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Full Length Research Paper

Effect of estrus synchronization on dairy goat milk composition

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This study was aimed to observe the effects of progesterone impregnated sponge insertion on milk yield and milk composition in dairy goats. For this reason milk samples were collected before insertion and during the treatment. Sixty four Turkish Saanen goats were used in the research. Animals were milked twice daily. Reduce in milk yield was observed. Fat content of milk decreased, while lactose content, solids-non-fat, density and pH value increased during the sponge application. Protein content was not influenced by the treatment. New experiment under controlled conditions might be planned to characterize the hormonal status of animal and their effects on milk yield and composition.

Key words: Milk composition, goat milk, milk fat, protein, lactose, estrus synchronization, Turkish Saanen goats.

INTRODUCTION

Success of reproduction season in small ruminant production plays an important role on continuity of herd and managing economy. Presence of male animal in herd in breeding season may cause difficulties to explain the success of reproduction performance. Beginning of breeding season occurs during the lactation. Biotechnological methods use to increase the productivity of the herd. Estrus synchronization methods are used mostly before the other biotechnological methods in assisted reproductive technology in livestock production. The progesterone impregnated sponge insertion is the widespread method for estrus synchronization in small ruminants (Mellado et al., 1998; Wildeus, 2000).

Authors reported that progestagen beside estrus synchronization had an effect on milk secretion, mammary growth. There were only a few studies about the mechanisms of exogenous progestagen on milk yield and milk composition. There are numerous factors affecting milk yield and composition. Nutrition, hormonal status, management factors, genetic factors and photoperiod can be taken into account as the most important factors (Reece, 1956; Morand-Fehr and Sauvant, 1980; Knight and Wilde, 1987; Manalu et al., 2000; Svennersten-Sjaunja and Olsson, 2005; Mabjeesh et al., 2007). High progesterone concentration caused to development of alveolus from the mammary gland (Reece, 1956). As known the secreted cell count influences the milk composition and milk yield and progesterone plays a role on increasing the secreting cell. Mckusick et al. (2002) studied on the East Frisian ewes with exogenous hormone treatment and reported that the presence of corpus luteum during lactation causes an increase in milk yield in these ewes.

The objective of the present study was to determine the effects of estrus synchronization treatment with progesterone impregnated sponge on yield and composition of milk provided from dairy goats.

MATERIALS AND METHODS

A total of 64 dairy Turkish Saanen goats were used in this study, whose ages differ between 1 - 6 years old. Goats were located in Çanakkale province in the Northwest part of Turkey. Çanakkale province stands as the “Breeding Center” of Turkey for Turkish Saanen goat breeding. The quality and aroma of milk products were influenced by milk composition. Ezine cheese is a famous cheese in Turkey. The cheese was produced only in this province. Karagul et al. (2009) reported that Ezine cheese was produced from mixture of in different proportion of cow, sheep and goat milk. Because sheep and goat are seasonal species, milk production is limited with season. For that reason with the help of biotechnological methods, it is possible to extend milk production in all the

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Table 1. Effects of intravaginal sponge insertion for estrus synchronization, farm and age of doe on milk yield.

		Milk yield, l		
		x̄	SE	P
Sampling period	1	1.39	0.05	0.193
	2	1.29	0.05	
Farm	F1 (n=44)	1.42	0.05	0.035
	F2 (n=20)	1.26	0.06	
Age	≤2 (n=42)	1.21	0.05	0.000
	2> (n=22)	1.49	0.06	
FarmXAge	F1 ≤2(n=31)	1.39[a]	0.05	0.000
	F1 2>n=13)	1.46[a]	0.08	
	F2 ≤2(n=11)	0.95[b]	0.08	
	F2 2> (n=9)	1.57[a]	0.09	

year around.

Goats were milked twice daily. Morning and evening milking samples were collected and weighed individually. Milk samples were analyzed by an ultrasonic milk analyzer (LACTOSCAN Milk Analyzer, Milkotronic Ltd, Nova Zagora, Bulgaria). Milk was analyzed for fat, protein, lactose, solids-non-fat, density and pH value. Milk samples were collected before and during intravaginal sponge using for estrus synchronization (sampling period 1 before insertion and sampling period 2 during sponge insertion). There was only five days between two sampling periods. For the estrus synchronization 20 mg cronolone sponges were used. Animals were kept under similar conditions and fed with similar concentrate and grazed on similar pasture.

Animals' weight was not taken in to account; because duration of the experiment was very short for the change of this parameter. The study was carried out under field conditions. Statistical analyses of data were done by SAS packet program (1999). The effect of period, farm (F_1 and F_2), age (≤2 and 2>) and farm x age interaction were used in the model. The interaction of treatment, age and/or farm was not significant, for that reason other interactions effects were not take place in the model. Milking time (morning and evening) was also used as fixed effect and morning and evening milk yield were taken place in the model as covariant, except milk yield.

RESULTS

Results of this study were summarized in Tables 1 and 2. There was a decrease in milk yield with hormone impregnated sponge insertion (Table 1). Farm effect and age of doe significantly affected milk yield (1.42 vs. 1.26; P = 0.035; 1.21 vs. 1.49; P = 0.000, respectively). The interaction between farm and age significantly affected milk yield (P = 0.000). The first farm had younger animals than second farm. Also the number of animals in the first farm was higher than other farm (Table 1).

In Table 2, it was shown that the treatment period has a significant effect on fat, protein, lactose, solids-non-fat, density and pH-value of milk. Hormone application resulted in a reduction in fat content (3.96 vs. 3.53, P = 0.000). Protein content was not influenced by application. On the other hand lactose content, solids-non-fat, density and pH value increased during treatment (4.50 vs. 4.58, P = 0.003; 8.40 vs. 8.61, P = 0.009; 1028.16 vs. 1029.13, P = 0.000 and 5.64 vs. 6.55, P = 0.000, respectively). There were significant differences between farms in terms of fat content, lactose content, solid-non-fat and density. There was an increase in fat content of milk (3.62 vs. 3.86, P = 0.048). On the other hand there were a reduction in lactose content, solids-non-fat and density between farms (P < 0.05, Table 2). Fat content and lactose content were affected by age of doe. There were significant increases in these parameters according to elevated ages (Table 2). Protein content, solids-non-fat and density were increased numerically. Morning milking has higher milk fat content than evening milking (P = 0.025). Milk density was also influenced also by milking time (P = 0.022).

Samples milked in the evening have higher density than morning samples. pH-values of milk samples were lower in evening samples (P = 0.000). A significant interaction between farm and age was observed in terms of fat content (P = 0.038). In the first farm, 2 years and younger doe's gave lower milk fat content than other farm and age groups (Table 2). In this group, there were more animal than other groups and they had higher milk yield in this age group (Tables 1and 2).

DISCUSSION

The results of this study demonstrated that, progestagen treatment for estrus synchronization in small ruminants influenced the milk composition, but not milk yield in a short period of time. Milk yield results of this study were in agreement with Knight and Wilde (1988). Progesterone secreted by corpus luteum after the ovulation till placental growth completed. In several species, like goat, during the gestation corpus luteum secretes progesterone. The effect of exogenous progesterone on secreting cell in mammary of animal may be expected to increase in milk yield.

According to our results, there is only numerical effect on milk yield. This may be explained by the short treatment period and hormone application methods can influence animal welfare negatively. In the long term of lactation period can influence positively.

Fat content of milk was influenced by feed carbo-hydrate content (Reece, 1956; Min et al., 2005). In this study, nutritional diet was not differed during the sampling, but milk fat content was reduced by hormone impregnated sponge insertion. This result was in agreement with the other study (Mellado et al., 1998). Milk protein content was influenced by nutritional diet (Sanz Sampelayo et al., 1998) but not observed in the present study. Moroni et al. (2007) reported that milk composition was very important for cheese manufacturer.

Table 2. Effects of intravaginal sponge treatment, farm, age of doe, milking time and the interaction of farm X age parameters on milk composition of dairy goats.

		Fat, %			Protein, %			Lactose, %			Solids-non-fat, %			Density, kg/m^3			pH		
		x̄	SE	P	x̄	SE	P	x̄	SE	P	x̄	SE	P	x̄	SE	P	x̄	SE	P
Period	1	3.96	0.08	0.000	3.23	0.04	0.183	4.50	0.02	0.003	8.40	0.06	0.009	1028.16	0.13	0.000	5.64	0.07	0.000
	2	3.53	0.08		3.30	0.04		4.58	0.02		8.61	0.06		1029.13	0.13		6.55	0.05	
Farm	F1	3.62	0.07	0.048	3.27	0.03	0.989	4.59	0.02	0.006	8.61	0.05	0.013	1029.04	0.12	0.000	6.06	0.04	0.478
	F2	3.86	0.10		3.27	0.05		4.50	0.03		8.40	0.07		1028.25	0.15		6.13	0.08	
Age	≤2	3.51	0.08	0.000	3.21	0.04	0.063	4.49	0.02	0.004	8.42	0.06	0.069	1028.45	0.13	0.056	6.15	0.06	0.211
	2>	3.98	0.09		3.32	0.04		4.59	0.02		8.59	0.07		1028.83	0.15		6.04	0.07	
Milking	Morning	3.87	0.08	0.025	3.27	0.04	0.923	4.52	0.02	0.120	8.46	0.06	0.379	1028.44	0.13	0.022	6.32	0.06	0.000
	Evening	3.62	0.08		3.27	0.04		4.56	0.02		8.55	0.06		1028.85	0.13		5.87	0.06	
Farm × Age	F1 ≤2	3.26b	0.08	0.038	3.25	0.04	0.165	4.52	0.02	0.263	8.56	0.06	0.523	1028.86	0.13	0.891	6.11	0.04	0.831
	F1 2>	3.99a	0.12		3.28	0.06		4.65	0.03		8.67	0.09		1029.22	0.19		6.02	0.07	
	F2 ≤2	3.76a	0.14		3.17	0.07		4.47	0.04		8.29	0.10		1028.04	0.22		6.19	0.11	
	F2 2>	3.97a	0.14		3.36	0.07		4.53	0.04		8.51	0.10		1028.45	0.22		6.06	0.11	
Milk yield*		-0.00	0.00	0.001	0.00	0.00	0.337	-0.00	0.00	0.007	-0.00	0.00	0.442	-0.00	0.00	0.314	0.00	0.00	0.745

*Milk yield used as covariant parameter, also b (regression coefficient), SE (standard error) and P value were given in the table.

Especially protein content of milk influenced cheese properties and quality. In this study, protein content increased numerically with the application. Mellado et al. (1998) were in agreement with the results of this study about the increase of milk protein content. Also milk lactose content, solids-non-fat, density and pH increased during hormone application. These could be explained by the decrease in milk yield. The decreasing of milk production can be explicable with the negative effect of insertion of animal welfare. In consideration that, Martins et al. (2009), reported that using intravaginal sponge can cause vaginitis of animal. This could be used as an indicator of negative effect on animal welfare.

Bhosale et al. (2009) stated that milk pH changed during lactation stage. There is no any study on using intravaginal sponge to determine the effect of pH. In conclusion of the mechanisms of the exogenous hormone treatment are still unclear (Mellado et al., 1998). The explanation of this evidence can be planned as new researches with greater animal population and under controlled conditions during lactation. The hormonal status must be described and blood and milk progesterone concentrations could also be reported.

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