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Mineral Dietary Supplement effects on Weight Performance and Physical Characteristics of the Components of Grazing Sheep Carcasses

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ABSTRACT: To investigate the effects of mineral dietary supplement (phosphorus, selenium, and copper) on the weight performance and characteristics of grazing sheep carcasses, 20 sheep with an average weight of 50 ±5.8 kg and average age of 3±0.2 years were studied in Margoon rangeland in kohgiloye-va-Booyerahmad Province of Iran in April-June 2010. Having a completely randomized design, the experiment was done on two 10-sheep groups of control (receiving only salt) and treatment (receiving mineral supplement of phosphorus, selenium, and copper plus salt as a complementary base). At the end of the experiment, 3 sheep were selected from each group and their carcasses performance and characteristics were measured. Regarding the carcass analysis, no significant difference was observed between the control and treatment groups. Therefore, mineral dietary supplement had no significant effect on weight performance and carcass characteristics of sheep grazing on Margoon rangeland. According to the results, the most cold carcass weight was 76.06±12.5, the most final weight was 54±6.6, and the highest average daily gain (gr/per day) was 20±0.06 in the treatment group.

Key words mineral supplement, weight performance, carcass characteristics

INTRODUCTION

Kohgiloye-va-Booyerahmad province is one of the most important places of sheep grazing in Iran due to its climate and topography. Sheep breeding is not industrial in this province and is typically rural and nomadic and depends on the rangeland for forage. For livestock grazing, forage is the most important source of energy, protein, vitamins, and minerals. In this province, like many other parts of the country, most of grazing livestock do not get mineral supplements except salt and supply of mineral is exclusively done through the livestock forage intake; However, forage can rarely provide the needed amount of minerals. In Iran, little attention has been paid to the use of mineral supplements in grazing animals and no study has been conducted on the effects of mineral supplements in Kohgiloye-va-Booyerahmad province yet. According to the Kohgiloye-va-Booyerahmad province Veterinary Office reports (2004), some physiological and physical characteristics such as wool loss, weight loss, low efficiency pregnancy, etc. can be related to shortage of selenium, copper, and phosphorus minerals. Therefore, considering the lack of some minerals in Margoon rangeland, using mineral supplements can solve this problem and ultimately increase the efficiency and productivity of livestock breeding in this area. The Margoon area is mountainous with cold climate and most of this area is covered with Astragalus SPP, Festuca arundinacea, and Prangos ferulacea (Naghdipour, 2004).

The aim of the present experiment was to investigate the effects of mineral dietary supplement containing phosphorus, selenium, and copper on weight gain and carcass characteristics of the Margoon area grazing sheep.

LITERATURE REVIEW

Studies in different regions of the world have shown that deficiency of some mineral nutrients, especially phosphorus is evident (MacDowell, 1985). Several reports have been published regarding the mineral deficiency (White, *et al.*, 1992).

Dow and colleagues (1991) examined the effects of copper supplement with different levels of iron on pigs. The result showed that unlike the iron supplement that had no effect on pig's growth rate and daily food intake, the copper supplement significantly increased both of them.

The use of mineral supplements has shown mixed results in most parts of the world. In Australia, an experiment (White, *et al.*, 1992) was done on 96 young male sheep to evaluate the effect of mineral salt licks on their weight gain. The results indicated that during the summer, the average live weight of sheep in the treatment group increased significantly (4.5 kg) compared to the control group. In New Zealand, phosphorus, selenium, and copper minerals were given separately to male Romney sheep as supplements. The results showed that the supplements alone had no significant effect on sheep live weight, carcass weight, and wool quality (Grace, *et al.*, 1990). Ranjbari and colleagues (2001) studied the effects of two mineral supplements on weight and carcass components of lambs grazing on rangeland. They reported that sheep in the treatment group (receiving mineral supplement) gained more weight during the months of experiment compared with sheep in the control group. In Markazi Province of Iran, Talebian and colleagues (2004) reported marginal to severe deficiency of selenium and iodine in the blood of sheep (ewes) in different seasons of the year. Hunter and colleagues (1982) mentioned wide seasonal variations as an influential factor in concentration and intake of some minerals in plants that influence health and reproduction in sheep. Master and colleagues (1996) reported that in areas with seasonal changes, there are significant fluctuations in the amount and availability of minerals in rangeland forage grazed by sheep.

METHODOLOGY

A. Location: This research was conducted at Margoon research station. This region has cold weather and the minimum and maximum annual temperatures are 5 and 35 degrees centigrade. During the experimental period, the temperature ranged from 15 degrees centigrade to 35 degrees centigrade. The station has a total area of 100 hectares.

B. Procedure: To investigate the effects of mineral dietary supplement (phosphorus, selenium, and copper) on the weight performance and characteristics of grazing sheep carcasses, 20 growing sheep with an average weight of 50 ±5.8 kg and average age of 3±0.2 years were bought in early April. The experiment was done on two 10-sheep groups of control (receiving mineral blocks containing only salt without any extra mineral supplement) and treatment (receiving mineral lick blocks containing phosphorus, selenium, and copper plus salt as a complementary base). The experiment started in April and ended in June. Conditions were the same for both groups of sheep. The sheep were grazing on Margoon rangeland from dawn to dusk and then transferred to their place. Then each group received its own mineral blocks and water was freely available to all sheep.

C. Provision of mineral supplement: For preparation of mineral dietary supplement scientific recourses (Ammerman, *et al.*, 1995) were used. As a result, monoammonium phosphate compounds, copper sulfate and sodium selenite were selected to provide the minerals of phosphorus, copper, and selenium. Then using the Excel software, the amount and chemical composition of the supplement were determined. In the mineral blocks, salt was chosen as the base supplement. Using a press machine, the mineral blocks were cut in dimensions of 10*10*10 cm.

D. Weighting method: To study the sheep weight gain, ewes were weighted first, at the beginning of the experiment and then, the weighting process was repeated every months (after 14-16 hours of fasting without food and water) before the sheep daily feeding and at a certain time of a day (7 a.m.) until the end of the experiment.

E. Health care: Every two-week period the ewes place was cleaned up. Before and during the experiment, routine anti-parasitic drugs such as albendazole, rafoxanide, and mebendazole were used to control and eliminate internal parasites.

F. Slaughter and carcasses separation: After the experimental period, with respect to at least 14-16 hours of fasting, 3 ewes of each group with the closest weights to the average weight of their groups were selected and slaughtered. After offal separation, the carcasses were weighted (hot carcass weight) and then, were transferred to a cold storage chamber and weighted again after 24 hours (cold carcass weight).

G. Statistical model: Having a completely randomized design, the experiment was done on two 10-sheep groups of control and treatment.

The statistical model is defined as follows:

$$Y_{ij} = \mu + T_I + e_{ij}$$

Y_{ij} The j-th iteration of the *i* diet

μ The average of the population

T_I The effect of *i* diet (I = 1, 2)

e_{ij} The random error effect of j-th ewe related to the i treatment

The obtained data from average daily gain, percentages of carcasses composition, and carcasses different components weights were analyzed through the SAS software (1996).

The means were compared using Duncan's multiple range test. Data related to the composition percentages and carcasses components (ranging from 0-30% and 70-100% respectively) were first converted to $Arc\sin\sqrt{x}$ and then analyzed (Yazdisamadi, *et al.,* 2002). In the analysis of variance, it is assumed that at the beginning of the experiment, all groups are identical in every respect and in cases where there is a lack of uniformity; the covariance analysis is applied to eliminate the influence of initial differences (Yazdisamadi, *et al.,* 2002). However, as the differences between the groups' initial and cold carcasses weights were not significant in the present study, the analysis of covariance was not applied.

RESULTS

A. Hot and cold carcass weights and cold carcass yield

Based on the results of the Duncan's test, the average weights of hot and cold carcasses and cold carcass yield were higher in the treatment group; however, these differences were not significant. These results were consistent with other studies (Ranjbari, *et al.,* 2001; White, *et al.,* 1992) in which the carcasses yield of lambs and male cattle fed by mineral supplement were higher than the control groups (Table 1).

Table 1: The effect of mineral supplement on carcass weight and yield.

Attributes	Experimental groups	
	Salt + mineral supplement (the treatment group)	Salt (the control group)
Average carcass weight (kg)	38.46±1.3	37.40±5.4
Average cold carcass weight (kg)	37.2±1.22	36.7±5.9
Cold carcass yield (%)	76.06±12.5	66.4±11.7

Table 2: The effect of mineral supplement on carcass bones weight, carcass fat weight, and tail fat weight.

Attribute	Experimental groups	
	Salt + mineral supplement (the treatment group) (gr)	Salt (the control group) (gr)
Carcass bones weight	3909.3±68.03	4230.7±532.02
Carcass fat weight	1849.3±68.03	1801.3±532.02
Tail fat weight	2050.7±661	1590.7±272

Table 3: The effect of mineral supplement on carcass offal weight.

Attribute	Experimental groups	
	Salt + mineral supplement (the treatment group) (gr)	Salt (the control group) (gr)
Liver weight	484±77	582.6±91
Kidneys weight	98±6.4	118.6±8.3
Heart weight	139.3±11.5	192±17

Table 4: The effect of mineral supplement on initial weight, final weight, and average daily gain.

Attribute	Experimental groups	
	Salt + mineral supplement (the treatment group) (kg)	Salt (the control group) (kg)
Initial weight	53.8±5.8	49.8±5.7
Final weight	54±6.6	51.6±5.4
Average daily weight gain (gr/per day)	20±0.06	1.8±0.09

B. Carcass bones weight, carcass fat weight, tail fat weight

Based on the results, the use of mineral dietary supplement had no significant effect on carcass bones weight, carcass fat weight, and tail fat weight of the sheep; but, carcass fat weight and tail fat weight were both higher in the treatment group while carcass bones weight was less in the mentioned group (Table 2).

C. Carcass offal weight

According to the results obtained from the Duncan's test, addition of mineral supplement did not affect carcass offal weight significantly. However, liver weight, kidneys weight, and heart weight were higher in the control group compared with the treatment group (Table 3).

D. Live weight, final weight, and daily gain

According to the results obtained from the Duncan's test, addition of mineral supplement did not affect sheep live weight, final weight, and average daily gain significantly. However, live weight, final weight, and average daily gain were higher in the treatment group compared with the control group (Table 4). The results presented in Table (4) indicate that the differences in initial and final weights between the two groups were not statistically significant. Statistical analysis showed that the initial weight had no effect on daily gain; therefore, correction of the initial weight was not required in the current experiment. Moreover, regarding the average daily weight gain, no significant difference was observed in the course of the experiment. During the experimental period, the average daily weight gain of the treatment and control groups were 20±0.06 gr and 1.8±0.9 gr respectively. Accordingly, the average daily weight gain was numerically higher in the treatment group compared with the control group which was consistent with two other studies of Ranjbari and colleagues (2001) and White and colleagues (1992) findings.

CONCLUSION

The results showed that mineral dietary supplement containing copper, selenium, and phosphorus had no significant effect on weight performance and physical characteristics of the components of grazing sheep carcasses in Margoon rangeland. However, the treatment group (fed with mineral supplement) showed higher average hot and cold carcass weights, cold carcass yield, final weight and daily weight gain compared with the control group. For completion of the results and better analysis, it is recommended to evaluate the effects of the used mineral supplement on pregnancy performance of sheep grazing on Margoon rangeland.

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