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Effect of Energy Deficiency at The End of Pregnancy on Sheep and Lamb Birth Weights

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Abstract

This study was carried out in Chios breed pregnant sheep which created experimentally energy deficiency. To determine the effect of low energy feeding on the birth weights of sheep and lambs in the last period of pregnancy. 38 Chios breed sheep, 4-6 years old, were used in the study. The live weight weights of the ewes before the pregnancy were done on the zero day and the other weight weights on the days 120, 127, 134, 141 and 148 of the pregnancy. On the 105th day of pregnancy, pregnant and non-pregnant sheep were divided into 3 groups as normal energy pregnant group (PNE), deficient energy pregnant group (PLE) and non-pregnant normal energy group (N-PNE). From the 106th day of pregnancy to delivery; The pregnant sheep in the PNE group were fed with the ration containing 13% HP and 10 MJ/kg ME, the pregnant sheep in the PLE group were fed with ration containing 13% HP and 8.0 MJ/kg ME. The sheep in the N-PNE group were fed with ration containing 11% HP and 8.8 MJ/kg ME. PLE and N-PNE groups were found to have lower body weight than the PNE group. However, there was no statistical difference between these groups. In all pregnant sheep, body weight was higher than 120 days of pregnancy, it was found to be higher than day 0 ($p < 0.05$) and after 120 days there was no statistically significant difference between groups. In the study, there was no statistically significant difference between the birth weights of PNE and PLE group. This can be explained by the fact that fetal growth is not affected by %13 HP ve 8.0 MJ/kg ME and does not cause serious energy deficiency in animals.

Key Words: Energy deficiency, ewe, lamb, live weight, pregnancy.

Gebeliğin Sonunda Uygulanan Enerji Eksikliğinin Koyun ve Kuzu Doğum Ağırlıkları Üzerine Etkisi

Öz

Bu çalışma, deneysel olarak enerji eksikliği oluşturulan ikizlik oranı yüksek Sakız Irkı gebe koyunlarda, gebeliğin son döneminde düşük enerji ile beslenmenin, koyunların ağırlıkları ile yeni doğan kuzuların doğum ağırlıkları üzerine olan etkisini saptamak amacıyla yapıldı. Araştırmada ikizlik oranı yüksek, 4-6 yaşlarında, 38 adet Sakız ırkı koyun kullanıldı. Koyunların gebelik öncesi canlı ağırlıkları 0. gün, diğer ağırlık tartımları ise gebeliğin 120, 127, 134, 141 ve 148 günlerinde yapıldı. Gebeliğin 105. gününde gebe ve gebe olmayan koyunlar, normal enerjili gebe grup (PNE), yetersiz enerjili gebe grup (PLE) ve gebe olmayan normal enerjili grup (N-PNE) olarak 3 gruba ayrıldılar. Gebeliğin 106. günü ile doğum arası, PNE grubundaki gebe koyunlar %13 HP ve 10 MJ/kg ME içeren rasyon, PLE grubundaki gebe koyunlar %13 HP ve 8.0 MJ/kg ME içeren rasyon ile beslendi. N-PNE grubundaki gebe olmayan koyunlar ise %11 HP ve 8.8 MJ/kg ME içeren rasyon ile beslendi. Araştırmada PLE ve N-PNE grupları, PNE gruptan daha düşük vücut ağırlığına sahip olduğu tespit edildi. Ancak bu gruplar arasında istatistikî farkın olmadığı görüldü. Bütün gebe koyunlarda vücut ağırlığı gebeliğin 120. günü, 0. güne göre daha yüksek bulunmuş olup ($p<0.05$), 120. günden sonra ise gruplar arasında istatistiki olarak anlamlı bir fark saptanamadı. Çalışmada PNE ve PLE grubundaki yavruların doğum ağırlıkları arasında istatistikî bir farkın olmadığı görüldü. Bu durum, fötal büyümenin %13 HP ve 8.0 MJ/kg ME'den etkilenmediğini ve hayvanlarda ciddi bir enerji yetersizliğine yol açmamış olması ile açıklanabilir.

Anahtar Kelimeler: Canlı ağırlık, gebelik, koyun, kuzu, yetersiz enerji.

INTRODUCTION

The most critical periods in the feeding of sheep are known as pregnancy and lactation period (1). Energy needs of sheep in the last period of pregnancy is increasing significantly. In particular, in the last 6 weeks of pregnancy, 70-80% of fetal growth is due to adequate growth and development of fetus in mother's womb due to balanced diet of mother (1,2). The weakness of the mother in the last months of pregnancy causes the fetus not to be fed well and therefore the lambs' ability to survive (3,4).

The daily nutrient requirement for sheep's normal life share is 8.4 MJ/kg ME (Metabolic energy) and 9.4% HP (Crude protein). Nutrition of pregnant sheep is discussed in two periods as first 15 weeks of pregnancy and last four weeks according to energy and nutrient requirements. For a first 15 weeks of gestation, fetus growth is 30% and nutritional requirements are 8.8 MJ/kg ME and 10.6% HP in a 55 kg body weight sheep. During the last four weeks of pregnancy, the development of fetus is very fast and the nutritional needs of the sheep increase considerably. Nutritional needs of

sheep carrying single offspring go up to 9.6 MJ/kg ME and 11.8% HP, while double sheep carry 10 MJ/kg ME and 12.8% HP (5,6). In the last 6 weeks of pregnancy, the balanced ration application increases the live weight of the sheep depending on the nutrition level and decreases the weight loss at birth (3).

The aim of this study was to determine the effect of low energy feeding on the weights of sheep and birth weights of newborn lambs in Chios breed sheep with experimentally low energy level.

MATERIAL AND METHODS

A total of 38 Chios breed 4-6 aged sheep were used for the study. Estrus synchronization was applied to sheep and sheep were placed in boxes with 1 Chios ram per 10 ewes for mating. After the sponges were removed, the first weights of the sheep before the pregnancy (day 0) were taken. Other weights were detected on days 120, 127, 134, 141 and 148 of pregnancy. The numbers, genders and weights of the lambs were determined by following the births of pregnant sheep.

On the 105th day from the date of introduction of ram, sheep were examined by ultrasound to separate pregnant sheep and form groups. According to the results of the examination, 24 out of 38 animals were found to be pregnant. These animals were divided into three groups as normal energy pregnant (PNE, n=12), deficient pregnant (PLE, n=12) and normal energy non-pregnant (N-PNE, n=14). From the 105th day of pregnancy, the animals were started to be fed appropriately to the groups in which they were present (Table 1). This continued until the birth of the animals. All sheep were fed with ad libitum water and from the group of feeds, about 700 grams per sheep, at 08:00 am and 16:00 pm. Considering feed tables, energy and crude protein levels of rations were determined approximately. Two ewes died in the PNE group during the final periods of pregnancy. It was determined that 2 ewes had acute pneumonia in the PLE group and 4 ewes had metritis in the N-PNE group. In total 8 ewes were removed from the 3 groups in this study.

Nutrition between 0-105 days; the pregnant and non-pregnant sheep were fed with ration containing 11% HP and 8.8 MJ/kg ME (n=38, 1400 g/day/animal) (Table 1).

Table 1. Composition of the diets (%)

Ingredients	PNE	PLE	N-PNE
Grass hay	34.00	65.00	75.00
Cracked barley	1.60	3.80	5.00
Cracked maize	28.00	1.00	7.50
Sunflower meal	21.00	18.50	1.10
Razmol	3.00	4.30	8.00
Wheat bran	6.00	3.00	1.50
Cracked wheat	6.00	4.00	1.50
Zeolitea	0.10	0.10	0.10
Vitamin premixb	0.10	0.10	0.10
Salt	0.10	0.10	0.10
Marble powder	0.10	0.10	0.10

[a] In 1kg zeolite, 48.58% SiO_2, 14.72% Al_2O_3, 11.11% CaO, 11.65% MgO, 9.19% Fl_2O_3, 2.50% LiO, 1.28% Na_2O, 0,44% K_2O There are 0.38% TiO_2, 0.16% MnO, 0.06% Cr_2O_3, and 0.03% P_2O_5.
[b] 1 kg of vitamin premix of 10.000.000 IU of vitamin A, 1.500.000 IU of vitamin D_3, 25 g of vitamin E, 20 g of niacin, 7 g of pantothenic acid, 2.5 g of vitamin B_2, 1.5 g of vitamin B1, 1.5 g of vitamin B_6 and 15 mg contains vitamin B_{12}.
PNE = Pregnant normal energy, PLE = Pregnant low energy, N-PNE =Non-pregnant normal energy

Nutritional feeding on day 106 of pregnancy; PNE group (n=10) 13% HP and 10 MJ/kg ME ration, PLE group (n=10) 13% HP and 8.0 MJ/kg ME ration, N-PNE group (n=10) were fed with 11% HP and 8.8 MJ / kg ME ration (1400g/day/animal). Since the 106th day of pregnancy, HP content of feed was increased due to fetus requirements of pregnant animals.

Statistical Analysis

Statistical comparisons of maternal weight and lamb birth weight were performed by the Independent-Student t-test among pregnant sheep fed by PNE and PLE ration, and sheep fed by PNE and N-PNE ration. In addition, statistical comparisons of maternal weight between days of blood collection in each group were evaluated by variance analysis (Duncan test). These tests were performed using SPSS 10.00 package program. The results were shown as mean standard deviation $\overline{X}\pm SD$). A significance level of $P<0.05$ was employed in the analysis of data from treatment groups.

RESULTS

The average body weights of pregnant sheep fed by PNE and PLE ration are shown in table 2. Although PLE and N-PNE sheep had lower body weight than PNE sheep, no statistically significant difference was found between these groups. In all pregnant sheep, body weight was higher than 120 days of pregnancy, it was found to be higher than day 0 ($p <0.05$). It was also found that body weight did not change during blood collection periods in non-pregnant sheep.

Table 2. Body weights of non-pregnant sheep fed by pregnant sheep fed by PNE and PLE rations and N-PNE ration (kg, n=10, $\overline{X}\pm$ SD)

	Pregnancy					
Group	Day 0	Day 120	Day 127	Day 134	Day 141	Day 148
PNE	55.7±8.83b	65.5±9.79a	66.4±9.01a	66.7±9.02a	67.5±7.48a	67.1±7.42a
PLE	51.4±5.82b	58.7±5.61a	59.1±5.38a	60.4±5.79a	60.7±6.16a	63.3±5.16a
N-PNE	51.6±6.64a	53.7±6.60a	54.8±6.40a	52.6±5.93a	54.1±6.53a	54.7±5.85a

[ab] statistical difference between the days in the same row with different letters are significantly ($p <0.05$).
PNE = Pregnant normal energy, PLE = Pregnant low energy, N-PNE =Non-pregnant normal energy

In the study, pregnant sheep fed by PNE, 22 lambs, and pregnant sheep fed by PLE gave birth to 18 lambs. The birth weights of the lambs are shown in Table 3. There was no significant difference between the two groups in terms of birth weights of the lambs.

Table 3. Birth weights of lambs born from pregnant sheep fed by PNE and PLE rations (kg, $\overline{X}\pm$ SD)

	Single Lamb	Multiple Lambs
n=4	3.97 ± 0.32	n=18
n=4	4.36 ± 0.46	n=14

PNE = Pregnant normal energy, PLE = Pregnant low energy

DISCUSSION AND CONCLUSION

In the last 6 weeks of pregnancy, the balanced ration application increases the live weight of the sheep depending on the nutritional level and decreases the weight loss at birth (3,7). Inadequate feeding of the sheep during pregnancy may lead to decreased body condition, decreased live weight gain, premature birth risk, high lamb deaths and low milk yield due to insufficient breast development and even death

in many cases (4,8-10). In addition, with sufficient energy consumption during the last 6 weeks of pregnancy, it has been reported that the increase in the reproductive organs during pregnancy is caused by growth and proliferation in the fetus, uterus, placenta and amniotic fluid, and this situation increases the body weight of the mother and lamb (10,11). They reported a 10 kg increase in live weight of single sheep and an increase of 16-17 kg in twin births (10). Steyn et al. (12) reported that pregnant sheep fed with sufficient energy levels (10.8 MJ/kg ME) had a higher weight than those fed with insufficient energy levels (9.1 MJ/kg ME). On the other hand, Aktaş et al. (13) reported that birth weight and survival rate were not significantly affected by the feeding level of sheep in the last period of pregnancy . In the study, no significant difference was found between pregnant sheep and malnourished sheep in terms of body weights. However, normal-fed pregnant sheep were found to tend to have more body weight than the poorly fed pregnant group (Table 2). In this respect, the findings of the study were reported by Steyn et al. (12) and Alçiçek and Yurtman (10), while they show similarities, Aktaş et al. (13) are compatible with the study.

In humans and animals, malnutrition of mother during pregnancy leads to slowing of fetus weight, uterine and placental growth (14,15). In pregnant sheep, it has been reported that alteration of protein and energy ratios in feed is effective on placenta, fetal growth is usually not affected by feeding changes in early and mid-term pregnancy, fetal growth is low in mid pregnancy, when mother is seriously malnourished (16). Dandrea et al. (17) reported that the fetus weights of pregnant sheep fed with insufficient energy level and placenta masses were lower than those fed enough. In a study by Aktaş et al. (13) the birth weights of single-born lambs were significantly higher than twin-born lambs. Şirin et al. (11) reported that additional feeding during the last period of pregnancy increased maternal weight and lamb birth weight. However, Mathews et al. (18) reported that maternal malnutrition did not affect the birth weight of the lamb. As in our study, no statistically significant difference was found between lamb birth weights in PNE and PLE groups. In this respect, the data of the study are consistent with the findings of Mathews et al. (18). The reason why there was no significant difference between the PNE and PLE pregnant groups in our study suggests that a serious lack of energy was not applied to the animals. Borwick et al. (19) reported that the birth weight of the sheep fed with insufficient energy (8.5 MJ/kg ME) was 18% lower than that of those fed enough (12.2 MJ/kg ME). However, the birth weight of the offspring in the PNE and PLE groups did not show a statistically significant difference (Table 3). This may be explained by the fact that, as Perry et al. (16) states, fetal growth is not affected by the energy insufficiency applied, the lack of a serious energy deficiency in animals. As a result, it was concluded that the nutrient energy values at the end of pregnancy should be lower than 8.0 MJ/kg ME in order to determine the effect of sheep fed with insufficient energy on body weights and fry birth weights at the end of pregnancy.

CONFLICTS OF INTEREST

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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