Effect of feeding corn stalks and sugar beet waste silage on sheep milk yield and lamb survival

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SUMMARY

In this study, corn stalk (CS) and sugar beet head and leaf (SBHL) silage were used to determine the effect of increasing milk yield on lambs' survival and end of fattening weight in sheep with multiple births. In the study, 17 Bafra sheep with multiple births and 38 lambs obtained from these sheep were used as animal material. The study was divided into two groups as experimental group (EG) and control group (C). The milk yields of the EG group were 293.00 g, 345.00 g and 576.39 g for the 5th, 35th and 65th days and the milk yield of the control group were 276.31 g, 236.38 g and 223.13 g for the 5th, 35th and 65th days. No statistically significant difference was found in milk yields between the EG and C groups of sheep on the 5th and 35th days, but a statistically significant difference was found in milk yields on the 65th day. Sheep weights were weighed at the 3rd, 4th, 5th, 10th, 11th and 12th weeks and sheep weights were higher in EG than in C. There was a statistical difference between EG and C in terms of roughage consumption, incremental feed amount and net amount of roughage + concentrate consumed. The birth weights of the lambs were 3.25 kg and 2.80 kg for EG and C groups, and the average live weights at the end of the study were 17.71 kg and 12.40 kg for EG and C groups. Lamb survival rates between the EG and C groups were 95.0% and 83.3%, and mortality rates were 5% and 16.7%, respectively. No statistically significant differences were found between the groups in terms of lamb survival and mortality rates. In conclusion; feeding of sheep with CS + SBHL silage after parturition increased milk yield, sheep weights, lamb live weights and lamb survival rate in Bafra sheep with multiple births.

KEY WORDS

Bafra sheep; Milk yield; Live weight gain; Survival, feeding.

INTRODUCTION

Livestock breeding is of great importance in Turkey, as in the whole world, in terms of healthy and balanced nutrition of people, supporting the family economy and ensuring the continuity of the livestock dependent industry. Sheep are animals that can transform the low quality feeds they consume into high quality products (1). Since sheep are very food intolerant, they can meet their nutrient needs to a large extent from meadow pasture, fallow and stubble. They are the most preferred animal species of small and medium sized enterprises in undeveloped and underdeveloped countries, especially because they are resistant to drought, extreme cold, sudden climate changes and some diseases (2, 3).

It is known that the effect of genotype and feeding on milk yield in sheep is very important (4). Feed expenses constitute approximately 65-75% of the cost in livestock farms. Roughages are an indispensable part of rations in terms of digestive physiology of ruminant animals. In addition to high feed costs, the quality of roughage used also affects the yield obtained from animals. For a sustainable production, high quality, cost effective and abundant roughage should be used in the rations of animals. In Turkey, there are 16.554.682 heads of cattle, 43.393.709 heads of sheep and 10.571.297 heads of goats (5). Considering the number of ruminant animals in our country, the fact that our total roughage need is high directs producers to alternative roughage sources.

According to the latest data, 23.000.000 tonnes of sugar beet is produced in our country. The residues left after the sugar beet harvest; sugar beet heads and leaves and the pulp, molasses and shillempe obtained after alcohol and spirit production can be used as feed raw material in animal feeding (5, 6, 7). Although there is a serious deficit of roughage in our country, sugar beet heads and leaves are not sufficiently utilised. Sugar beet leaves contain quite a lot of protein and are a feed rich in carbohydrates if the leaves are found together with the head (8). The fact that sugar beet head and leaves are rich in carbohydrates as well as protein content facilitates their ensiling. However, the high water content of sugar beet heads and leaves and their contamination with soil and foreign substances make ensiling difficult and increase nutrient losses. For this reason, care should be taken to ensure that sugar beet heads and leaves are cleaned from soil and foreign materials for ensiling. In addition, due to its high water content, the use of bran, cereal crumbs, dry grass or various straws during ensiling facilitates ensiling and increases the quality of silo feed (9).

One of the roughage sources to be used in ruminant feeding

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is corn stalks (corn straw) remaining from the field after harvest (10, 11). Corn straw has low protein and energy content and high cell wall components (12, 13). According to the latest data, 8.5 million tonnes of corn is produced annually in Turkey (5). After the corn harvest, it is possible to utilise the remaining stalk and sheath parts as straw. Corn straw is in better condition compared to other wheat straws. Low quality roughage such as straw can be processed by various methods (physical methods; chopping, grinding, pelletising, boiling under pressure and steaming etc., chemical methods; urea and some alkalis and ammonia etc.) to increase its nutritional value. In recent years, various studies have been carried out in this field and it is aimed to increase the nutritional value of feeds with low roughage quality, especially straws (14, 15, 16, 17, 18, 19).

Sugar beet head and leaf silage with corn stalks is an alternative roughage source for ruminants. Especially in terms of meeting the need for quality roughage and utilising the harvest residues left in the field at the end of crop production, silage feed consisting of sugar beet head and leaves and corn stalks should be evaluated for use in both dairy cattle breeding and sheep breeding. The aim of this study was to determine the effects on milk yield and lamb survival in sheep consuming silage feed obtained from the mixture of sugar beet head and leaves and corn stalk left over from crop production.

MATERIAL AND METHODS

In the study, Bafra sheep and lambs raised in Ondokuz Mayıs University, Faculty of Agriculture, Research and Application Farm Sheep Breeding Unit were used as animal material. In animal selection, 17 sheep from sheep with similar live weights in at least the second lactation were included in the experiment. One sheep from each two gilts was included in the experimental group and the other one was included in the control group. Thus, there were 8 sheep in the experimental group and 9 sheep in the control group. After the sheep and lambs were cared for following the birth, sheep were weighed for dam weights and lambs were weighed for lamb birth weights with a 50 g precision scale and all necessary information was recorded.

The silage used as feed material in the study was made from sugar beet head and leaves (SBHL) and corn stalk (CS). For silage production, 1000 kg of SBHL and 500 kg of CS passed through a straw machine were homogenously mixed in a feed mixer for 2 hours, packed in 25 kg nylon bags with no air in them and left to mature for about 45 days. A scale with a sensitivity of 50 g was used during silage making and weighing of the concentrate feed. The nutrient contents of meadow hay and CS + SPBY silage are given in Table 1. In addition, sheep dairy feed and lamb growth feed were used as concentrate feed (Table 2). Sheep milk feed was given only to sheep. Lamb fattening feed was given to the lambs 10 days after birth and the lambs were accustomed to it by giving it little by little, and the amount was increased as they ate in the following days.

The 17 sheep used in the study were randomly divided into 8 sheep in the control group and 9 sheep in the silage fed group. In the control group, 2 sheep had triplets, 6 sheep had twins and 9 sheep had male and 9 sheep had female lambs, in total 18 sheep were used in the control group. In the experimental group, 2 sheep gave triplets, 7 sheep gave twin births and 12 male and 8 female lambs were used in the experimental group and 20 lambs were used in total. A total of 38 sheep lambs were used in the control and experimental groups. The experiment

Table 1 - Nutrient contents of meadow hay and corn stalk + sugar beet head and leaves silage (%).

Feed Material	DM	OM	CP	Ash
CS+ SBHL silage	88.61	75.20	12.49	13.41
Meadow dry grass	91.88	85.66	9.73	6.22

DM: Dry matter; OM: Organic matter; CP: Crude protein.

Table 2 - Nutrient contents of sheep dairy feed and lamb growth feed.

Nutrient Substance	Sheep dairy feed	Lamb growth feed
Dry matter (%)	88	88
Crude protein (%)	16	16
Crude cellulose (%)	14	10
Crude ash (%)	9	10
HCl insoluble ash (%)	1.0	1.0
Ca (%)	0.6-1.2	0.8-2.0
P (% minimum)	0.4	0.5
Na (%)	0.3-0.6	0.1-0.4
NaCl (%)	1.0	0.6
Metabolic energy (Kcal/kg)	2500	2600
Vitamin A (IU/kg)	20000	20000
Vitamin D (IU/kg)	3000	3000
Vitamin E (mg/kg)	30	30

Table 3 - Mean milk yield (MY) of sheep at 5th, 35th and 65th days (g).

Features	n	C	n	EG	t value	p
		Mean ± SE		Mean ± SE		
MY 5	8	276.31 ± 39.35	9	293.00 ± 47.12	-0.268	0.792
MY 35	8	236.38 ± 32.93	9	345.00 ± 41.59	-2.012	0.063
MY 65	8	223.13 ± 42.46	9	576.39 ± 56.61	-4.889	<0.001

C: Control, EG: Experimental group, SE: Standard error, P<0.05: there is a difference between means.

started after the sheep gave birth and acclimatisation feeding was given to the groups before the start of the experiment. The birth weights of the dams and lambs were measured at the time of birth and the dams were included in the control and experimental groups according to the order of birth. The experiment was completed when the lambs were 75 days old. For the experimental and control groups, 1100 g of concentrate feed was given per sheep per day. Sheep milk feed was used as concentrate feed source for control and experimental groups. The live weights of the lambs were weighed at birth, on the 5th day and every week from the beginning of the experiment by using a scale with a sensitivity of 50 g. The amount of roughage to be given per sheep was determined according to the live weight of the sheep and the number of lambs born (20). SBHL silage was used as roughage source in the experimental group and dry meadow grass was used in the control group. During the experiment period, the amount of feed consumed daily by the animals and the amount of leftover feed in front of the animals were weighed and recorded. The sheep were milked on the 5th, 35th and 65th days and milk yields were measured. The lambs were separated from their sheeps in the evening the day before milking and placed in different pens. Thus, the next morning the sheeps were milked and measured.

For the data obtained as a result of the research, normality assumptions for two groups (feed consumption amount, milk yield, changes in live weights, etc.) were examined by Shapiro Wilk test and then t-test was used to compare the groups. The dependence of the survival status of lambs on the method applied was analysed by Khi-Square test and percentages were given as frequencies. Covariance analysis was performed for the differences between the weights of the dams, birth weights of the lambs and live weights of the dams at the beginning of the experiment. SPSS 21.0 statistical programme was used for statistical analyses.

RESULTS AND DISCUSSION

The milk yield averages of the sheep on the 5th, 35th and 65th days are given in Table 3. There was no statistical difference (P>0.05) in the milk yield of the sheep on the 5th and 35th days, but higher milk yield was obtained from the experimental group animals than the control group animals. The average milk yields of the control group and experimental group on the 5th and 35th days were 276.31 g, 293.00 g, 236.38 g and 345.00 g, respectively. Although higher values were found in the experimental group animals, no statistically significant difference was found. The average milk yields obtained on the sixty-fifth day were statistically significant (P<0.001) in the control group (223.13 g) and the experimental group (576.39 g).

In a study conducted to determine milk yield and some milk quality characteristics in different sheep breeds, the average daily milk yield of Bafra sheep during lactation was reported as 849.76±55.63 g and the average milk yield on the 30th day was reported as 1426.37±92.67 g. These values were higher than the values obtained in this study (21).

Milk yield varies among breeds and also varies among the same breeds. These differences are due to the genetic structure of the

Table 4 - 1-12th week weight averages of sheep (kg).

Features	n	C	n	EG	t value	p
		Mean ± SE		Mean ± SE		
1	8	53.33 ± 2.05	9	58.26 ± 1.82	-1.803	0.091
2	8	52.36 ± 1.84	9	57.75 ± 1.84	-2.066	0.057
3	8	48.56 ± 1.50	9	54.52 ± 1.58	-2.720	0.016
4	8	46.23 ± 1.78	9	51.86 ± 1.58	-2.381	0.031
5	8	43.71 ± 2.00	9	49.79 ± 1.70	-2.337	0.034
6	8	44.36 ± 1.90	9	49.01 ± 1.88	-1.734	0.103
7	8	45.00 ± 2.07	9	49.50 ± 1.93	-1.591	0.132
8	8	45.43 ± 2.21	9	49.73 ± 1.98	-1.453	0.167
9	8	45.43 ± 2.12	9	50.15 ± 1.93	-1.654	0.119
10	8	44.86 ± 1.96	9	50.69 ± 1.88	-2.143	0.049
11	8	44.62 ± 1.94	9	51.51 ± 1.94	-2.502	0.024
12	8	44.38 ± 1.96	9	52.16 ± 2.02	-2.751	0.015

C: Control, EG: Experimental group, SE: Standard error, P<0.05: there is a difference between means.

Table 5 - Feed consumption of sheep (kg).

Features	n	C	n	EG	t value	p
		Mean ± SE		Mean ± SE		
Total roughage consumption	8	76.80 ± 3.03	9	138.26 ± 4.73	-10.632	<0.001
Total concentrate feed consumption	8	82.50 ± 0.00	9	82.50 ± 0.00	-	-
Increased feed quantity	8	2.20 ± 0.27	9	6.04 ± 1.59	-2.382	0.043
Net amount of roughage + concentrate feed consumed	8	157.35 ± 2.97	9	205.32 ± 11.11	-3.948	0.001

C: Control, EG: Experimental group, SE: Standard error, P<0.05: there is a difference between means.

animal and environmental conditions. Milk yields of animals with the same genetic structure may differ depending on environmental factors. The role of care and feeding plays an important role in milk yield. Some studies have reported that milk yield in sheep is closely related to the level of feeding during lactation (22). As a matter of fact, in our study, milk yield of sheep fed with CS + SBHL silage was found to be higher than sheep not fed with CS + SBHL silage. Silages are an important roughage source used for milk production in ruminants due to their high water content and fermentation products. Lactic acid formed in silages as a result of microbial fermentation (23) is also known as milk acid. After harvesting, the remaining feed raw materials can be utilised in sheep production, especially in milk production, by utilising them as silage.

Weight averages of sheep are given in Table 4. No statistical difference was found in the analysis of covariance between sire weights, control and experimental group and the difference was not shown in the table because it was statistically insignificant. According to the rootstock weights, there was a difference between the rootstock weights at the 3rd, 4th, 5th, 10th, 11th and 12th weeks (P<0.05). In the study, it was determined that the live weights of the sheep fed with CS + SBHL had higher live weights than those fed with dry grass. In the results of the study, the live weights of the experimental group showed similar results with the live weights of sheep aged 2 and 3 years (54.2 kg and 58.1 kg) in similar studies, while the live weights of the control group were found to be lower (24). However, experimental group live weights were lower than those of 4 and 5 age sheep (66.3 kg and 69.6 kg). In a study conducted in Bafra sheep, live weight values of 1, 2, 3 and 4 age sheep were reported as 55.67 kg, 57.00 kg, 59.17 kg and 61.23 kg, respectively, and these values showed similar results with experimental group and were higher than control group values (25). The live weight values of the control group showed similar results with some studies (43.53 kg and 50.31 kg) (26). The fact that live weights do not show similar results in the studies carried out in Bafra sheep may be due to factors such as year, management, feeding method and age of the sires.

The values related to the feed consumption of sheep are given in Table 5 According to the results obtained, there was a statistical difference between experimental group and control in terms of roughage consumption (P<0.001), incremental feed amount (P<0.05) and net amount of roughage+concentrate consumed (P<0.001).

The most important feeding in sheep breeding period is lactation period. The rations made in this period should be in a quality and quantity that will provide both the needs of the sheep and the milk production required by the offspring. The use of lactating feeds such as silage, which has high water content and can meet the nutrient needs of sheep during lactation period, increases the productivity.

In order to obtain the desired yield in Bafra sheep and all other sheep breeds, care and feeding conditions should be paid attention. In the studies conducted with Bafra sheep, it is seen that the information on feed consumption is insufficient. The fact that roughage consumption was higher in experimental group compared to control is thought to be due to the flavour of the silage given to the experimental group. The flavour of silage increased roughage consumption. It is important to give flavourful roughages with laxative effect to sheep at birth in order to increase milk yield.

Lamb weight averages are given in Table 6 The analysis of covariance between the live weights of lambs, control and experimental group showed no statistical difference and the statistical difference was not shown in the table because it was insignificant. According to the results obtained, there was no difference between control and experimental group in the birth weights of lambs (P>0.05). There was a statistical difference in the live weight values of lambs measured at different weeks (P<0.05). In the study, birth weight, 45th day and 75th day live weights of lambs in EG showed similar results with some studies, but live weight values of control group lambs were found to be lower (27, 28).

In the study, the lamb survival rate in the control group was found to be 83.3% and the mortality rate was 16.7%, while the lamb survival rate in the experimental group was found to be 95.0% and the mortality rate was 5%. Lamb survival rate during the 75-day trial period was similar to other studies in terms of control group (25, 27). Some studies showed similar results with the lamb survival rates of the experimental group (28, 29). In our study, the lambs died on the 5th day after birth in experimental group, 1 lamb died on the 5th day after birth in control group and the other 2 lambs died on the 15th day after birth. The first deaths after birth may be caused by the lamb not finding its mother and not getting enough colostrum (30). Colostrum taken immediately after birth plays an important role in strengthening the immune system of lambs. Many factors affect lamb survival. However, good care and feeding dur-

Table 6 - 11-12th week weight averages of lambs (kg).

Features	n	C	n	EG	t value	p
		Mean ± SE		Mean ± SE		
1	18	2.80 ± 0.12	20	3.25 ± 0.20	-1.910	0.066
2	17	3.59 ± 0.13	19	4.72 ± 0.29	-3.541	0.002
3	15	4.84 ± 0.21	19	5.91 ± 0.30	-2.787	0.009
4	15	5.88 ± 0.27	19	7.24 ± 0.37	-2.852	0.008
5	15	6.81 ± 0.34	19	8.49 ± 0.44	-2.922	0.006
6	15	7.73 ± 0.45	19	9.61 ± 0.50	-2.704	0.011
7	15	8.53 ± 0.51	19	10.63 ± 0.58	-2.652	0.012
8	15	9.19 ± 0.59	19	11.94 ± 0.65	-3.042	0.005
9	15	10.32 ± 0.73	19	13.28 ± 0.73	-2.816	0.008
10	15	11.03 ± 0.76	19	14.76 ± 0.84	-3.227	0.003
11	15	11.64 ± 0.83	19	16.08 ± 0.90	-3.547	0.001
12	15	12.40 ± 0.93	19	17.71 ± 0.98	-3.850	0.001

C: Control, EG: Experimental group, SE: Standard error, P<0.05: there is a difference between means.

Table 7 - Lamb survival rates (LSR) (%).

	Live	Dead	Total
	n (%)	n (%)	n (%)
C	15 (83.3)	3 (16.7)	18 (100.0)
EG	19 (95.0)	1 (5.0)	20 (100.0)
Total	34 (89.5)	4 (10.5)	38 (100.0)
χ^2 : 1.369 df:1 p=0.242			

C: Control, EG: Experimental group, P<0.05: there is a difference between means.

ing the suckling period in the enterprise conditions increases the survival of lambs.

CONCLUSION

A profitable production can be made with the care and feeding to be done during the lactation period. The heads and leaves left in the field after the sugar beet harvest can be used as silage with some additional additives and can be used for feeding sheep. In the study, it was observed that milk yield, rootstock weight, lamb live weights except birth weight and lamb survival were increased in sheep consuming silage prepared with corn stalk and sugar beet heads and leaves left in the field as harvest residues. With the increase in milk yield, the amount of milk to be consumed by the lambs increased and in parallel with this, experimental group lambs suckled more milk and their live weight gain was higher than control group lambs. On the other hand, one of the aims of this study was to observe the consumability of CS + SBHL silage, which is not widely used in animal husbandry, by animals. These feeds, which are among the cheapest feed sources in terms of their prices, contributed positively to milk yield in sheep, live weight gain and survival in lambs. In conclusion, in this study, milk yield, sheep weights, lamb live weights and lamb survival rates were increased in Bafra sheep with multiple births fed with CS + SBHL silage.

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Authors' Contributions

AA: data collection, laboratory analysis, methodology and review; MO: conceptualization, analysis, writing and editing; HT: conceptualization, methodology, writing and original draft preparation.

Conflict of interest

The authors declare no conflict of interest.

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