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Effects of Gender and Dietary Ionophores on Growth Performance and Carcass Characteristics in Moghani Lambs

Research Article

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ABSTRACT

An experiment was carried to evaluate the effects of gender and two dietary ionophores on growth performance and slaughter characteristics in Moghani sheep. A total of 30 Moghani lambs (15 males and 15 females) were distributed randomly into 30 individual cages. Each gender group consisted of 5 animals and fed with a basal diet with no supplement, the same basal diet plus 25 mg/kg monensin (MON) or 25 mg/kg lasalocid (LAS). The lambs were weighed and slaughtered after a feeding period of 134 days and carcass parameters were determined. Average slaughter weight (SW) was significantly influenced by gender (48.9 kg for females *vs.* 51.4 kg for males) ($P<0.01$) but not by diet type. Neither gender nor ionophore supplementations affect average daily gain (ADG) ($P>0.05$). Lambs fed MON had the lowest feed intake (FI) and feed conversion ratio (FCR) which significantly differed from those of the lambs fed the other two diets. Females had a significantly higher average internal fat compared with their male counterparts ($P<0.01$). In regard to fat-tail weight, significant decreasing was observed in ionophore groups as compared to control group ($P<0.05$). Males exhibited higher growth performance with heavier offals and carcass cuts including valuable cuts than in females. Dietary MON could be used as a potent feed additive improving feed efficiency and reducing internal fat and offals proportions in Moghani lambs.

KEY WORDS carcass characteristics, fat-tail, growth performance, internal fat, Moghani sheep.

INTRODUCTION

The aim of the sheep production is to get slaughter lambs in a short time with maximum amount of lean meat, minimum bone and an amount of fat which is desired by the market (Massae and Mtenga, 1986). The quantity and quality of fat are important to consumers, who are more and more interested in healthy products and usually prefer lean meat and carcasses. As a result, a primary objective in many countries is the reduction of fat in order to improve the efficiency of commercial lamb production and prevent the demise of the sheep industry (Sanudo *et al.* 2000). Nutrition (Fluharty *et al.* 1999), gender (Zgur *et al.* 2003) and genetic (Zamiri and Izadifard, 1997) are main factors influencing the lean: fat ratio in lambs. Ruminal microbial fermentation is a determining stage to manipulate body fat deposition pattern. Acetate produced in rumen is the main precursor of the acetyl units to lipogenesis in subcutaneous fat and conversely glucose, whose precursor is propionate, provides 50 to 75% of the acetyl units in the intramuscular depot. Thus, an enhanced propionate: acetate ratio may be fruitful in altering fat deposition in lambs (Smith and Crouse, 1984). This may be achieved using ionophores which are believed to increase propionate production (Callaway *et al.* 2003). Ionophores are commonly used in ruminants to improve feed efficiency. They specifically target the ruminal bacte-

rial population and alter the microbial ecology of the intestinal microbial consortium, resulting in increased carbon and nitrogen retention by the animal, increasing production efficiency (Callaway *et al.* 2003). The controversy has across with ruminant carcass and slaughter parameters may be changed by dietary ionophore administration (Gibb *et al.* 2001) and unable to modifying carcass traits in the majority of associated literatures (Fluharty *et al.* 1999; Potter *et al.* 1976a). In addition, growth rate and pattern (Bures and Barton, 2012; Carrillo and Segura, 1993; Yilmaz *et al.* 2007; Kuchtik and Dobes, 2006) and carcass characteristics (Dransfield *et al.* 1990; Vergara *et al.* 1999) have been shown to be influenced by several factors including gender. The present trail aimed to evaluate the effect of gender and supplemental ionophores on growth performance and carcass characteristics in Moghani lambs.

MATERIALS AND METHODS

This experiment was carried out at the animal research station, College of Agriculture, University of Tabriz, Iran. Thirty heads of 140 ± 5 days old Moghani lambs (15 males with initial BW averaged 27.73 kg and 15 females with initial BW averaged 27.27 kg) were randomly allocated in individual cages. Each gender was divided into three groups with 5 replications. A control group (CONT) was fed with the basal diet containing alfalfa dry (38.27%), soybean meal (12.76%), corn (20.92%), barley (27.55%) and vitamin and mineral supplements (0.5 %); the others two were fed the same basal diet plus 25 mg/kg of supplemental monensin (MON) or lasalocid (LAS). Individual body weights and residual un-consumed feed weights were determined at the end of the experiment. Feed intake was calculated individually by subtraction of weight of feed supply (kg DM) and the residual. The lambs were slaughtered after feeding 134 days to evaluate slaughter characteristics. Head, skin, feet and offals were removed and weighed. The carcasses were weighed after remove head, skin, feet and offals and chilled at 4 ˚C for 24 h and then were taken to split longitudinally into two cuts. The left sides of carcasses were cut into six pieces and fat-tail was weighed separately, as described by Atefi *et al*. (2012). Data produced were analyzed using the GLM procedure of SAS 9.1 (SAS, 2002) as a completely randomized design. The means were compared by the Duncan's multiple range test ($P<0.05$).

RESULTS AND DISCUSSION

The effects of dietary treatments and gender on growth performance are summarized in Table 1. Males were heavier than females at slaughter time ($P<0.05$). Dietary treatments failed to produce a pronounced change in slaughter weight ($P>0.05$).

Statistical analysis of average body weight gross data indicated that the tested animals gained independent of gender and diet type. The MON group grown on the diet supplemented with monensin had less feed intake and feed to gain ratio than LAS (lasalocid) and control groups ($P<0.05$). However, these two traits were not influenced by gender. In case of the carcass evaluation shown in Table 2, the males exhibited lower empty body weights and higher hot carcass weights when compared with females. The ratio of highest fat-tail weight and fat-tail weight to hot carcass weight were recorded in male lambs while female lambs reserved more internal fat, and consequently had a higher internal fat weight: hot carcass weight ratio.

Empty body weight of MON lambs was lower than control ($P<0.05$). They also had the lowest hot and cold carcass weights, but there were no significant differences between this group and control. Animals given ionophores had reduced fat-tail weights and fat-tail weight: hot carcass weight ratios compared with unsupplemented controls ($P<0.05$). Adding 25 mg/kg of LAS to Moghani lambs diet stimulated fat deposition in central parts of the body and caused the largest internal fat proportion significantly different from MON and CON treatments ($P<0.05$). There were no interactions between gender and diet type on the evaluated traits (data not shown).

In present study, the body weight of male lambs were more than female lambs. This was in agreement with findings previously reported by Carrillo and Segura (1993) and Kuchtik and Dobes (2006). Kuchtik and Dobes (2006), also reported that ram lambs gained more than ewe lambs during the same period, although this superiority was not statistically significant. Sex hormones influence the growth pattern of lambs. The fast growth rate of ram lambs can be also attributed to their ability to utilize feed more efficiently (Notter *et al*. 1991).

Lack of responses to ionophores in slaughter weight and average daily gain was in concurrence with Price *et al*. (2009), who evaluated the effect of MON (16.4 mg/kg), LAS (33.0 mg/kg) or salinomycin (17.5 mg/kg) in feedlot finisher diets on the production performance of South African Mutton Merino lambs and detected no effect on final body weight and ADG. In contrast, fattening Arabi lambs fed diets containing 30 mg/kg MOS or 30 mg/kg LAS had more total ADG and final BW compared to lambs fed a control diet with no additive (Heydari *et al*. 2008). The MOS supplementation had no influence on average daily gain and dry matter intake, but tended to increase (4.8%) gain to feed in finishing cattle during period of heat stress (Barreras *et al*. 2013). The average daily gain, daily dry matter intake, feed to gain ratio and subcutaneous fat were not affected by ionophore supplementation in the feedlot hair lambs (Salinas-Chavira *et al*. 2010).

Table 1 The effect of gender and dietary ionophores on growth performance criteria in Moghani lambs

Traits	Gender				Diet*				
	Male	Female	SEM	Prob.	CON	MON	LAS	SEM	Prob.
Initial live weight (kg)	27.73	27.27	0.16	0.86	27.6	27.4	27.5	0.11	0.79
Slaughter weight (kg)	51.44^{a}	48.9^{b}	0.19	0.043	50.3	49	50.2	0.19	0.39
Average daily gain (kg)	0.175	0.161	0.02	0.083	0.169	0.161	0.169	0.019	0.53
Average daily feed intake (kg)	1.11	1.08	0.09	0.54	1.215^{b}	0.947^{a}	1.117^{b}	0.063	0.008
Feed conversion ratio (FCR)	6.33	6.69	0.18	0.32	7.11^{b}	5.85^{a}	6.59^{b}	0.21	0.017

The means within the same row with at least one common letter, do not have significant difference (P>0.05).
CON: basal diet; MON: basal diet + 25 mg/kg monensin and LAS: basal diet + 25 mg/kg lasalocid.
SEM: standard error of the means.

Table 2 The effect of gender and dietary ionophores on slaughter and carcass traits (n=30)

Traits	Diet					Gender			
	CON	MON	LAS	SEM	Prob.	Female	Male	SEM	Prob.
Carcass characteristics(kg)									
Empty body weight	45.4^{a}	43.4^{b}	45.4^{a}	0.32	0.036	45.1^{a}	44.37^{b}	0.219	0.035
Hot carcass weight	26.6^{ab}	25.5^{b}	27.1^{a}	0.86	0.023	25.9^{b}	26.83^{a}	0.94	0.038
Cold carcass weight	26.1^{ab}	25.00^{b}	26.6^{a}	0.92	0.018	25.4	26.35	1.17	0.23
Dressing percent	52.9	51.96	52.8	1.03	0.68	53.00	52.2	1.32	0.64
Carcass half	10.1	10.1	10.2	0.28	0.67	10.1	10.2	0.48	0.86
Offals (kg)									
Feet	0.941	0.928	0.957	0.046	0.43	0.828	1.059	0.073	0.09
Heart	0.159	0.145	0.160	0.011	0.47	0.146	0.165	0.04	0.23
Liver	0.724	0.696	0.728	0.04	0.83	0.624	0.809	0.08	0.31
Kidney	0.121	0.108	0.119	0.008	0.67	0.110	0.123	0.04	0.53
Head	1.93	1.91	2.03	0.14	0.49	1.73^{b}	2.17^{a}	0.23	0.024
Lien	0.141	0.128	0.138	0.026	0.84	0.128	0.145	0.032	0.69
Lung	0.623	0.608	0.624	0.079	0.69	0.596	0.642	0.092	0. 47
∑ Heart, Liver, Lien and Lung	1.65	1.57	1.66	0.17	0.54	1.5	1.76	0.21	0.32
Carcass cuts (kg)									
Neck	0.734	0.747	0.746	0.09	0.24	0.664	0.823	0.12	0.49
Shoulder	1.99	1.92	2.03	0.31	0.41	1.97	1.981	0.26	0.83
Sirloin	2.01	2.13	2.02	0.09	0.32	2.06	2.05	0.25	0.78
Rib	1.38	1.44	1.42	0.11	0.72	1.35	1.50	0.15	0.65
Flank	0.61	0.54	0.63	0.06	0.81	0.63	0.552	0.11	0.57
Leg	3.33	3.38	3.47	0.13	0.42	3.29	3.50	0.16	0.41
Carcass components									
Fat-tail (kg)	5.58^{a}	4.8^{b}	5.12^{b}	0.42	0.033	4.77^{b}	5.57^{a}	0.43	0.013
Skin (kg)	6.01	5.94	6.06	0.37	0.78	5.67	6.32	0.42	0.075
Internal fat (kg)	1.27^{b}	1.25^{b}	1.50^{a}	0.18	0.025	2.00^{a}	0.689^{b}	0.22	0.007
Fat-tail/hot carcass (%)	21.00^{a}	18.9^{b}	18.9^{b}	0.19	0.016	18.4^{b}	20.8^{a}	0.376	0.027
Internal fat/hot carcass (%)	4.77	4.94	5.55	0.11	0.17	7.71^{a}	2.57^{b}	0.29	0.006

The means within the same row with at least one common letter, do not have significant difference (P>0.05).
CON: basal diet; MON: basal diet + 25 mg/kg monensin and LAS: basal diet + 25 mg/kg lasalocid.
SEM: standard error of the means.

The MON fed group displayed significant falls in feed intake and feed conversion ratio. Similar effects of MOS on FI and FCR have been reported in lambs (Heydari *et al.* 2008), sheep (Oliveira *et al.* 2007) and steers (Gibb *et al.* 2001).

Feed intake is decreased in a dose response manner by MOS, while ADG remains intact (Potter *et al.* 1976a; Goodrich *et al.* 1984), resulting in an increase in feed efficiency of 10-17% (Potter *et al.* 1976a; Potter *et al.* 1976b). We found significant gender effects on fat-tail weight, in-

ternal fat weight, fat-tail weight to hot carcass weight and internal fat weight to hot carcass weight ratios in Moghani lambs (Table 2). These findings are in agreement with those reported by Rodriguez *et al*. (2008a), who indicated that female Assaf milk fed lambs deposited higher carcass and non-carcass fat. According to Negussie *et al*. (2003), female lambs exhibit more internal fat compared to male lambs due to their physiologically higher fat storing nature in the central parts of the body, especially in uterus. Similarly, Woodward and Wheelock (1990) found a higher carcass fat in female lambs for same slaughter weight in same breed and environment. Female poorer ADG and FCR usually associate with a greater fat deposition and with a gain composition that is substantially different from that of males (Rodriguez *et al*. 2011b). However, Bennett *et al*. (1991), reported no significant difference in total fat weight between eunuch ram and ewe lambs. We estimated significantly higher hot carcass weight and lower empty body weight with a numerically less carcass percent in ram lambs. Average dressing percentage, 48% (cold carcass weight/slaughter weight) and 55% (hot carcass weight/empty live weight), was greater in females than males in the work conducted by Pena *et al*. (2005). These findings about carcass cuts and offal are in agreement with those reported by Barreras *et al*. (2013) that ionophores in the diet resulted in relatively minor changes in carcass characteristics in finishing cattle during period of heat stress. These authors recorded higher percentages of "caidos", red offals and white offals were in males, while fat deposits were greater in females. Less empty live weight in males, therefore, may be due to the heavier offals and to thinner subcutaneous fat in males.

Lambs in MON and LAS treated groups produced the lowest and the highest empty body weight, hot carcass weight and cold carcass weight, respectively. These results are in line with data published by Heydari *et al*. (2008), where LAS-fed Arabi lambs tended to have higher hot carcass weight (HCW), cold carcass weight (CCW), dressing percent and boneless meat compared with MON and non-additive control group. Different fat depots are not regulated in coordinated manner which could allow altering one depot without affecting another. Decreased fat-tail weight in MON or LAS fed lambs could primarily be ascribed to modified rumen fermentative events.

Acetate provides 70 to 80% of the acetyl units to lipogenesis in subcutaneous fat and conversely glucose, whose precursor is propionate, provides 50 to 75% of the acetyl units in the intramuscular depot. Thus, manipulating the concentration of acetate and propionate has potential in altering fat deposition in lambs (Smith and Crouse, 1984). On the other hand, ionophores, in particular MOS, are well known to enhance production of the most reduced volatile fatty acids, propionate, resulting in a decrease in the acetate to propionate ratio (Callaway *et al*. 2003), presumably, stimulating intramuscular, but not subcutaneous adipose tissues development.

CONCLUSION

In current study, it indicated that MON fed lambs need less feed per unit of gain. Inophore treatment resulted in lighter fat-tail and reduced body adipose tissue in Moghani lambs, regardless of the ionophore type. As expected, there were profound differences between gender in growth and carcass performance. No interaction of gender and ionophore supplementation under this condition was observed. However, further studies appear to be of necessity to identifying the effects of inophores and gender along with other factors affecting growth and slaughter performance including dam age, diet composition, age of tested animals, production system as well as the duration of feeding program.

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