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Effect of Ionophores Monensin and Lasalocid on Performance and Carcass Characteristics in Fattening Arabi Lambs

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Abstract: This experiment was conducted to investigate the effect of ionophores monensin and lasalocid on performance and carcass characteristics in fattening Arabi lambs. Thirty fattening male lambs with similar conditions (22.14±0.72 kg body weight) were included in this experiment from day 90 until day 150. Three high concentrate diets containing with 30 ppm monensin (M), 30 ppm lasalocid (L) and none additive (Control = C) were offered to lambs in a completely random design. The Body Live Weight (BLW), Average Daily Gain (ADG), Dry Matter Intake (DMI) and Feed Conversion Ratio (FCR) of lambs were measured two weeks interval until eight weeks. Carcass components were recorded at the end of trial. Total ADG and final BLW of fattening lambs fed the diets containing ionophores were significantly higher ($p<0.05$) than lambs fed the control diet. DMI of the lambs fed diet containing monensin were significantly lower ($p<0.05$) than other two groups. The same trend was found for FCR, while the differences was significant ($p<0.05$) only between M and C group lambs. Carcass characteristics was not affected by treatment ($p>0.05$), but lambs fed diet containing lasalocid had greater dressing (%) and boneless meat (%). It is concluded that the performance and carcass characteristics were improved in diets containing ionophores.

Key words: Monensin, lasalocid, carcass characteristics, fattening lambs

Introduction

In some part of world for intensive production of fattening of lambs, they are fed with high amount of concentrate. However this pattern of feeding often affect negatively of rumen fermentation (Mould *et al.*, 1983). For many years, animal nutrition has been interested in improving animal production by manipulating ruminal fermentation by using additives. The efforts have particularly focused on substances that increase fiber digestibility, ruminal propionic acid and saliva output and that reduce ruminal acidosis, bloat incidence, methanogenesis, ruminal proteolysis and domination of dietary protein (Flores Perez, 2004). Additives are substances or preparations which when incorporated in feedstuffs, influence or affect food characteristics and improve animal production (Lyons, 1994). They are administrated in a regular from in small quantities in the diet over long periods. Ionophores are the most anticoccidial agent used in domestic animals (Flores Perez, 2004). Ionophores act by interrupting transmembrane movement and intracellular equilibrium of ions in certain classes of bacteria and protozoa that inhibit the gastrointestinal tract (McGuffey *et al.*, 2001). The ionophore monensin can improve cellulose digestion of diets high in readily available carbohydrate by inhibition the growth of lactate-producing bacteria (Russell and Stroble, 1989). In Ruminants, monensin (obtained from *Streptomyces Cinnamonensis*) has shown selective inhibition of ruminal bacteria, lactic and methane producers and stimulation of propionate production by 25% (Matabudul *et al.*, 2001). In lambs, monensin improves weight gain and Feed Conversion Ratio (FCR) and depressed the Dry Matter Intake (DMI) (Martini *et al.*, 1996), but lasalocid (obtained from *Streptomyces lasaliensis*) improve average daily gain (ADG) without depressed the DMI (Swanson *et al.*, 2000). There is limited information about the effect of ionophores on performance of Iranian fattening lambs and particularly no works was done with Arabi lambs. Therefore, the present study was conducted to investigate the effects of feeding monensin and lasalocid on performance and carcass characteristics of fattening Arabi lambs.

Materials and Methods

Thirty fattening male lambs with similar conditions (22.14±0.72 kg body weight and 90±5 days of age) from a flock of autumn lambing of Arabi sheep of the Ramin Agricultural and Natural Resources University were used in this study. The lambs were divided into three equal groups. Three high concentrate diets (with similar composition) containing with 30 ppm monensin (M), 30ppm lasalocid (L) and none additive (Control = C) were offered to lambs in a completely random design. The diets were formulated according to NRC (1985) and were isonitrogenous (16.7% CP) and isocaleric (2.86 Mcal $kg^{-1}{}_{DM}$ ME) and had similar concentrations of other nutrients. The ingredient composition and analysis of the basal diet are shown in (Table 1).

The diets were offered ad libitum to all groups. The Body Live Weight (BLW), Average Daily Gain (ADG), dry matter intake (DMI) and feed conversion ratio (FCR) of lambs were measured two weeks interval until eight weeks. At

Table 1: Ingredient composition and calculated analysis (Kg/ton) of the basal diets (DM basis)

Ingredient	Diet
Barley	500.00
Corn grain	220.00
Soybean meal	130.00
Wheat bran	50.00
Bagas	40.00
Alfalfa hay	40.00
Supplement (v+m)	10.00
Limestone	5.00
Salt	5.00
Total	1000.00
CP (%)	16.70
ME (Mcal kg^{-1})	2.86

the end of the experiment, three lambs for each treatment (close to the mean pen weight) were fasted for 14-16 h (water was allowed), weighted and slaughtered. After dressing and storing refrigerated for 24 h at 3°C, carcasses were weighted according to Method of standard and industrial research institution of Iran guidelines and sectioned into two symmetric halves. The right half was divided into the cuts: neck+proximal thoracic limb+steaks+brisket, lumbar+abdominal region, proximal pelvic limb and weights of each cut were recorded. The weights of liver, kidney, visceral fat and carcass meat, bone and fat tail percentage were measured separately.

Performance and carcass characteristics of lambs were analyzed as a completely random design using the GLM procedures of SAS® (SAS Institute, 1999) using the model $Y_{ij} = \mu + \tau_j + \varepsilon_{ij}$. Examination of treatment means revealed opposite effects of lasalocid and monensin compared to controls for several variables. In these instances Duncan's test for treatment mean comparison to control at ($p<0.05$) was used. Initial BLW of lambs were used as a covariate for final LW, ADG and FCR.

Results and Discussion

Growth performance: Effect of ionophores on performance fattening lambs (BLW, DMI, ADG and FCR) are shown in Table 2. The results indicated that addition of monensin and lasalocid to the diets rich in cereals affected BLW, DMI, ADG and FCR amounts during fattening and the differences was significant ($p<0.05$). Total ADG (285.8 vs 252.8) and final BLW of fattening lambs fed the diets containing ionophores were significantly higher ($p<0.05$) than lambs fed the control diet. DMI of the lambs fed diet containing monensin were significantly lower ($p<0.05$) than other two groups. These figures for C, M and L lamb groups during whole period of experiment were 1190.8±30.02, 1124.4±27.11 and 1226.8±23.25 g day^{-1}, respectively. Total ADG of these 3 lambs groups were 252.8±11.43, 285.8±7.49 and 285.8±8.52 g day^{-1}, respectively, indicating a lower ADG for C group lambs than other 2 groups ($p<0.05$). FCR were, respectively 4.7±0.19, 3.9±0.13 and 4.3±0.16 for diets C, M and L, which was the same trend with DMI. The results of this experiment are in agreement with the results of Worrell *et al.* (1990), Baraghit (1995), Martini *et al.* (1996) and Swanson *et al.* (2000). The lower DMI and FCR, but greater ADG in lambs fed M compared with C lambs in this experiment are very consistent with the results reported by Martini *et al.* (1996) for lambs fed M. Improving ADG without depressing DMI in lambs fed L in this experiment are also in agreement with the results reported by Swanson *et al.* (2000) for lambs fed L. The lower DMI and improved FCR associated with greater ADG in ionophores group lambs, particularly in M fed lambs may caused by better rumen fermentation and energy utilization. Anaerobic fermentation in the rumen derives energy from substrate oxidation by the transfer of electrons (and hydrogen) to acceptors other than oxygen. The reduced compounds formed are mainly volatile fatty acid and methane. Fermentation balance requires that an increase in propionate production must be accompanied by a decrease in methane production (Surber and Bowman, 1998). Up to 12% of the gross energy of feeds can be lost as eructated methane. Diverting hydrogen to other end products captures more digestible energy from fermented OM, resulting in more efficient use of feed energy. It also lessens the contribution of cattle to atmospheric methane accumulation (McGuffey *al.*, 2001). Similarly as (Raun, 1990) explained feed conversion (feed to gain ratio) improves when monensin is added to the diet because of a more efficient ruminal fermentation, resulting from an increased proportion of propionate to acetate in the rumen, a concomitant depression in CH_4 production and an inhibition of degradation of dietary protein in the rumen.

Approximately, similar trend of responses to M or L as lambs were reported for most experiments done with cattle. In grain-based feedlot diets, feed efficiency has been improved by reducing Dry Matter Intake (DMI) with little or no effect on Average Daily Gain (ADG) (Tedeschi *et al.*, 2003). Monensin increased ADG by 1.6 to 1.8%, decreased DMI by 4 to 6.4% and improved feed conversion by 5.6 to 7.5% in growing cattle fed in feedlots. The net effect of monensin was to maintain animal performance while reducing feed intake (Raun, 1990). In a direct comparison of monensin and lasalocid efficacy, 744 heifers were assigned to 24 week treatments by light (740 lb) or heavy (886 lb) BW. Treatments were either 200 mg day^{-1} of lasalocid or monensin. Dry matter intakes were not different and averaged 17.2 lb day^{-1} for all heifers on both treatments. Average daily gain was greater for heifers fed monensin versus lasalocid (1.63 lb vs 1.44 lb) and since dry matter intake was not different by treatment, feed efficiency was increased by approximately 14% in heifers fed monensin (McGuffey *et al.*, 1997). Lana *et al.* (1997)

Table 2: Effect of feeding monensin and lasalocid on the performance fattening Arabi lambs

Item	C	M	L
Lambs (n)	10	10	10
BLW (kg)			
Initial	22.36±0.592[a]	21.95±0.638[a]	22.12±0.927[a]
Final	37.53±0.789[b]	39.10±0.885[a]	39.27±0.647[a]
DMI (g day^{-1})			
1-30 days	1107.60±30.05[b]	1061.90±20.10[c]	1163.15±23.09[a]
31-60 days	1274.00±30.39[a]	1186.80±37.39[b]	1290.40±25.79[a]
Total	1190.80±30.02[a]	1124.35±27.11[b]	1226.78±23.25[a]
ADG (g day^{-1})			
1-30 days	269.41±11.86[b]	281.18±17.25[ab]	317.94±7.56[a]
31-60 days	214.64±19.96[b]	271.07±13.38[a]	226.43±12.61[b]
Total	252.83±11.43[b]	285.83±7.49[a]	285.83±8.53[a]
FCR			
1-30 days	4.17±0.198[a]	3.96±0.347[a]	3.68±0.12[a]
31-60 days	6.48±0.717[a]	4.45±0.199[b]	5.87±0.36[a]
Total	4.77±0.192[a]	3.96±0.133[b]	4.33±0.159[ab]

[(a-c)]: Means in row with different superscripts different significantly (p<0.05)

Table 3: Effect of feeding monensin and lasalocid on the carcass characteristics fattening Arabi lambs

Traits	C	M	L
Preslaughter weight (kg)	38.70±0.433[a]	38.50±0.750[a]	38.80±0.472[a]
Hot carcass weight (kg)	20.10±0.358[a]	20.00±0.669[a]	21.40±0.989[a]
Cold carcass weight (kg)	19.50±0.474[a]	19.60±0.674[a]	20.60±1.00[a]
Dressing (%)	51.97±1.49[a]	52.02±0.807[a]	55.01±1.89[a]
Boneless meat (%)	50.15±3.11[a]	50.58±2.31[a]	52.14±2.19[a]
Carcass bone (%)	21.16±0.78[a]	21.37±1.62[a]	21.73±1.13[a]
Carcass fat (%)	28.34±3.93[a]	27.95±2.08[a]	25.65±3.08[a]

[(a-b)]: Means in row with different superscripts different significantly (p<0.05)

observed that most of the effect of monensin appears to be modulating intake with affecting performance thus increasing feed efficiency. Lasalocid do not appear to affect intake as dramatically and demonstrate increased growth performance. Based on the observed results of ionophores on dry matter intake and feed efficiency Fox and Black (1984) developed adjustment factors for use of ionophores in growing cattle. These adjustments are now found in the (NRC, 1996) Beef and indicate that with the addition of ionophores to the diet that dry matter intakes will be reduced by 6% and the net energy for maintenance will be increased by 12%. However, not all ionophores have demonstrated consistent effects on intake (NRC, 1996).

Carcass traits: The results obtained for carcass characteristics are presented in Table 3. The results of this study indicated that some of the carcass yield traits were affected by feeding diets with increasing ionophores (lasalocid especially), but differences between them weren't significant (p>0.05). Carcass traits was not affected by treatments, but lambs fed diet containing lasalocid had greater dressing % and boneless meat %. These finding are in agreement with those obtained by Fluharty *et al*. (1999) and Gilka *et al*. (2003). Baraghit (1995) reported that the addition of lasalocid tended to slightly increased in carcass (%), dressing (%), boneless meat (%) and while bone (%) was decreased. Smith and Crouse (1984) suggest that different fat depots are not regulated in a coordinated manner which could allow for altering one depot without affecting another. They showed that acetate provides 70 to 80% of the acetyl units to lipogenesis in subcutaneous fat and conversely glucose, whose precursor is propionate, was shown to provide 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 and hence influence the value of the final product. Ionophores have been proven to alter fatty acid concentrations in the rumen. Murphy *et al*. (2003) reported that ionophore supplementation significantly (p<0.05) reduced carcass back fat depth and dressing percent and had no effect (p>0.05) on the other carcass traits. They concluded that, the decrease in dressing percent may partially be due to the decrease in back fat depth.

Conclusion

These results are shown that by using both ionophore (M and L) as an additive can improve lamb growth rate. Within the experimental lamb groups, lambs fed diet (M) had lower DMI and better economic efficiency. An improvement in feed conversion results in less feed resources being used for the same meat and milk production. These benefits have a direct effect on protecting the environment due to decreased feed usage and reduced manure excretion (less intake and higher digestibility). Thus, it is recommended that, using ionophores (particularly M) as an additive would be useful for fattening lambs.

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