Veterinary Science & Technology

Dvalishvili, et al., J Veterinar Sci Technol 2015, 6:6
http://dx.doi.org/10.4172/2157-7579.1000275

Research Article Open Access

Influence of Crossbreeding Romanov Ewes with Crossbred Argali Romanov Rams on Male Progeny Performance and Carcass Traits

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Rec date: Oct 27, 2015; **Acc date:** Nov 25, 2015; **Pub date:** Nov 27, 2015

Abstract

The study was conducted to investigate growth performance, nutrient digestibility, carcass quality measures and some serum blood parameters of purebred and crossbred Romanov male lambs (7/8 Romanov:1/8 Argali). For this purpose two groups of sheep were formed, the first consisted of 163 ewes with 2 rams of purebred Romanov sheep, while the second consisted of 49 purebred Romanov ewes with one crossbred ram (3/4 Romanov:1/4 Argali). The ewes were mated with the rams from the same group. Newly born lamb survivability and live body weight were estimated just after lambing. The lambs kept in the experiment till the age of 4 months (weaning age) then ten male lambs from each group were selected and kept under the same feeding and housing condition till the age of 8 months. The lamb keeping index, growth performance, nutrient digestibility, carcass traits and some serum blood parameters were determined for each lamb group.

The results of the study revealed that, the crossbred Romanov male lambs (7/8 Romanov:1/8 Argali) had 4.80 kg more in their body weight as well as 19 g of average daily gain by the age of 8 months. Crossbred lambs had 2.8 kg more in their hot carcass weight over the purebred ones. Crossbred Romanov lambs had higher lamb keeping index, growth performance and nutrient digestibility than purebred ones. Also, they have a better metabolic blood profile.

Keywords: Argali; Romanov; Crossbreeding; Growth performance; Carcass traits; Serum blood parameters

Introduction

Sheep breeding is one of important subjects dealing with sheep production in Russia. The main aim of all breeding programs directed to construct good profitable sheep herds which considered as an important sector of agriculture providing the population with food and essential raw materials necessary for many branches of industry in cold Russia.

Romanov sheep is one of the most important profitable sheep breed originating from Russia. This sheep breed is genetically unique that it carries pure genes and it not originates from any crosses. Romanov characterized by high productive and reproductive performance with high lamb crops, as a Romanov ewe can produce seven live and healthy lambs in a litter. Romanov get mature by the age of 3 month and reproduce overall the year by the rate of three times every 2 years (lambing every 8 months) [1]. However, all of these properties of Romanov sheep, this sheep can't meet the requirements of either breeders or customers. Romanov lambs suffered from poor growth performance and dressing percentages [1], high susceptibility to viral diseases and low natural immune resistance [2,3]. For this needs Romanov sheep needs a crossing strategies to overcome such problems. Many crossbreeding strategies were investigated to overcome the poor growth performance of Romanov lambs [4].

The Argali Sheep (Ovisammon) is one of the largest species of wild sheep in the world. This sheep breed spreads in Mongolia, Altay Mountains, Hangay Mountains, and Gobi Desert [5], however this breed number decreased due to poaching and habitat destruction [6,7]. Argali are highly variable in their body size, as their body size decreased from west to east area of the middle Asia [8]. The purpose of the concurrent work was to investigate the difference of the lamb survivability, growth performance, nutrient digestibility, carcass quality and some blood parameters between crossbred (7/8 Romanov: 1/8 Argali) and purebred Romanov male lambs. These lambs were obtained via crossing of the purebred Romanov ewes with either purebred or crossbred Romanov Argali ram (3/4 Romanov: 1/4 Argali).

Materials and Methods

The study was conducted in All-Union Scientific Research Institute of Animals (VIZH), Moscow, Russia. The experiment was conduct within the period from January 2014 to January 2015. Two hundred and twelve yearling purebred Romanov ewes, two purebred Romanov rams and one crossbred Romanov ram (3/4 Romanov: 1/4 Argali) were used in the study. The crossbred Romanov ram was selected from a number of 10 crossbred rams according to high live body weight and wool characters. The female animals were allotted into two groups, the first group formed of 163 ewes and 2 rams of purebred Romanov sheep, while the second one consisted of 49 purebred Romanov ewes with one crossbred ram (3/4 Romanov:1/4 Argali). The ewes were

mated with the rams from the same group. All the animals were kept under the ideal standards of sheep keeping.

The Romanov ewes were mated in January 2014 and lambed in June 2014. The newly born lamb survivability and live body weight were estimated just after birth. Either purebred or crossbred lambs (7/8 Romanov: 1/8 Argali) were weaned by the age of 4 months then they directed to growing stage. Lamb keeping Index was measured to each group at age of 4 month according to the following equation:-

Lamb keeping Index=(number of weaned lambs/number of borne lambs)*100

Just after weaning 10 male lambs were selected from each group. Both purebred and crossbred Romanov male lambs were selected to be within the same age (4 months ± 5 days) and body weight (19.54 ± 0.39). Lambs were identified via plastic ear tag and housed in two separated and well ventilated pens bedded with wood shavings within the same house. The floor space allowance was kept at 6 x 15 meter/20 lambs. The lamb growing stage was divided into two main periods the first period was 4-6 months while the second one was 6-8 months. The growing male lambs were received the same feeding ration in the two groups. The starting of the feeding of the ration was at the 3rd month of life. The ration was consisted of two main components, the first one was green fodders (silage) and the second was concentrates with free access to hay and fresh water. The concentrated component consisted of barley, oats and wheat as protein feed as well as feed mineral salt 1% and mineral premix 1%, as dispenser and mineral additives. Two random samples of ration were analyzed in the Laboratory of Breeding and Nutrition Department of (VIZH) for estimation of crude protein, fat, fiber and aflatoxin level (Table 1).

Parameter	Group			
	Romanov	Crossbred (R × A)	Romanov	Crossbred (R × A)
	4-6		6-8	
Green fodders, kg /head/day	1.76	1.91	2.32	2.54
Concentrates, g /head/day	490	490	600	600
The diet contained, DM basis				
dry matter, kg	1.24	1.37	1.47	1.63
Metabolizable energy, MJ	12.01	13.79	14.92	16.23
crude protein, g	204	231	256	279
Digestible CP, g	134	161	168	194
Crude fat, g	39	44	49	53
Crude fiber, g	211	278	261	304
nitrogen-free extract, g	593	695	734	807
Calcium, g	11.58	13.25	14.72	16.20
Phosphorus, g	6.19	6.60	7.66	8.01
Carotene, mg	79	87	104	115

Table 1: Ration of lambs from 4 to 8 months of age (on the base of actual feed intake).

Blood samples were collected at two hours post feeding by jugular vein puncture at age of 7 months to determine the serum biochemical parameters. Bimonthly body weight started from the age of 4 months was determined. The average daily gain (ADG) and the daily feed intake were calculated twice within the two different stages of growing period. Average daily gain (ADG) was calculated as the difference between two successive weights divided by the day's period. Daily feed intake and feed residues throughout the first and second periods of growth estimated as dry matter and metabolize energy.

Chemical analysis of feed was done for estimation of digestibility coefficients, as moisture, total nitrogen, crude fiber, crude fat, crude protein, ash, calcium, phosphorus and sulfur were detected in the ration. The digestibility of nutritive substances were determined by conducting a metabolism trails (balancing experiment) at the age of seven months using 3 animals from each group according to the method of Tommy [8].

Measuring carcass characteristics were determined by choosing three lambs from each group randomly for control slaughtering at the age of 8 months according to the method of Benjamin et al., [9]. The animals were slaughtered after 18-hour fasting. Carcasses were weighed and chilled for 20 hours at 5°C then weighed again.

Statistical analysis

The obtained data were analyzed by using SAS software [10] by applying analysis of Student's T test of independent samples. The data were significant at ($P<0.05$).

Results

Lamb survivability

Concerning to the lamb survivability results Table 2, it was clear that in the first group (Purebred Romanov lambs) 389 lambs were born from 163 purebred Romanov ewes while in the second group (crossbred Romanov lambs of 7/8 Romanov: 1/8 Argali) 139 live lamb born from 49 breeding ewes. The lamb survivability at the weaning age expressed as the lamb keeping index. The lamb keeping index showed difference among the different lamb groups, as the first group had low lamb keeping index (88.03%) compared with the second one (100%).

Parameter	Group	
	Romanov	Crossbred (R × A)
No. of dams	163	49
No. of born lambs	389	139
No. of weaned lambs	376	139
Lamb Keeping Index, (%)	88.03	100

Table 2: Purebred and crossbred Romanov lamb survivability.

The life body weight of lambs at the weaning age (age of four months) possessed no significant difference among different lamb groups Table 3. As, in the first group 376 purebred lambs were weaned with an average live body weight of 19.20 ± 0.32 of kg, while in the second group it was 139 of heads with average live body weight of 19.87 ± 0.46 kg. Later on the body weight of the second crossbred group differed significantly from the first purebred group at the age of 6 and 8 months, as the second group had higher body weight at the age of 6 and 8 months (34.47; 45.24, respectively) compared with the first group (31.07; 40.73, respectively) at (P<0.05).

Parameter		Group	
		Romanov	Crossbred (R × A)
		Mean ± SE	Mean ± SE
Body weight, kg	4 mon.	19.20 ± 0.25	19.87 ± 0.24
	6 mon.	31.07 ± 0.68	34.47 ± 0.89*
	8 mon.	40.73 ± 0.85	45.24 ± 0.83*
Body weight gain, Kg	4 – 6 mon.	11.87 ± 0.6	14.60 ± 0.7*
	6 –8 mon.	9.66 ± 0.8	10.77 ± 0.3
Average daily gain, g	4 – 6 mon.	198 ± 9.8	243 ± 11.7*
	6 –8 mon.	161 ± 13.9	180 ± 5.1

Table 3: Body weight (kg) and average daily gain (g) of lambs from 4 to 8 months of ages. Means within the same raw marked with star (*) are significantly differed at (P ≤ 0.05).

Growth performance

Table 3 indicated that, the body weight gain was significantly higher in crossbred (R × A) lambs in the first and the second periods of the experiment (14.6 kg; 10.77 kg) compared with purebred Romanov lambs (11.87 kg; 9.66 kg, respectively) at (P<0.05). the same trend appeared in the average daily gain results, as the lambs in the second group increased significantly the average daily gain in both first and second periods of the experiment (243 g; 180 g, respectively) than the first group ones (198 g; 161 g, respectively) at (P<0.05). Throughout the entire period of the experiment the purebred Romanov lambs gained 21.53 kg, vs. 25.37 kg for crossbred lambs (R × A).

The results of average daily gain differences in the first period of the experiment recorded 45 g or 22.7%, while in the 2nd period of experiment 19 g or 11.8%. Within entire period of experiment the difference in the average daily gain represented 32 g or 17.9 % at (P<0.01). The crossbred male lambs were 4.80 kg heavier and gained daily 19 g more at the age of 8 months.

Nutrient digestibility

From Table 4, it was clearly that the digestibility of nutrients were generally higher in crossbred lambs (R × A) compared with purebred Romanov ones in moisture, total nitrogen, crude fiber, crude fat, crude protein, ash, calcium, phosphorus and sulfur. On the other hand, the balancing experiment for studying digestibility of the nutrients showed that digestibility of all nutrients of rations in crossbred lambs (R × A) exceeded than the purebred ones. The digestibility of the organic matter possessed significant differences among either purebred or crossbred lamb groups. The second crossbred group sustained significantly higher dry matter, crud protein, and crud fiber (71.43%; 69.60%; 55.73%, respectively) compared with purebred first group (68.37%; 65.67 %; 51.40%, respectively) at (P ≤ 0.05).

Parameter	Group	
	Romanov	Crossbred (R × A)
	Mean ± SE	Mean ± SE
DM	66.60 ± 0.53	68.57 ± 0.58
OM	68.37 ± 0.56	71.43 ± 0.56*
CP	65.67 ± 0.77	69.60 ± 0.46*
EE	67.30 ± 0.55	69.20 ± 0.97
CF	51.40 ± 0.53	55.73 ± 0.55*
NFE	71.90 ± 0.68	72.53 ± 0.41

Table 4: Digestibility coefficients of nutrients composing ration of lambs. Means within the same raw marked with star (*) are significantly differed at (P ≤ 0.05).

Carcass quality

Regarding to the measures of controlled slaughtering and carcass deboning Table 5, it was proofed that the crossbred lambs (R × A) had significantly higher parameters of controlled slaughter and deboned carcass than purebred ones. Pre-slaughter weight, hot carcass weight (doubles), slaughter weight and cold carcass weight revealed significant differences (P ≤ 0.05) between the two groups, while visceral mass fat and carcass fat mass possessed no significant differences.

Crossbred Romanov lambs increased significantly the pre-slaughter weight, hot carcass weight, slaughter weight and cold carcass (43.97; 20.97; 21.68; 20.37, respectively) than the purebred ones (39. 27; 18.17;

18.70; 17.43, respectively) at (P<0.05). Moreover, the weight loss in the mass of carcass during the cooling period was significantly higher in the first purebred group (0.74 kg) than the second one (0.6 kg) at (P<0.05). Dressing percentage based on the hot carcass weight, show no significant differences between crossbred (R × A) and purebred Romanov lambs.

Parameter	Group	
	Romanov	Crossbred (R × A)
	Mean ± SE	Mean ± SE
Pre-slaughter weight, kg	39. 27 ± 0.67	43.97 ± 0.62*
Hotcarcass weight, kg	18.17 ± 0.6	20.97± 0.12*
Visceral fat mass, kg	0.53 ± 0.04	0.72 ± 0.04
Slaughter weight, kg	18.70 ± 0.64	21.68 ± 0.13*
Dressing percent, %	47.60 ± 0.86	49.33 ± 0.69
Cold carcass wt, kg	17.43 ± 0.62	20.37 ± 0.18*
Longissimus muscle, kg	0.846 ± 0.01	1.014 ±0.2
Mass of flesh-meat, kg	11.41 ± 0.23	13.12 ± 0.15
Carcass fat mass, kg	1.53 ± 0.15	2.40 ± 0.15
Carcass bone mass, kg	3.91 ± 0.11	4.16 ± 0.04
Ratio of other tissues, kg	0.307 ± 0.3	0.273 ± 0.2
Bone/ carcass ratio	22.43	20.42
Flesh/ bone ratio	3.30 ± 0.06	3.73 ± 0.03

Table 5: Controlled slaughtering and carcasses deboning parameters. Means within the same raw marked with star (*) are significantly differed at (P ≤ 0.05).

The meatiness and the fatness are important factors govern the carcass value. The carcass of crossbred lambs (R × A) contains 15% more muscle tissue and 57% intramuscular fat, however bone contents were the same in carcasses of either purebred and crossbred Romanov lambs. The hot carcass weight of crossbred lambs was more than purebred ones by 2.8 kg. As a result, the coefficient of meatiness (ratio of flesh to bone) was more by 13%.

Serum biochemical parameters

The blood serum parameters possessed significant differences between purebred and crossbred Romanov (R × A) lambs Table 6. The results of total protein increased significantly the serum protein level in the crossbred lambs (74.9) than the purebred lambs (61.2) at (P<0.05). The opposite trend appeared in the serum urea level, as it was decreased significantly in the blood of the crossbred lambs (3.07 Mmol/L) than the purebred ones (4.86 Mmol/L). The decrease of the serum urea level in the crossbred Romanov lambs reached to 1.79 Mmol/L or by the rate of 36.8% compared with the purebred Romanov lambs. Moreover, the serum glucose level increased significantly in crossbred lambs (5.24 Mmol/L) than the purebred ones (3.54 Mmol/L) at (P<0.05). Furthermore, the level of the serum glucose in crossbred lambs was significantly more than Romanov lambs by about (1.7 Mmol/L).

Parameter	Group	
	Romanov	Crossbred (R × A)
	Mean ± SE	Mean ± SE
Total protein, g/L	61.2 ± 2.12	74.9 ± 3.03*
Albumin, g/L	34.4 ± 1.3	41.4 ± 1.7
Urea, mmol/L	4.86 ± 0.2	3.07 ± 0.4*
AST, µ/L	114.4 ± 13.6	120.0 ± 19.6
ALT, µ/L	32.25 ± 4.57	39.67 ± 5.47
Alkaline phosphatase, µ/L	256 ± 27.8	297 ± 44.7
Glucose, mmol/L	3.54 ± 0.27	5.24 ± 0.32*

Table 6: Serum biochemical parameters of lambs at age 7 months. Means within the same raw marked with star (*) are significantly differed at (P ≤ 0.05).

Regarding to the concentrations of aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase were slightly increased in the crossbred lambs than purebred ones; however this increase did not reach to the significant level.

Discussion

Sheep breeding is an important business dealing with better returns in near future, thus explained with the high demands of the sheep products in domestic and international markets. Poor growth performance of the growing purebred lambs considered as the major matter facing purebred sheep expansion in Russia federation especially for Romanov breed. The poor growth performance of Romanov lambs was handled in this paper trying to overcome such problems via crossing the purebred Romanov ewes with crossbred Romanov* Argali ram. The results of this cross were indicated improvement of the lamb survivability, growth performance, nutrient digestibility, carcass traits and serum blood parameters.

Lamb survivability

The outgoing results of the lamb survivability may indicate the high lamb survivability in the crossbred lamb group than purebred ones. As, the high lamb keeping index in the second group give indirectly indication about the increase of the nature immune resistance and viability of the lambs of the second group. These results were in agreement of those of Zapasnikiene et al., [1] as they reported that the crossbreeding of Romanov with Wiltshire Horn ram increased the lamb survivability with no lambing complications.

Growth performance

There was no difference between the purebred and crossbred lambs in the weaning body weight, thus may be due to growth performance was the same in this early stage of life. The improvement of the growth performance of the crossbred Romanov lambs could be due to the desirable crossbreeding effects such as heterosis (hybrid vigor) and breed complementarity. The foregoing results go in parallel with those of Momani et al. [11] Abdullah et al. [12], as they reported that the growth performance parameters (body weight, average daily gain and relative growth rate) are significantly differ among different sheep

genotypes. In contrast, Gökdal et al. [13] reported that there were no significant difference in the growth performance between Ile de France x Akkaraman cross and Karakas sheep genotype raised in Turkey rural farms (Figure).

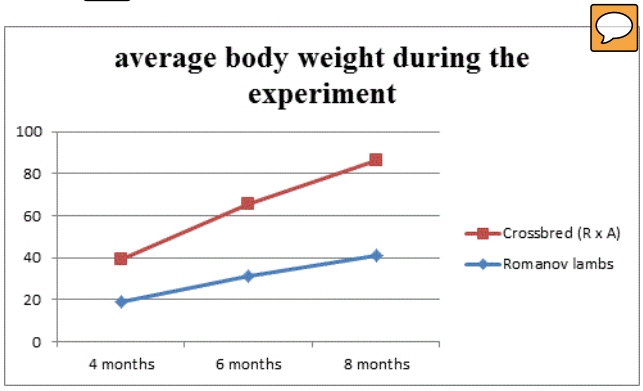

Figure 1: Average body weights during the experiment.

Nutrients digestibility

Digestibility coefficients of nutrients is an important measure govern the growth performance, as it can calculate the apparent quantities of the absorbed nutrients from the food within the gut [14]. The crossbred lambs had high nutrient digestibility with high digestibility coefficient. The obtained results are parallel to those of Wildeus et al. [15] who founded breed differences between three hair sheep breeds (Barbados Blackbelly, Katahdin, and St. Croix) in digestibility and absorption of nutrients especially nitrogen.

Carcass Quality

Carcass traits are some of the most important characteristics that affected with the lamb genotype. The foregoing results proofed that the crossbred Romanov lambs had superior carcass quality measure than purebred Romanov ones. The results could be due to the effect of crossbreeding upon the meat production of the lambs. Crossbreeding improved slaughter and carcass traits via reducing the body fat in the fatty tailed sheep breeds [16].

Serum biochemical parameters

The results of the serum blood parameters in the study were within the normal physiological range. The level of decrease of the serum urea level in crossbred lambs may be indicated more efficient use of nitrogen of feed in those animals than others. Moreover, the high level of glucose together with low level of urea in the serum of the crossbred lambs may be indicated the efficient metabolism of those animals than the purebred ones. The serum glucose results agreed with those of El-Barody et al. and Fathala et al., [17-19], as they recorded a significant difference among purebred Romanov and purebred Romanov X crossbred Romanov [20] cross in the blood glucose level.

Generally the other serum parameters possessed no significant difference between the two groups. These results agreed with El-Ashry et al., Fathala et al. and Saleh et al. [18,21-23] who reported that there were no significant differences among different sheep genotypes in the serum biochemical blood parameters except for AST, ALT and glucose levels.

Conclusion

Crossing of the purebred Romanov ewes with Crossbred Romanov rams (3/4 R X ¼ A) had positive influences on growth performance and muscularity of the newborn lambs (7/8 R: 1/8 A). As, the newborn crossbred male lambs had high lamb keeping index, growth performance, nutrient digestibility and metabolic blood profile. The crossbred male lambs were 4.80 kg heavier and gained daily 19 g more at the age of 8 months. Also, their hot carcass weight was more than purebred ones by 2.8 kg.

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