaning weight was 0.63 and 0.05g, respectively. This indicates that weaning weight was not a significant source of variation in either case.

From the results of this experiment it can be concluded that:

1. Barley may be replaced by sugar beet molasses as the major ingredient of the concentrate in fattening lambs ration.
2. Generally Mehraban lambs gained faster and were more efficient than Karakul lambs in feedlot and therefore the former breed seems to be more suitable for feedlot operation than the latter.

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