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Effect of terbutaline and metaproterenol (two beta-adrenergic agonists) on performance and carcass composition of culled Moghani ewes

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Abstract

The effects of terbutaline (T), metaproterenol (M) and low energy diet (LE) on growth performance and carcass composition were evaluated in 72 Moghani culled ewes. Terbutaline and metaproterenol, each one at the doses of 0, 5, 10 and 20 mg/kg DM (C, T5, T10, T20, M5, M10 and M20, respectively) were added to the diet (ME: 2.9 Mcal/kg DM) of seven groups of 63 culled ewes and the other group was fed on LE (ME: 2.5 Mcal/kg DM) for the final 8 weeks of the fattening period. M10 and M20 equally increased ($p < 0.05$) total weight gain of ewes. The lowest ($p < 0.05$) amount of dry matter intake was observed in LE treatment. All metaproterenol-treated groups showed improved ($p < 0.05$) of feed efficiency compared with controls. Both the beta-agonists increased ($p < 0.05$) carcass efficiency compared with control. Total carcass crude protein was higher ($p < 0.05$) for ewes receiving the M20. Addition of terbutaline and metaproterenol to the diet had no significant effect on carcass fat and cavity fat weights; nevertheless, ewes treated with T20, M5, M10, M20 and LE had lower ($p < 0.05$) fat-tail weight than controls (3.44, 3.55, 3.54, 3.52 and 2.99 kg versus 4.52 kg). Blood urea concentration was reduced ($p < 0.05$) by LE treatment 12.6 and 23.8% on days 60 and 90, respectively. Results indicated that metaproterenol causes a repartitioning of nutrients resulting in improved feed efficiency, increased carcass meat and lowered weight of-fat tail. Metaproterenol was more effective on feedlot parameters and carcass characteristics than terbutaline and low energy diet.

Keywords: Terbutaline; Metaproterenol; Carcass; Ewes

1. Introduction

Excessive deposition of fat is a major problem of the livestock industry today. The problem of extra fat especially in Iranian fat-tailed breeds of sheep is more prominent. Fattening of culled ewes is a common practice in Iran and since the majority of their gain in fattening period relates to fat, improving the quality of carcasses will be of great benefits to producers and consumers' health.

Phenethanolamine leanness-enhancing repartitioning agents have been studied in livestock species for more than two decades. Some beta-adrenergic agonists have

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been shown to decrease fat deposition and increase muscle accretion in thin-tailed sheep carcass (Baker et al., 1984; Beermann et al., 1986a,b, 1987; Hamby et al., 1986; Kim et al., 1987; Koohmaraie and Shackelford, 1991; Koohmaraie et al., 1996; Li et al., 2000). The results of feeding repartitioning agents include consistently reduced fat accretion accompanied by an increase in muscle mass. Any proposed mechanism must begin with the possibility of direct effects of the agonists on skeletal muscle and adipocyte beta-adrenergic receptors. Beta-adrenergic agonists cause modification of metabolite concentrations and adipocytes (Mersmann, 1998; Beermann, 2002; Mersmann, 2002). Few experiments have been conducted with fully developed animals. So far, no studies have been reported the effects of oral administration of terbutaline and metaproterenol on feedlot parameters and carcass composition of ewes.

This paper describes the effect of metaproterenol and terbutaline, chosen for low price and availability on feedlot parameters and carcass composition, in culled Moghani ewes and also compares their effects with those of a low energy diet.

2. Materials and methods

In this study, 72 nonpregnant culled Moghani ewes, weighing 46.8 ± 5.4 kg and approximately 6–7-year old were used. The experiment was conducted at the Kenebist farm of Astane Ghodse Razavi, which is located in Mashad. Moghani breed is well known as a high fat breed of sheep in Iran and is used for meat and carpet wool production.

Ewes were housed in a well-ventilated closed barn in which they were randomly divided into 24 group pens (three ewes in each pen). A 3-month fattening schedule was arranged; in the first month animals were adapted to the treatment feeds. Then, 63 ewes were administered T and M (0, 5, 10 and 20 mg/kg DM, designated C, T5, T10, T20, M5, M10 and M20, respectively) in a complete diet, in the second and third months of fattening period (nine ewes per treatment group). Other nine ewes were fed LE diet in two latter months of fattening period.

The amount of fresh feeds offered daily at 08:00 h to each pen were adjusted daily to accommodate intake. Residual feeds were collected, weighed and discarded immediately before the next feeding. The feeds ingredients (balanced on the basis of AFRC, 1993) and compositions are presented in Table 1. T and M powder (Iran Hormone Co.) were mixed with premix vitamin and thoroughly mixed with the basal diet. Salt licks and water were freely available. Animals were weighed at 30-day intervals. Feed and water were withdrawn for 12 h before weighing and slaughtering. Individual blood samples were obtained from jugular vein at 0, 1, 3 and 5 h after feeding on days 60 and 90. These sampling times were selected based on previous studies evaluating the effects of beta-adrenergic agonists on blood variables in sheep (Beermann et al., 1987; Galbraith et al., 1997; Kim et al., 1987). Samples were centrifuged at 1500 × *g* for 20 min at 4 °C. Plasma was removed and stored at −20 °C pending analysis for glucose and urea. Beta-agonists were withdrawn from the ration 48 h before slaughter. At the end of fattening period (day 91), four of nine animals of each treatment were randomly slaughtered according to local practices and skinned. All the abdominal and thoracic organs were removed and carcass was prepared. Due to the probability of tissue residues of beta-agonists, kidneys, liver and eyes in beta-agonists treated ewes were discarded. The hot carcasses were weighed immediately after dressing and removal of the offal parts. Weight of cold carcass (after 24 h), cavity fats (cardiac, renal, pelvic and gastrointestinal), meat and fat extracted from hot carcasses for all slaughtered animals were measured (Farid, 1989). By cutting between the 12th and 13th ribs of the back, the cross-section of the longissimus dorsi. muscle (LD) was traced on paper, and then measured by digital planimeter. Fat-tail was removed, weighed and each cold carcass separated into two right and left side. Dissected fat and meat from the right side of carcass were completely minced. Minced meat and fat thoroughly mixed and a sample taken for determination of protein and fat (Association of Official Analytical Chemists, 1975). The following plasma metabolites were quantified using kits from Zistshimi, Diagnostic Products (Tehran, Iran). Plasma glucose and urea concentrations were determined using an enzymatic, colorimetric-GOD-PAP and di-acetyl mono oxium procedures, respectively. Data on glucose and urea collected at each sampling time were analyzed with the MIXED procedure of SAS (1996) for repeated measures. In case of significant difference in main effects, contrasts were evaluated and least square means were separated using the least significant differences. The overall means obtained were least square means and were declared significant at $p < 0.05$. Data related to feedlot and carcass parameters were adjusted by analysis of covariance (Kaps and Lamberson, 2004) using start weight and cold carcass weight as the covariate, respectively. Other data were analyzed using the GLM proce-

Table 1
Composition of diets

Ingredient (%)	Basal (control) diet	Low energy diet
Wheat straw	26	42
Barley	48	33
Wheat bran	11	9
Cottonseed meal	2.5	6
Dried sugar beet pulp	9	7.5
Cottonseed oil	1	–
Limestone	1.5	1.5
Vitamin premix	1	1
Chemical composition		
ME (Mcal/Kg DM)	2.9	2.5
Crude protein (%)	12	12
Crude fiber (%)	16.2	22.3
Ca (%)	1	1
P (%)	0.7	0.6