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# Comparing the Incidence of Mastitis in Sheep Flock with Different Milking Methods

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**Abstract:** Maintaining good health in dairy farms is a challenge for all involved in primary milk production. Despite the increasing level of technical support during milking, inflammation of the mammary gland - mastitis is still one of the main problems affecting ewes' health and welfare. The aim of the work was to study the occurrence and etiology of mastitis in two sheep farms with different milking technology. At the start of milking season (after the lamb weaning) were examined 400 and 352 sheep in a farm with machine milking technology and hand milking, respectively. The comparison of both farms showed a reduced incidence of mastitis by 6% in the flock with machine milking technology. The most common subclinical forms were recorded in both farms with an increased score of California mastitis test. In flock with machine milking technology, the most frequently isolated udder pathogens were *S. aureus* and non-aureus staphylococci (NAS). In addition to NAS in flock with hand milking were the most frequent *E. coli* and *E. faecalis* which indicates reduced level of hygiene and sporadic observation of the hygiene rules during milking.

**Keywords:** Sheep; Hand milking; Mastitis; Prevalence; Udder pathogens.

## 1. Introduction

Healthy ewes are the foundation for sustainable milk production. However, inflammation of the mammary gland - mastitis and other infectious diseases are common problems in dairy herds, resulting in increased costs and decreased production [1].

The disease not only reduces the amount of milk produced, but also decreases its quality and therefore often becomes a reason for exclusion of affected individuals from rearing. Mastitis also adversely affects the biological, hygiene and nutritional parameters of the milk produced resulting in negative impact on further processing of such milk [2].

Mastitis can be caused by non-infectious or infectious factors. The infectious ones are mostly of microbial origin as up to 95% of mastitis is caused by pathogenic bacteria that penetrate into the mammary gland through the teat channel. The bacteria causing the most common forms of mastitis may be considered within two groups. Contagious pathogens (e.g. *Staphylococcus aureus*, *Streptococcus agalactiae*, or *Streptococcus dysgalactiale*). These

organisms can survive and grow within the mammary gland so that transmission of infection from infected to uninfected halves and from sheep to sheep is most likely to occur during milking [3]. Environmental pathogens thrive in the environment, especially where ewes' faeces are involved. Of this group, *E. coli* is the most important with multiple strains of varying pathogenicity for animals and humans. Others include *Streptococcus uberis*, non-aureus staphylococci (NAS), *Corynebacterium* spp., *Pseudomonas* spp., *Serratia* spp., *Proteus* spp., *Pasteurella* spp., *Listeria* spp., *Leptospira* spp., *Yersinia* spp., *Enterobacter* spp., *Brucella* spp. and *Mycobacterium* spp. [4,5].

According to Vasil et al. [6] the incidence of mastitis on individual sheep farms ranges from 5 to 30% and depends mainly on the hygiene level of rearing, milking and milk treatment. Therefore, the aim of this study was to evaluate the incidence and etiology of ewe mastitis on two farms using different milking technologies.

## 2. Material and methods

### 2.1 Characteristics of sheep herds and milking

***Sheep farm – A,*** comprised 420 sheep of the Improved Valachian breed, that were housed during the winter in two brick sheep houses on deep bedding that were fitted with feeding troughs and drinkers. Machine milking of sheep was performed in a double-row milking parlour 2 x 12 Miele Melktechnik (Hochreiter Landtechnik, Germany) twice a day after weaning of lambs, during April - September. Before the milking, a dry udder toilet was performed according to Gyarmathy [7]. During milking, the milk was collected in a mobile milk tank and after milking it was immediately transported to a hut for further processing.

**Figure 1:** Sheep flock with machine (A) and hand (B) milking

***Sheep farm - B***, comprised 370 sheep of the Improved Valachian and Tsigai breeds, which were housed in a brick sheep house on deep litter during the winter. Manual milking of sheep was performed after weaning of lambs, during April - September, twice a day in a covered strunga (milking pen) with three fixing places interconnected with running aisles. The milk was collected into 10 l buckets and then poured into a stainless steel tank and transferred into a hut for further processing.

### 2.2 Mammary gland examination and sampling

A complex examination of the mammary gland health in ewes A and B was carried out at the beginning of the milking season (April). The ewes underwent a clinical examination of the mammary gland during each complex examination, and the milk from each half was evaluated by the California mastitis test according to Fthenakis [8]. Bacterial agents of mastitis were cultured and isolated from individual milk samples from 400 ewes from farm A and 352 ewes from farm B, according to Malinowski et al. [9].

The biochemical identification of each species was made by STAPHYtest 24, Strepto test 24, and ENTEROTESt 24 by program TNW ProAuto 7.0 (Erba-Lachema, Brno, CZ) with a probability of correct designations of the kind above 90%.

### 2.3 Statistical analysis

The differences in the prevalence of mastitis among monitored farms of ewes were statistically analyzed using the Chi-square test. The dependence of the individual signs was tested at a significance level $\alpha = 0.05$.

## 3. Results and Discussion

The period of lactation plays an important role in the incidence of mastitis. It should be noted that especially start of lactation immediately after lambing is described as another moments of great importance for the weakening of the body and infection of the mammary gland [5].

Complex examination of ewes (400 – flock A; 352 - flock B) from two farms with different milking technology at the beginning of the season showed that the incidence of mastitis reached 15.3% on farm A and 21.3% on farm B. The most common forms of intramammary infection (IMI) were subclinical mastitis in both farms (Fig. 2). Of the major udder pathogens, *S. aureus* and *S. uberis*, the agents causing mainly the clinical forms of mastitis, were isolated on both farms. Of the causal organisms of subclinical forms, NAS – namely *S. schleiferi, S. chromogenes* and *S. epidermidis*, were isolated from milk on both farms (Table 1).

Generally, IMI begins when pathogens passes through the teat canal, interacts with the mammary tissue cells, multiplies and disseminates in the cisterns and throughout the duct system. The onset of infection depends on the immune response of the mammary gland tissue as a factor in the virulence of the pathogen itself [10].

If both halves of the udder are affected by inflammation, the consequences may be serious, occurring in the form of mammary gland involution resulting in a significant reduction in milk production, which has a negative impact on overall production and the risk of possible transmission of udder pathogens within the flock. Other losses associated with mastitis are the cost of treatment and the slaughter of sheep due to permanent udder damage. In very severe cases, gangrene can develop and the sheep can die [11].

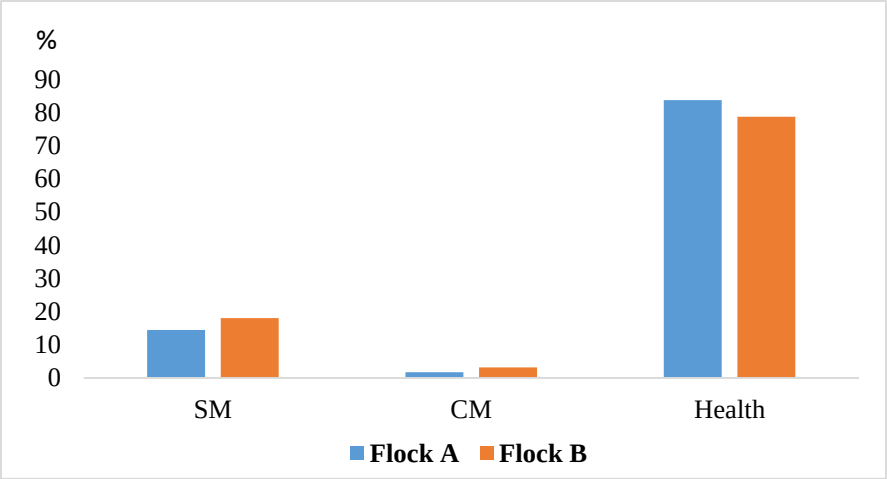


**Figure 2: Comparison of the occurrence of sheep mastitis in monitored farms**

Note: Flock A - sheep farm with milking machine technology, Flock B - sheep farm with hand milking, SM – subclinical mastitis, CM – clinical mastitis

**Table 1: Occurrence of mastitis in sheep farm** (A) **with machine milking and in sheep farm** (B) **with hand milking**

| Isolated bacteria | Flock A (n=400) | | Flock B (n=352) | | Subclinical forms | | | | Clinical forms | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Flock A | | Flock B | | Flock A | | Flock B | |
| | *n* | *%* | n | % | n | % | n | % | n | % | n | % |
| *Staphylococcus* spp. | | | | | | | | | | | | |
| *S. aureus* | 9 | *2.3* | 5 | *1.4* | 6 | *1.5* | 3 | *0.8* | 3 | *0.8* | 2 | *0.5* |
| Non-aureus staphylococci | | | | | | | | | | | | |
| *S. schleiferi* | 14 | *3.5* | 9 | *2.4* | 14 | *3.5* | 9 | *2.4* | 0 | *0* | 0 | *0* |
| *S. chromogenes* | 9 | *2.3* | 7 | *1.9* | 8 | *2.0* | 7 | *1.9* | 1 | *0.3* | 0 | *0* |
| *S. epidermidis* | 7 | *1.8* | 15 | *4.0* | 7 | *1.8* | 13 | *3.5* | 0 | *0* | 2 | *0.5* |
| *S. caprae* | 6 | *1.5* | 2 | *0.5* | 6 | *1.5* | 2 | *0.5* | 0 | *0* | 0 | *0* |
| *S. felis* | 0 | *0* | 4 | *1.1* | 0 | *0* | 4 | *1.1* | 0 | *0* | 0 | *0* |
| *S. simulans* | 4 | *1.0* | 2 | *0.5* | 4 | *1.0* | 2 | *0.5* | 0 | *0* | 0 | *0* |
| *Streptococcus* spp. | | | | | | | | | | | | |
| *S. uberis* | 5 | *1.3* | 2 | *0.5* | 4 | *1.0* | 0 | *0* | 1 | *0.3* | 2 | *0.5* |
| *S. sanguinis* | 4 | *1.0* | 1 | *0.3* | 2 | *0.5* | 0 | *0* | 2 | *0.5* | 1 | *0.3* |
| Other environmental bacteria | | | | | | | | | | | | |
| *E. faecalis* | 1 | *1.3* | 11 | *3.0* | 5 | *1.3* | 9 | *2.4* | 0 | *0* | 2 | *0.5* |
| *E. coli* | 2 | *0.5* | 10 | *2.7* | 2 | *0.5* | 7 | *1.9* | 0 | *0* | 3 | *0.8* |
| *A. viridans* | 0 | *0* | 4 | *1.1* | 0 | *0* | 4 | *1.1* | 0 | *0* | 0 | *0* |
| *Bacillus spp.* | 0 | *0* | 3 | *0.8* | 0 | *0* | 3 | *0.8* | 0 | *0* | 0 | *0* |
| **Total** | 61 | ***15.3**$^{a}$* | 75 | ***21.3**$^{b}$* | 54 | ***14.5*** | 63 | ***18.1*** | 7 | ***1.8*** | 12 | ***3.2*** |

Note: Flock A - sheep farm with milking machine technology, Flock B - sheep farm with hand milking. $^{a,b}$Significant difference $p < 0.05$ when significance level $\alpha = 0.05$ (5%).

According to Wentz et al. [12] many cases of clinical mastitis are caused by Gram-positive microorganisms (*Staphylococcus* spp. or *Streptococcus* spp.) however, bacteremia develops in a substantial proportion of ewes with coliform mastitis. Depending on the farm structure and hygiene status, about 20% of udder infections are caused by Gram-negative microorganisms. This is consistent with our results where IMI caused by *E. coli* accounted

13.3% from all mastitic ewes in monitored herd with hand milking. Their presence in the mastitic milk samples indicates a reduced level of hygiene and mammary gland toilets during the milking process.

The polyethiological and multifactorial nature of ruminants' mastitis in combination with major and environmental udder pathogens makes sporadic adherence to a milking hygiene program (especially hand milking) is often ineffective [13]. In an effort to eliminate the incidence of mammary gland diseases based on the results obtained in the monitored farms, it is necessary to reduce the effect of adverse factors on the ewe. The main principles include ensuring adequate housing of sheep, compliance with hygiene measures during milking, application of preventive anti-mastitis methods with early antimicrobial and anti-inflammatory treatment of clinical forms of mastitis, which allows to successfully address the disease and ensure the production of safe milk and milk products.

## 4. Conclusion

The results of the work indicate an increased incidence of mastitis in the farm of ewes with manual milking. The reduced level of hygiene associated with manual milking adversely affects the quality of milk as there is a much greater possibility of contamination of milk with various impurities (dust, faeces, wool, etc.) and introduction of a large number of pathogenic bacteria into the milk.

In addition to meeting the conditions of the rearing standard and hygiene in production of milk at both machine and conventional hand milking, the systematic health control of both the entire flock and individual ewes and their performance still remains an important issue. The health status of the mammary gland of sheep and its performance should be permanent indicators of the interest of farmers in their animals throughout the year and not only as part of seasonal organizational measures in the period immediately after weaning and during preparation for milking.

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