



Comparative performance and digestibility of nutrients in pure and cross bred lambs

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Abstract

This study was investigated to compare the performance and digestibility of nutrients in Lori Bakhtiari (LB) and Romanov × Lori Bakhtiari (R×LB) cross bred lambs. In the first trial, 24 animals at the age of 4 months (12 LB and 12 (R×LB) cross bred lambs) were randomly allocated to individual pens in order to determine fattening performance for a period of 90 days. In the second trial, 3 animals at the age of 10 month from each breed were randomly allocated in individual metabolic cages to determine the *in vivo* digestibility for 7 days after adaptation period. The results showed that there were no significant effect in initial body weight, daily gain, feed conversion ratio and feed efficiency between treatments. LB lambs had significantly ($P<0.05$) higher feed intake compared to R × LB cross bred lambs. The study showed that there were no significant differences for digestibility of dry matter, protein, ether extract, acid detergent fibre, neutral detergent fibre, phosphorus, calcium, magnesium and iron between the two breeds. In conclusion the results showed that R× LB cross breed had no significance effect on feed digestibility and fattening characteristics of cross breed lambs. The study indicated that cross breeding was successful in term of consuming less feed with no compromise on weight gain.

Keywords: Ram lambs; Lori Bakhtiari, Romanov × Lori Bakhtiari; fattening performance; digestibility

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Introduction

The sheep population in Iran in 2011 was about 54 million heads, including 27 breeds and ecotypes (Iranian Ministry of Agriculture, 2011). A high majority of the sheep and goats population is managed under migratory and nomadic system where most of the people depend on the livestock socio-economic system (Shadnoush et al., 2004). Furthermore, Iranian native breeds of sheep are multipurpose and have significant role in meat, milk and wool production. Consumption of sheep meat has been preferred in Iran (Farid et al., 1977).

Lori-Bakhtiari is one of the most common native breeds in the south-western part of Iran, with a population of more than 1.7 million heads having the largest fat-tail size among all breeds (Satari, 1975; Vatankhah, 2007). Romanov is a breed of domestic sheep originating from the Upper Volga region in Russia. Most other sheep give birth to singles and twins, while the Romanov gives birth to about 2-5 lambs per lambing (Ricoardeau et al., 1990; Momani et al., 2002).

The Ministry of Jihad Agriculture in Iran has found it important to increase the efficiency of sheep production, because the output of sheep in this system is high (Vatankhah, 2005). Crossbreeding is the

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recommended breeding strategy for commercial production of meat from sheep and goat. The best rams used in commercial production are those that are fertile at the time of year when one wants to breed the ewes, aggressive so that they will find and impregnate those ewes that are in heat (Donald et al., 1963; Fitch, 1990). Many times crossbreeding in animals leads to high productivity performance and enhanced level of meat and milk (Satari et al., 2005). In recent years, some foreign breeds of lambs were used for crossbreeding with large breed size such as Lori Bakhtiari lambs (Farid, 1977; Valizadeh, 2010). Digestibility of forages feed is very important as it contributes to the energy and protein values and intake potential (Huhtanen et al., 2007) of the feed in ruminant production systems. Sheep fed at maintenance level of feeding present a model of ruminant digestion commonly used as the basis of estimating digestibility in feed evaluation systems (Schneider et al., 1975). They can be considered as the best estimate of the intrinsic digestibility value of a feed. The aim of this study was to evaluate comparative performance and *in vivo* digestibility of nutrients in Lori Bakhtiari and cross (Romanov × Lori Bakhtiari) breed lambs.

Materials and Methods

The research was carried out in Lori-Bakhtiari Research Flock at Shooli Sheep Breeding Station in Shahrekord. In order to determine fattening performance, the data of 24 Lori Bakhtiari and Romanov × Lori Bakhtiari cross breed ram lambs were used. Ingredients of diets were analyzed according to AOAC (2000). Crude protein (CP) was determined by Kjeldahl procedure. Neutral detergent fibre (NDF) and acid detergent fibre (ADF) were analyzed according to the method of Stern et al. (1997) and Van Soest et al. (1994). Ether extract (EE) was determined using diethyl ether (AOAC, 2000). Concentration of magnesium, calcium, zinc and iron was determined by atomic absorption spectrometer (PinAAcle 900 F, Perkin Elmer, USA) after sample digestion while phosphorous was determined by spectrophotometer (Thermo Scientific UV-Vis Evolution 220 USA) following the instruction of Odell (1971).

In the first study, 24 ram lambs at the age of 10 months (12 Lori-Bakhtiari and 12 Romanov × Lori Bakhtiari cross breed ram lambs) were used for 90 days to find fattening performance. The lambs were fed three times a day. The experimental diet is shown in Table 1. In this study, the initial body weight (IBW), final body weight (FBW), feed intake (FI), average daily gain (ADG), feed conversion ratio (FCR) and feed efficiency (FE) were evaluated.

In vivo (second study) digestibility of feed ingredients, 6 adult animals (3 Lori-Bakhtiari and 3

Romanov × Lori Bakhtiari cross breed ram lambs) with initial weight of 50 ± 4.50 kg and average age of 300 days were randomly allocated to the individual metabolic cages for 14 days. They were fed maintenance ration with total mixed ration (TMR) contained 60% alfalfa hay and 40% feedlot concentrate at level of 0.87 ± 0.05 kg/day (Ensminger, 1986). The ingredients and chemical composition of the experimental rations are shown in Table 1. The diets were fed for 7 days for adaptation and 7 days for experimental period. Also due to the trial plan, their feed intake, residual feed and faeces were collected and digestibility of diets and nutrients were investigated (Givens et al., 2000).

Statistical analysis

Data were analyzed using t-test (SAS, 2001). P value less than 0.05 was considered statistically significant.

Results

The IBW, FBW, FI, ADG, FCR and FE are presented in Table 2. No significant difference was found in both breeds except FI which was significantly higher in LB. Also the data indicated that IBW, FBW, FCR and FE were numerically higher in cross bred lambs compared to pure bred.

Data observed from Table 3 indicated that average nutrients consumption such as total feed intake (TFI) and dry matter intake (DMI) were higher ($P > 0.05$) in cross bred lambs. On the other hand, protein intake (PI), ether extract (EE), neutral detergent fibre (NDF) and acid detergent fibre (ADF) were numerically ($P > 0.05$) higher in LB breed.

Data of faecal nutrient for LB and R×LB lambs are shown in Table 4. Table showed that excreted faecal dry matter (DM), protein, ether extract (EE), neutral detergent fibre (NDF) and acid detergent fibre (ADF) were higher in LB than R×LB ram lambs, but the differences were not significant ($P > 0.05$). Similar to the other nutrients, faecal minerals including phosphorus, calcium, magnesium, zinc, and iron were higher in LB compared to R ×LB lambs ($P > 0.05$) as shown in Table 6.

The mean *in vivo* digestibility coefficients of nutrients in LB and R×LB ram lambs are shown in Table 7. Although there were no significant differences in nutrients digestibility between breeds, however, it was higher ($P > 0.05$) in cross bred lambs except NDF.

Means *in vivo* digestibility of minerals was not affected by the breed of animals. Data showed that digestibility of phosphorus, calcium, magnesium, zinc, and iron were higher in R×LB than LB ram lambs.

Table 1: Ingredients (DM basis %) and chemical composition of the experimental rations

Ingredients	Dry mater basis %
Alfalfa hay ¹	60
Corn	5.83
Barely	13.60
Wheat bran	9.32
Fish meal	0.78
Soybean meal	2.88
Canola Meal	2.33
Beet pulp	1.94
NaCl	1.94
Calcium bicarbonate	0.27
Baking soda	0.39
Magnesium Oxide	0.16
Bentonite	0.39
Mineral and vitamin per mix ²	0.17
Chemical Composition	
Crude protein	14
Metabolizable Energy (Mcal/kg DM) ³	2.4
Ash	8.6
Neutral detergent fiber (NDF)	19.55
Acid detergent fiber (ADF)	38.69
Ca	0.61
P	0.39

¹Chopped to 2-3 cm length, ²Supplies per kg of feed: 4.9 mg Zn, 4.05 mg Mn, 0.45 mg Cu, 0.075 mg I, 0.1 mg Se, 2,500 IU Vitamin A, 400 mg Vitamin D, 2.5 IU vitamin E, ³Calculated metabolized energy

Table 2: Means ±SE of fattening comparative performance in LB and R×LB ram lambs

Traits	LB	R×LB	SE
Initial live weight (kg)	36.10	39.10	1.47
Final live weight (kg)	58.70	61.10	1.34
Final body weight gain (kg)	22.63	22.06	1.34
Average daily gain (g)	251	245	14.9
Feed intake/day (kg)	2.10 ^a	2.04 ^b	0.02
Feed conversion ratio	8.30	8.50	0.46
Feed efficiency (%)	12.01	12.16	0.72

^{ab}Means within a row with differing letters differ significantly (P<0.05).

Discussion

Data from this study showed that final body weight, feed intake, average daily gain, feed conversion ratio and feed efficiency were little influenced by lamb's breeds. The aim of R×LB cross breeding was to establish rapid growth genes, increase the feed efficiency by lowering the feed intake, improve meat quality and reduce body fat (Anonymous, 2008). The R×LB cross bred lambs consumed less feed with no effect on the other parameters which indicates that the cross bred lambs efficiently utilized feed. Given that the share of food expenditure in LB lambs in village and centralized systems are 9.73 and 53 percent in the tropic areas respectively, interest in crossbreeding with tiny size breeds such as Romanov is necessary for the

reduction in food intake (Kosgey, et al., 2001; Vatankhah et al., 2013). Contrary to our finding, El Fadili et al. (2001) found a significant higher average daily gain in cross bred lambs of sired by D'man (D), Timahdite (T) and terminal sires of the Ile-de-France (IF), Lacaune (L) and Merinos Precoce (MP) breeds compared to pure breed. LB lambs consumed high feed intake with no increase in feed efficiency may increase the production costs, hence cross breeding program in this breed is beneficial and recommended (Kazemi-Bonchenari et al., 2014).

Abdullah et al. (2010) indicated that crossbreeding Awassi lambs with exotic breeds improved growth rate and meat production. Galivan (1996) showed that the average daily gains after weaning and during the finishing period and dry matter intake in breeding programs are important. No significant difference in feed conversion ratio, feed efficiency and many carcass characteristics between cross breeds Of Ile de France × Akkaraman (G1) genotype (IDFAG1) and pure breeds of fat-tailed Karakas sheep was reported earlier (Gokdal et al., 2004). In the present study, there were no significant difference in mineral intake and uptake in L B and R×LB ram which may be due the lack of significant differences in their feed intake. Esmailzadeh et al. (2010) showed that dry matter intake was significantly influenced by lamb's genotype at different recording periods, except at the fourth one, and total period of the experiment.

Kiyazad et al. (2003) evaluated the reproductive and growth performance of three Iranian local sheep breeds (Moghani, Chal and Zel), and three breeds were crossed amongst themselves reciprocally. The results showed that crossbreeding improved the growth performance and reproductive efficiency of the Zel ewes. With decreasing lamb mortality, through supplemented feeding of lambs in pre-weaning period, and average daily gain, feed conversion ratio through crossbreeding. So, in parts this finding is similar to our study.

Manafiazar et al. (2005) conducted a feedlot trial and carcass composition involving male lamb of two Iranian local breeds of Zandi and Zel and reciprocal cross breeds. They reported that average daily gain and other traits of feedlot performance were not affected by crossbreeding, but carcass composition showed significant differences.

Better digestibility in R ×LB ram (Table 8) seemed to be due to the enhanced ability of nutrients adsorption. Result of this study is in agreement with Esmailzadeh et al. (2012) that showed that there were no significant differences between pure and cross bred lambs in feed conversion rate. Bahrami et al (2010) showed that feed conversion efficiency for LB lambs was lesser than R×LB cross breed lambs.

Table 3: Means \pm SE of nutrients consumption (g) in LB and R \times LB lambs

Traits	LB	R \times LB	SE
Total feed intake	1440	1441	22
Dry matter intake	1083	1097	16.8
Protein intake	243	239	3.7
Ether extract intake	46.9	46.3	0.72
NDF	424	419	6.5
ADF	214	211	3.3

Table 4: Means \pm SE of nutrients excreted (g) in faeces of LB and R \times LB lambs

Traits	LB	R \times LB	SE
Faecal dry matter	594	533	34.7
Faecal Protein	53.8	46.9	3.7
Faecal ether extract	5.5	4.7	0.33
Faecal neutral detergent fibre	336.6	279	21.5
Faecal acid detergent fibre	152.3	143.5	.33

Table 5: Means \pm SE of some macro and micro elements consumption in LB and R \times LB lambs

Traits (ppm)	LB	R \times LB	SE
P	420	410	60
Ca	218	216	33
Mg	1040	1030	150
Zn	34.6	34.1	0.52
Fe	218	215	3.30

P: phosphorus; Ca: calcium; Mg: magnesium, Zn: zinc, Fe: iron

Table 6: Means \pm SE of some mineral excreted in faeces of LB and R \times LB lambs

Traits (ppm)	LB	Ro \times LB	SE
P	190	170	10
Ca	106	97	6
Mg	490	430	29
Zn	28.7	24.9	1.70
Fe	124.5	109.1	7.90

P: phosphorus; Ca: calcium; Mg: magnesium, Zn: zinc, Fe: iron

Table 7: Means \pm SE *in vivo* nutrients digestibility in LB and R \times LB lambs

Traits (%)	LB	R \times LB
Dry matter	45.8	50.8
Protein	77.8	80.4
Ether extract	88.3	89.8
NDF	76.8	74.2
ADF	64.1	65.8

Table 8: Means \pm SE *in vivo* minerals digestibility (%) in LB and R \times LB ram lambs

Traits	LB	R \times LB
P	54.7	58.5
Ca	51.4	55.1
Mg	52.0	58.2
Zn	15.8	27.8
Fe	42.8	49.3

P: phosphorus; Ca: calcium; Mg: magnesium, Zn: zinc, Fe: iron

According to the limitation of feed resources and production efficiency of meat animals can be defined as the return of salable product per unit of feed input, therefore, any reduction in feed cost would have tremendous effect on production efficiency (Sidwell et al., 1964; Timon and Hanrahan, 1986; Lewis et al., 2010). Since the Romanov \times Lori Bakhtiari ram lambs have lesser feed intake and better feed efficiency, therefore, they are economically more advantageous for farmers. The positive effects of cross breeding in feedlot performance of lambs had demonstrated formerly by Donald et al. (1963). This study demonstrated that R \times LB cross breed lambs may efficiently utilize the scarce feed resources in draught condition.

Conclusion

In conclusion the results showed that crossbreeding of Romanov and Lori-Bakhtiari breed had no significance effect on feed digestibility and fattening performance and these characteristics were similar between pure and cross breed lambs. Further, the study indicated that cross bred lambs were efficiently utilized the feed.

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