

MASTITIS OF DAIRY EWES: ETIOLOGY, DETECTION, AND CONTROL

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Intra-mammary infections of dairy ewes

1. Etiology

In milk sheep production, intra-mammary infections (IMI) (clinical and subclinical mastitis) are mainly due to Staphylococci bacteria. Frequency of clinical mastitis is generally not greater than 5%. The main isolated bacteria is *Staphylococcus aureus* (from 16.7 up to 57.5% of clinical mastitis). Bacteria considered as minor pathogens when isolated in dairy cows, mostly CNS*, are responsible for 10.3 to 59.6% of clinical mastitis. Frequency of other bacteria: Streptococci, Pasteurella, or *Escherichia Coli* is very low (Marco Melero, 1994).

Nowadays, prevalence of mastitis in dairy ewes is not well known and can vary considerably, but it can be estimated with somatic cell count (SCC) in bulk tanks. Early results coming from studies carried out in France show that about 20 to 30% of new infections occurring during a year are associated with SCC values within the range of 600,000 to 800,000 per ml.

Etiology of sub-clinical mastitis is the following:

- most infections are principally due to minor pathogens (CNS) and particularly *Staphylococcus epidermidis*;
- low infection rate due to Streptococci bacteria;
- low infection rate due to environmental bacteria, especially *Escherichia Coli*.

During lactation, persistence of mastitis is high because of their origin (Staphylococci).

During the dry period, the rate of spontaneous recovery is estimated around 60 to 67% of half udders including cases of substitution of infections. In fact, it can be estimated that only about 45% of half udders are sterile.

2. Transmission and risks

Staphylococci bacteria come from the skin of teats where they live and spread out. The main factors of transmission are milking machines, especially liners, and sometimes milkers (hands). Risks of transmission occur during milking when vacuum level and/or pulsation characteristics are not well adjusted and when milkers have a poor routine with overmilking.

Transmission also occurs when milkers strip ewes at the end of milking and remove clusters without shutting the vacuum off; then, likelihood of impacts of infected milk droplets against teats is very high. It is now well known that impacts are one of the main causes of mastitis in dairy cows and there is probably no reason to think that the same physical phenomena does not induce the same effects in dairy ewes.

* Coagulase Negative Staphylococci

Discovering infected animals

In dairy sheep production, effect of non-infection factors such as stage and number of lactation on SCC is very low; so, since the number of somatic cells in milk is indicative of a degree of udder infection, SCC should be reliable to predict IMI infections.

Only a few studies trying to evaluate the accuracy of a presumptive diagnostic test based on SCC in predicting infection status of the udder have been made till now.

Authors have suggested that the difference in SCC between healthy and infected udders should be within 200,000 to 500,000 cells/ml (Beltran de Heredia and Iturritza, 1988; Fthenakis, 1994; Romeo and al., 1994). Most authors suggested punctual thresholds within 200,000 to 800,000 for diagnosis of IMI infections (discrimination between infected and non-infected udders or halves).

French studies (Bergonier et al., 1997) suggest to divide the population into 3 categories instead of 2 in respect of individual data of ewes during the whole lactation:

- An udder is considered as uninfected, if every SCC measurement except two do not exceed 500,000 cells/ml during the whole lactation.
- An udder is infected if at least two SCC measurements during the lactation exceed 1,000,000 cells/ml.
- Infection status of the udder is uncertain in all other cases.

Accuracy of this prediction is about 80%.

Different authors (Zivet et al., 1968; Deutz et al., 1990; Regie et al, 1991; Baumgartner et al., 1992; Marco Melero, 1994; Gonzales-Rodriguez et al., 1996) found a good correlation between SCC and California Mastitis Test. This is why CMT appears to be a good tool to detect infected animals when individual SCC cannot be regularly checked.

Using SCC data of bulk tank

In France, farmers' organizations and dairy manufacturers in the Roquefort and the West-Pyrenees areas, have defined a method to follow changes in SCC in the bulk tank (2 to 3 samples per month from every farm). In the Roquefort area, SCC is one of the criteria involved in determination of the milk price since 1993.

From 1991 until 1996, fluctuations in average SCC have been relatively low: from 570,000 up to 800,000 cells/ml (Table 1). The two areas do not have different results even though there are different breeds and different management conditions in the two areas. SCC in dairy sheep are greater than those of dairy cows but lower than those of dairy goats (Table 1).

Table 1 - Average SCC in bulk tanks from 1991 until 1996

Area	Averages (x 1000 cells/ml)					
	1991	1992	1993	1994	1995	1996
Roquefort	757	701	685	714	569	675
West Pyrenees	751	737	802	741	674	734

In the Roquefort area, a penalty of 0.20 F (3 cents) and 0.45 F (8 cents) is respectively applied when bulk tanks have more than 1.0 million and 1.5 million cells/ml, respectively. Introducing SCC as a criteria in determining the price of milk has considerably increased interest of farmers to improve management of ewes and especially milking machine efficiency related to mastitis. Figure 1 gives the frequency of different categories of SCC in the two main areas of sheep milk production in France.

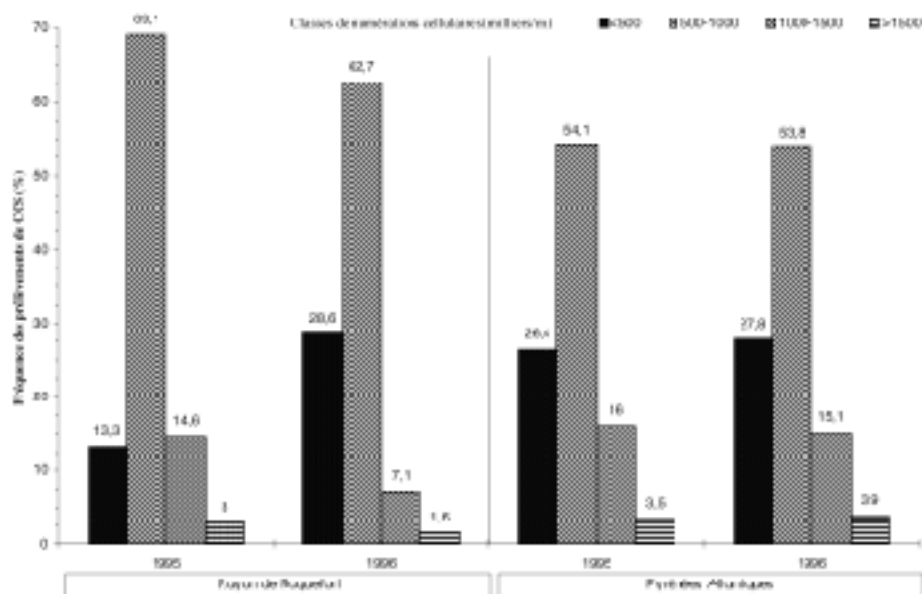


Figure 1 - Frequency of categories of SCC in Roquefort and West Pyrenees areas

SCC in the bulk tank are relatively high at the beginning of the campaign (lactation), decrease, and then slowly raise up to about 900,000 cells/ml at the end of the milking campaign (Figure 2).

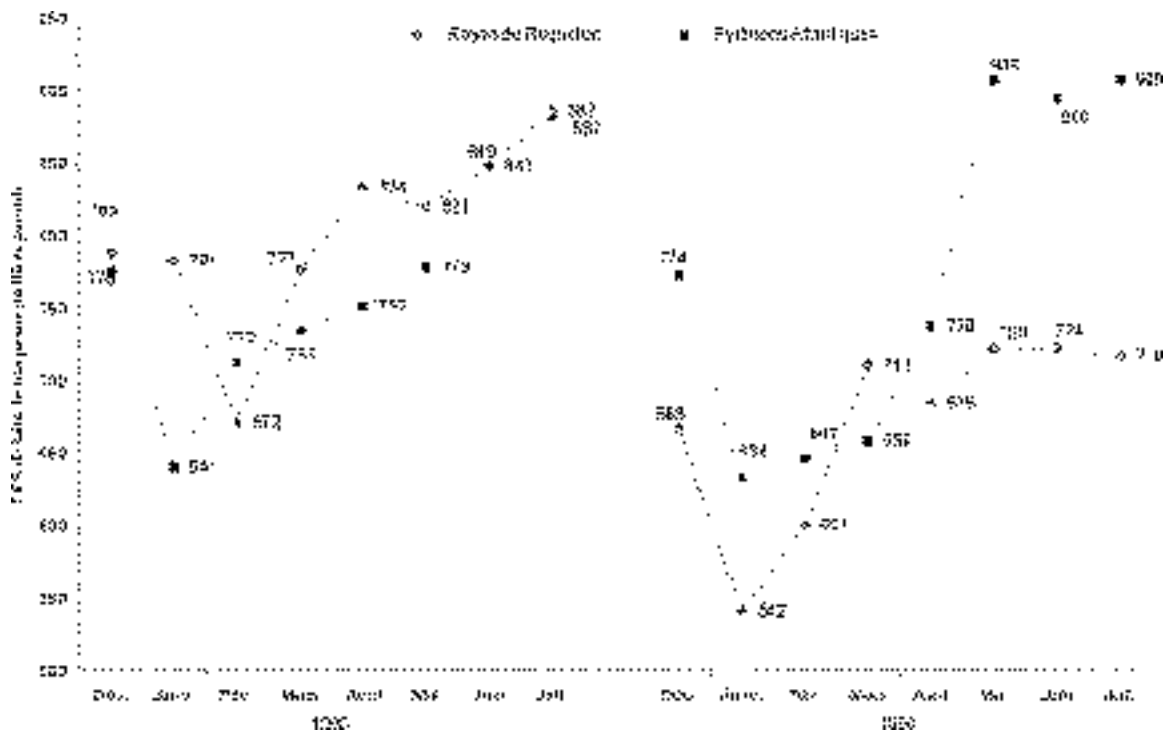


Figure 2 - Monthly variation of SCC in sheep flocks

Monthly variation of SCC can easily be related to the seasonal production of milk. In France, milk production traditionally begins in November-December and finishes in July-August; 60% of the milk production is collected from January until April. Variations in SCC are also correlated with management breeding conditions. It is possible that the beginning of the pasture period in March-April in the Roquefort area and the reproduction period may have some effects on bulk tank SCC.

Actual studies (European programme FAIR) are being conducted to have a better idea of possible relationship between individual SCC and bulk tank SCC. SCC (individual and tank) and milk production have been recorded for 4 to 6 years. Distribution of individual data has been recorded for each category of bulk tank SCC to estimate the relative rate of individual SCC to bulk tank SCC. On average, milk from a bulk tank with 440,000 cells/ml is constituted of 6.5% of ewes with individual SCC exceeding 2 million cells/ml which produce 5.5% of the milk and provide 76.6% of the cells in the tank (Figure 3).

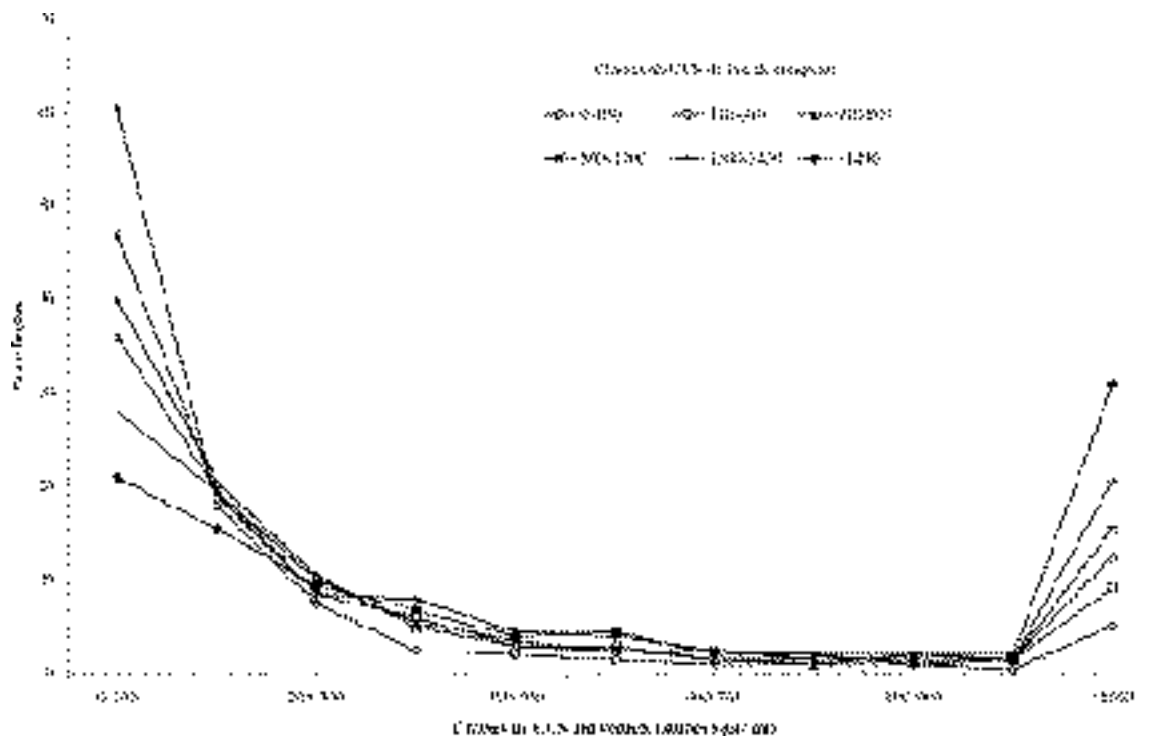


Figure 3 - Distribution of individual SCC in relationship to bulk tank SCC

The distribution of individual SCC for different levels of SCC in the tank depends on the relative ratio of ewes in the extreme categories (less than 500,000 cells/ml and more than 1 million cells/ml (Table 2).

Table 2 - Distribution of individual SCC associated with bulk tank SCC

SCC categories (cells per ml)	Ewes with SCC(%) < 500,000 cells per ml	Ewes with SCC > 1,000,000 cells per ml (%)
< 400,000	90.1	5.1
400,000-600,000	83.5	9.2
600,000-800,000	78.9	12.5
800,000-1,000,000	74.8	15.5
1,000-1,400,000	68.2	20.6
> 1,400,000	56.7	30.9
Correlation with tank SCC	0.79	0.83

Using the thresholds suggested by Bergonier et al., the distribution of individual SCC related to the bulk tank shows that the level of SCC of the bulk tank depends above all on the presence of ewes with high individual SCC.

When considering the whole lactation, prevalence of IMI infections could be deduced from tank SCC as shown in Table 3.

Table 3 - Prevalence of mammary infection and bulk tank SCC

Annual average SCC of milk tank	< 400,000	400,000-800,000	> 800,000
Number of flocks	14	36	23
Average SCC of the flock	302,000	572,000	1,094,000
% ewes with healthy udders	83.6	71.9	58.7
% ewes with uncertain udder health	10.5	15.6	15.7
% ewes with infected udders	5.9	12.6	25.6

The percentage of infected ewes increases 3.5% for every 100,000 cells per ml increase in bulk tank SCC.

Conclusion

IMI infections in dairy ewes have different characteristics from those observed in dairy cows. However, prevention and elimination of infections require various measures which have already proved their effectiveness in dairy cattle, for example:

- Control and good maintenance of milking machines.
- Good milking routine without overmilking and removal of clusters without impacts.
- Hygiene after milking (disinfection of teats) (if possible).
- Good housing management.

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