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Short communication

Estimate of milk and curd yield loss of sheep and goats with intrammamary infection and its relation to somatic cell count

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Abstract

Equations for predicting milk and curd loss due to intramammary infection in sheep and goat herds were derived. The empirical equations were derived from previously published studies conducted by this team with Assaf sheep and crossbreeds of goats in Israel. From these equations, it appears that infection of 25, 50 and 75% of the udders in a given herd was associated with loss of 4.1–12.2.5% milk in sheep and 0.8–2.3% in goats; whereas curd loss was 5.2–15.5% in sheep and 3.3–9.8.9% in goats. Based on percent of udder infection and projected SCC, the following categories are suggested for classification of sheep and goat milk: i. High-quality milk <800,000 SCC/mL, associated with infection of ~25%; ii. Medium quality milk <1,500,000 SCC/mL, associated with infection rate between 25 and 50%; iii. Low-quality milk >1,500,000 SCC/mL, associated with infection rate above 50%; iv. Milk containing >3,500,000 SCC/mL should not be accepted for human consumption.

Keywords: Sheep; Goat; Udder infection; Milk yield; Curd yield

1. Introduction

The major income from dairy animals is derived from their milk; therefore, factors that reduce milk quantity and quality can cause high economic losses to the farmers. In the case of dairy goats and especially sheep, most, if not all of the milk is processed into fermented products and cheese; therefore, any reduction in the content of the dry matter, mainly casein, will have a detrimental influence on the industrial value of the milk. In recent years there is an effort in industrialized countries to implement payment schemes for goats and sheep milk based on somatic cell count (SCC) and protein content, similar to those practiced for bovine milk (Gonzalo et al., 1994). Consequently, factors influencing milk quality that were ignored hitherto are now proving to be more crucial to the farmers than ever before. Goat and sheep farming encompass a greater variety of breeds and more different management systems than the farming of dairy cows. To date, variations between countries in the acceptable levels of SCC in healthy udders exist (Maisi et al., 1987; Fthenakis et al., 1991; Fthenakis, 1994; Gonzalez-Rodriguez et al., 1995). Moreover, the effect of the number of somatic cells in the milk on the final product (quality and yield) is unclear.

In Israel, clinically infected glands of goats and sheep are not always treated, and even if treated, it saves the animal but leads in most cases to irreversible loss of

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gland function and degeneration of the infected gland. Consequently, either the animal is culled or the infected gland is not milked for the rest of the animal's productive life. Thus, although clinical mastitis causes direct economic loss to the farmers, in most cases it does not affect the quality of the bulk milk. In contrast, subclinically infected udders are subtle and therefore are milked into the bulk milk tank.

In dairy cows, subclinical mastitis, ranging from 20–50% (Wilson et al., 1997; Janosi and Baltay, 2004; Pitkala et al., 2004) is largely ignored because the increase in SCC in infected gland is modest (about 300–500 $\times$ 10^3 cells/mL) and the mixing with the milk from uninfected quarters is sufficient in most cases to appreciably lower the effect of SCC on the cow level, and hence, the herd bulk milk (Djabri et al., 2002).

Previous studies of dairy sheep and goats (Gonzalez-Rodriguez et al., 1995; Mavrogenis et al., 1999; White and Hinckley, 1999; Leitner et al., 2004a,c; Luengo et al., 2004) demonstrated that intramammary infection (IMI) in its subclinical form is the single most important factor affecting milk quality and quantity, although other factors such as stage of lactation, lactation number, time of day, lentivirus infection and management (Menzies and Ramanoon, 2001) could be of relevance. The major types of bacteria involved in dairy cow subclinical mastitis are the same as in sheep and goats, which are various coagulase-negative staphylococci (CNS), that are found on the skin of the udder and its surroundings (Haenlein, 2002; Bergonier and Berthelot, 2003; Bergonier et al., 2003; Leitner et al., 2000, 2003, 2004a,b,c). However, because sheep and goats have only two mammary glands mixing of milk with high SCC coming from infected glands with low SCC from a healthy gland is insufficient to reduce the SCC on the animal level and obviously not in the bulk milk tank. These changes in SCC were found to be associated with loss of curd yield and deterioration in its quality (Leitner et al., 2004a,b).

As subclinical mastitis is not visually detected and sometimes hard to evaluate, there were few attempts to evaluate its incidence in herds through indirect markers, such as the bulk tank somatic cell count (BTSCC). Lukas et al. (2005) suggested that monitoring BTSCC in dairy cows could be used to estimate subclinical mastitis prevalence during the monitored test days. Similarly, in dairy goats and ewes, a relationship between the annual geometric mean of BTSCC and the estimated prevalence of IMI was demonstrated (Bergonier et al., 2003; Berthelot et al., 2006).

The aim of this presentation is to evaluate the losses of milk and consequently cheese at the herd level in relation to IMI in herds of Assaf sheep and Saanen and Shami $\times$ Anglo-Nubian goats, the major dairy breeds and crossbreeds of small ruminants in Israel. In order to do so we re-analyzed previously published data (Leitner et al., 2004b,c,d). An outcome from this analysis would provide farmers with a tool to assess the economic losses associated with prevalence of IMI in their herd, and dairies with a scheme to grade sheep and goat milk according to BTSCC.

2. Methods

The results of studies that included an overall follow-up of health measures on a herd level (Leitner et al., 2003, 2004d) and individual level of animals within a herd, using the udder-half model (Leitner et al., 2004b) (Table 1) were analyzed. The data on the herd level provided a large set, albeit one major drawback being that it was not possible to separate the recording of milk between animals with infection in one or two glands. In these studies, milk yield was recorded by the owners at the animal level; therefore, the analysis of the data was based on animals with two uninfected glands compared to animals with both glands infected. The udder-half model, where each animal had one udder half chronically infected with bacteria in a subclinical form of mastitis and the contra lateral gland free of bacteria provided more insight for the understanding and mea-

Table 1
Milk and curd loss due to subclinical IMI for sheep and goat

Specie	No. of animals	SCC ($\times$1000)		Milk (infected halves)			Milk loss (%)		Curd loss (%)	Study reference
		−	+	0	1	2	1	2		
Sheep	823	141	2089	2.88	2.80	1.81	2.8	37.2	–	Leitner et al., 2003 (1)
	745	374	3272	2.05	1.78	1.44	13.2	29.8	–	Leitner et al., 2004d (2)
	26	270	2358	–	–	–	–	52.6[a]	4.37[a]	Leitner et al., 2004b (3)
Goat	682	485	2203	2.68	2.68	2.45	0	9.7	–	Leitner et al., 2004d (2)
	25	417	1750	–	–	–	–	31.9[a]	9.97[a]	Leitner et al., 2004c (4)

0, not infected; 1, infected in one gland; 2, infected in 2 glands.
[a] Results obtained by the udder-half model.