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Factors influencing milk quantity and quality in Assaf sheep and goat crossbreds

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Abstract

The present study aimed to analyze the major factors that influence milk yield in Assaf sheep and Saanen, and Shami x Anglo Nubian goats, the major small ruminant dairy breeds and crossbreds in Israel. Six different farms with 745 Israeli-Assaf dairy sheep and 682 goats were surveyed. Udder halves were tested for udder bacterial condition, California mastitis test (CMT), somatic cell count (SCC), N-acetyl-β-D-glucosaminidase (NAGase) activity and milk composition (fat, protein and lactose). Effects of subclinical mastitis caused by CNS include a drastic increase in SCC and a decrease in milk yield. Changes are more acute in sheep compared with goats: SCC was quadrupled and milk yield was decreased by 30% in sheep, and in goats SCC was doubled and milk yield was only slightly decreased. However, in both sheep and goats, the direct income loss from decreased milk yield and the strong immune response to bacterial udder contamination, which results in the increase of SCC, appear to be of much greater magnitude than noted in dairy cows. The implication of these results is that for a given percentage of animals with udders contaminated with CNS, the increase in SCC will be much higher in the bulk milk of dairy sheep than cows. In dairy sheep and goats, grading milk according to SCC as currently practiced in herd improvement programs will place great pressure on growers to produce milk of a higher quality.

Keywords: Sheep, goat, udder infection, milk yield
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Introduction

The major income of dairy sheep and goats comes from milk production, which is mainly processed into fermented products and cheese. Thus, factors influencing milk quantity and quality, such as subclinical mastitis, have an overwhelming effect on economic losses to the farmer. In recent studies it was demonstrated that curd yield and its properties were damaged by subclinical mastitis as well, thus posing a secondary loss to the dairy industry (Leitner *et al.*, 2004a,b).

The present study aimed to analyze the major factors that influence milk yield in Assaf sheep and Saanen, and Shami x Anglo Nubian goats, the major small ruminant dairy breeds and crossbreds in Israel.

Materials and Methods

Six different farms with 745 Israeli-Assaf dairy sheep and 682 goats were surveyed (Table 1). Animals in each flock were sampled once during March-April or during September-October. Each sampling time, one-third of the animals were 15-30 days post-partum, one-third were in peak lactation and one-third were at the end of lactation before drying-off. Similar proportions of each group were in the first, second and third or more lactations. Udder halves were tested for udder bacterial condition, California mastitis test (CMT), somatic cell count (SCC), N-acetyl-β-D-glucosaminidase (NAGase) activity and milk composition (fat, protein and lactose). Lactation, days in milk (DIM), and milk yield were recorded by the owner up to two weeks before or after sampling time. Data were statistically analyzed with a nested block design using SAS JMP (SAS, 2002).

Results

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Udders infected with bacteria in the flocks tested ranged between 25% and 50%. Various species of coagulase-negative staphylococci (CNS) were the main pathogen group in the infected udders (Table 1). The methods used to test inflammation response of the udder, CMT, SCC and NAGase activity, differed between infected and uninfected bacteriology status ($P < 0.001$) (Table 2).

Table 1 Distribution of 745 dairy sheep udders (1490 halves) and 682 dairy goat udders (1364 halves) from six different flocks, according to udder bacteriology infection

Bacteria	Number of udder halves	
	Sheep	Goats
S. aureus	8	45
Coagulase-negative staphylococci (CNS)		
S. chromogenes	78	28
S. epidermidis	275	171
S. haemolyticus	2	-
S. simulans	68	97
S. xylosus	21	36
S. caprae	-	77
Total CNS	444	409
Streptococci	31	8
Coliforms	10	15
Corynebacteria sp.	29	12
Total infection	522 (33%)	489 (35.9%)
Total uninfected	968 (65%)	875 (64.1%)

Table 2 Mean of California mastitis test (CMT), somatic cell count (SCC), N-acetyl-β-D-glucosaminidase (NAGase) activity, according to udder bacteriology status, flock, lactation number and days in milk

	Sheep			Goats		
	CMT	SCC	NAGase	CMT	SCC	NAGase
Status						
Uninfected	0.65	374,000	38.1	0.91	485,000	22.6
Infected	2.23	3,272,000	76.6	1.59	2,203,000	26.4
Effects						
Bacteriology status	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Flock	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0028	NS
Lactation	NS	NS	NS	0.002	NS	0.003
Days in milk	NS	NS	0.0001	< 0.0001	NS	NS

NS - Not significant

The owners on the farms recorded milk yield. In the cases where only one half was infected, each half was recorded as having the same milk yield. Consequently, analyses were made as follows: two uninfected halves; one infected half; two infected halves. Effects of bacteriological status on milk yield of sheep or goats over flock, lactation and DIM are summarized in Table 3.

In sheep, the average milk yield of animals with two uninfected udder halves was higher ($P < 0.001$) than that of animals with only one infected half and both were higher ($P < 0.001$) than milk yield from animals with two infected halves (2.05, 1.78 and 1.44 kg/day, respectively) (Table 3). Effects of flock, lactation and DIM were also significant. In goats, the average milk yield of animals with two uninfected halves and that of animals with only one infected half did not differ, but values for both groups were higher ($P < 0.05$) than for animals with two infected udder halves (2.68, 2.68 and 2.42 kg/day, respectively). Effects of flock, lactation and DIM were also significant.

Milk composition (fat, proteins and lactose concentrations) varied among flocks (Table 4). Bacteriological udder infection significantly decreased the lactose concentration in milk of both sheep and goats. Fat level was not significantly different between infected or uninfected udders in sheep. However, in goats, fat level was significantly lower in the infected udders. Protein levels were higher in uninfected udder

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halves, but only in sheep was this difference significant. In both sheep and goats, fat and protein levels increased with increasing lactation number and DIM, although in goats, the effect of lactation was not significant.

Table 3 Mean of milk yield according to udder bacteriology status (two uninfected halves, one infected half and two infected halves) and effects of udder bacteriology status, flock, lactation number and days in milk

	Sheep	Goats
	Milk (kg/day)	Milk (kg/day)
Status		
Uninfected (2 halves)	2.05	2.68
Infected (1 half)	1.78	2.68
Infected (2 halves)	1.44	2.42
Effects		
Bacteriology status	< 0.0001	0.05
Flock	< 0.0001	0.0029
Lactation	< 0.0001	0.0027
Days in milk	< 0.0001	< 0.0001

Table 4 Means of percentage fat, protein and lactose, according to udder half bacteriology status, flock, lactation number and days in milk effects

	Sheep			Goats		
	Fat	Protein	Lactose	Fat	Protein	Lactose
Status						
Uninfected	4.90	5.59	4.94	3.74	3.81	4.59
Infected	5.03	5.69	4.29	3.57	3.83	4.40
Effects						
Bacteriology status	NS	< 0.0001	< 0.0001	0.0041	NS	< 0.0001
Flock	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Lactation	0.006	< 0.0001	0.02	0.02	NS	NS
Days in milk	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0007	< 0.0001

NS = Not significant

Discussion

Effects of subclinical mastitis caused by CNS include a drastic increase in SCC and a decrease in milk yield. Changes are more acute in sheep compared with goats: SCC was quadrupled and milk yield was decreased by 30% in sheep, and in goats SCC was doubled and milk yield was only slightly decreased. However, in both sheep and goats, the direct income loss from decreased milk yield and the strong immune response to bacterial udder contamination, which results in the increase of SCC, appear of much greater magnitude than noted in dairy cows. The implication of this result is that for a given percentage of animals with udders contaminated with CNS, the increase in SCC will be much higher in bulk milk of dairy sheep than cows. In dairy sheep and goats, grading milk according to SCC as currently practiced in herd improvement programs will place great pressure on growers to produce milk of higher quality.

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