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Effect of Rumen Protected Fat on Somatic Cell Counts of Milk in Dairy Goats

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Abstract: The objective of this study was to investigate the effect of protected fat supplementation on Somatic Cell Counts (SCC) of milk in Saanen×Kilis crossbred dairy goats. A total of 17 primiparious does were allocated into 2 groups as trial and control. Both trial and control groups were fed ad-libidum with alfalfa hay and a concentrate involving 12.5 MJ ME kg^{-1} dry matter and 160 g kg^{-1} crude protein. Trial group received 100 g doe^{-1} of protected fat during 8 weeks from 7th day of kidding. Milk samples were taken 8 times with 14-30 day intervals throughout lactation. SCC was determined with microscopic direct counting method, after DNA staining. A lower but non-significant SCC values were observed in the milk of trial group for first half of lactation period. It was concluded that protected fat supplemented-feeding did not affect significantly SCC of milk in dairy goats.

Key words: Protected fat, somatic cell count, dairy goat

INTRODUCTION

Somatic cell content of milk has been commonly accepted as a quantitative sign for determining udder health in dairy cows (Zeng *et al*., 1996). Somatic cells are mostly composed of leucocytes which are natural protectors of organs in all body fluids and blood circulation. It is widely suggested that SCC is higher in goat in comparison with cow milk (Fahr *et al*., 1999). Beside several factors such as milking frequency (Paape *et al*., 1992), stage of lactation (Miller *et al*., 1991), parity (Contreras *et al*., 1999) and mainly udder infections, SCC of milk can be affected also by alimentary stress related to acidosis (Lerondelle *et al*., 1992). In recent years, the increased genetic merit of dairy cows has led to higher supplementation of cereal grains which provide fermentable energy and improve the protein/energy balance (Muller and Fales, 1998; Barnouin *et al*., 1995). However, higher level of starch in concentates can increase the risk of ruminal acidosis (Bargo *et al*., 2003). Increased SCC in sheep milk reduces cheese yield by increasing the moisture in curd and cheese and by reducing the quantity of casein trapped in it. Increased SCC affect also proteolysis to become more quickly as cheese ages (Pirisi *et al*., 2000). There is no reliable information about the effect of dietary fat use on milk SCC in ruminants. The objective of this study is to investigate the effect of protected fat supplemen-tation on somatic cell counts in goat milk.

MATERIALS AND METHODS

Animal material, feeding and housing: Seventeen primiparious Saanen×Kilis crossbred does, raised in the experimental pen of Ankara University, Faculty of Agriculture, Department of Animal Science were used. Animals were randomly assigned into 2 dietary treatments, as one for control received non-supplemented concentrate; other group composed of 8 does started to receive a concentrate involving a protected fat supplementation during 8 weeks after 7 days of kidding. The concentrate part of the ration was daily given as 1 kg doe^{-1} in a 2 equal meals at the milking. The consumption of protected fat was provided daily at the level of 100 g doe^{-1} in the individual pens.

Add-libidum dried alfalfa hay was given as a basal diet beside the water supply to all animals. The concentrate mixture containing 12.5 MJ kg^{-1} DM metabolizable energy and 160.0 g kg^{-1} DM crude protein was composed of barley, wheat, sunflower and cotton seed meals, limestone, DCP, mineral, vitamin premix and salt. The composition of protected fat is given in Table 1.

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Table 1: The ingredients of protected fat supplement

Ingredients	(%)
Total fat	84.0
Moisture	3.5
Ash	12.5
Calcium	9.0
Myristic acid (C14:0)	1.5
Palmitic acid (C16:0)	44.0
Stearic acid (C18:0)	5.0
Oleic acid (C18:1)	40.0
Linoleic acid (C18:2)	9.5

The kids were kept with their mothers 7 days, then separated and fed with feeding bottle. Machine milking was practiced twice a day. The udder and teats were cleaned before and after milking. The goats were observed regarding clinical mastitis, but no sign was observed until the end of the trial.

Sample collection: The milk samples were taken morning and evening from individual milk pail after discarding the first few strippings, on 20th April, 4th May, 25th May, 15th June, 15th July and 15th August with 14-30 day intervals.

Staining and somatic cell counts: The counts were performed by using the Pyronin Y-Methil Green (PYMG) stain direct microscopic standard method, recommended for goat milk (Packard *et al*., 1992). A smear was fixed in Carnoy's fixative solution for 5 min and then the film was hydrated for 1 min each in 50% ethanol, 30% ethanol and distilled water, respectively and stained for 6 min in PYMG (Sigma, St Louis MO). The film was dried, immersed in butanol and distilled water for 1 min. The inspection of the smear was made microscopically using a field-wide single strip method. Breed direct counting was used for SCC (Gurgun and Halkman, 1988). The smears were duplicated for each sample and average values were used for statistical analysis.

Statistical analysis: Three factors with 2 factors repeated measurement variance analysis was used (Gurbuz *et al*., 2003). Square root transformation was performed for SCC values before analysis. As significant sampling period×feeding, milking time×feeding and sampling period×sampling time interactions were observed, statistical comparisons were performed separately for morning and evening milking (sampling time), sampling period of lactation and feeding. The model used for calculation was:

$$X_{ijkm} = \mu + \alpha_i + \pi_{m(i)} + \beta_j + \gamma_k + \alpha\beta_{ij} + \alpha\gamma_{ik} + \beta\gamma_{jk} + \alpha\beta\gamma_{ijk} + \beta\pi_{jm(i)} + \gamma\pi_{km(i)} + \beta\gamma\pi_{jkm(i)}$$

μ = Population mean.
α_i = Effect of feeding.
$\pi_{m(i)}$ = Effect of animals.
β = Effect of months.
γ_k = Milking time effect.
$\alpha\beta_{ij}$, $\alpha\gamma_{ik}$, $\beta\gamma_{ik}$, $\alpha\beta\gamma_{ijk}$, $\beta\pi_{jm(i)}$, $\gamma\pi_{km(i)}$, $\beta\gamma\pi_{km(i)}$ = Interactions.

RESULTS AND DISCUSSION

Average initial body weights of does not vary significantly by groups (45.89±1.600 and 45.38±1.000). In addition, total milk yield measured during first 8 weeks of lactation did not vary significantly by diet. These values were found as 1.53±0.130 kg for trial, 1.54±1.130 kg for control groups.

The SCC values were observed significantly lower ($p<0.01$) in the milk of morning throughout lactation, except 5th sampling taken on 15th July. Lowest SCC was found as 1,756.033 cells mL^{-1} for the milk sampled on 4th May at morning from goats fed with protected fat. The differences were found also significant between stages of lactation ($p<0.01$) with regard to SCC values. However, the effect of protected fat was not significant on SCC values of milk during lactation period. Average SCC values by sampling time and stage of lactation are shown in Table 2.

The value of SCC in the milk was not affected significantly by feeding with protected fat supplementation. The slight decrease of SCC observed on first half of lactation in trial group may be attributed to protected fat use. Thus, the concentration and type of dietary fats alter various indices of immune response in animals (Kelley and Daundu, 1993) as recently reported in monogastrics. Rich saturated fatty acid-based diet may inhibit lymphoproliferation in the blood (Niranjan and Krishnakatha, 2001). Polyunsaturated fatty acids (n-3) and n-6 fatty acids in the diet are also known as suppressor of lymphocyte (Yaqoob *et al*., 1994; Jeffery *et al*., 1996). However, a significant decrease of SCC were not observed in trial group. In this study, SCC values increase as lactation comes forward. In addition, morning milk contains higher SCC. Both observations are in accordance with findings of recent studies (Zeng *et al*., 1996; Cedden *et al*., 2002). It would be more illuminative to retain protected fat supplemented-feeding until drying-off, in order to investigate definitive effect of the diet on SCC during late lactation period. Detection of immuno-hematological parameters, beside SCC values

Table 2: Comparison of SCC between trial and control groups according to sampling time and period

Sampling period	20th April		4th May		25th May	
Sampling time	Morning	Evening	Morning	Evening	Morning	Evening
Trial group	1,756.033±218.768	2,673.827±610.585	1,953.267±291.891	4,778.963±886.596	2,407.233±540.978	5,718.936±567.694
Control group	2,218.135±381.117	2,726.254±456.166	2,187.071±432.212	4,809.781±789.767	3,146.734±714.315	5,696.569±1.116.813
General	1,973.493±214.260^{a}A	2,698.498±376.258^{b}A	2,063.292±248.726^{a}A	4,793.466±580.089^{b}B	2,755.233±437.074^{a}B	5,708.411±584.899^{b}C
Sampling period	15th June		15th July		15th August	
Sampling time	Morning	Evening	Morning	Evening	Morning	Evening
Trial group	2,581.127±292.022	6,762.473±587.874	4,594.879±561.369	5,255.611±824.971	4,563.650±471.868	3,866.759±243.560
Control group	2,998.439±334.211	6,913.275±336.028	4,188.126±843.963	4,181.470±650.348	4,721.625±597.674	3,083.866±331.585
General	2,777.509±219.730^{a}B	6,833.439±339.238^{b}D	4,403.466±482326C	4,750.133±534.038B	4,637.992±364.516^{a}C	3,498.339±218.822^{b}E

(a, b: p<0.01); Minuscules show the difference between morning and evening within each stage of lactation; (A, B, C, D and E: p<0.01): Majuscules show the difference with respect to the stages of lactation

would be complemantary for asserting the effect of protected fat. In conclusion, further studies would be helpful to clarify the use of protected fat in lactating ruminants.

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