

Subclinical mastitis in meat-producing sheep flocks in Quebec

Prevalence, risk factors and antimicrobial resistance to *Mannheimia haemolytica*

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CONTEXT

The productivity of the meat-producing sheep industry in Quebec has been increasing substantially over the last decades, driven in part by a higher lambs per ewe ratio. Profitability is directly related to the number of weaned lambs per ewe, which is influenced by milk production. Therefore, it is paramount to understand the impact on milk production of the numerous pathogenic agents causing subclinical mastitis in ewes.

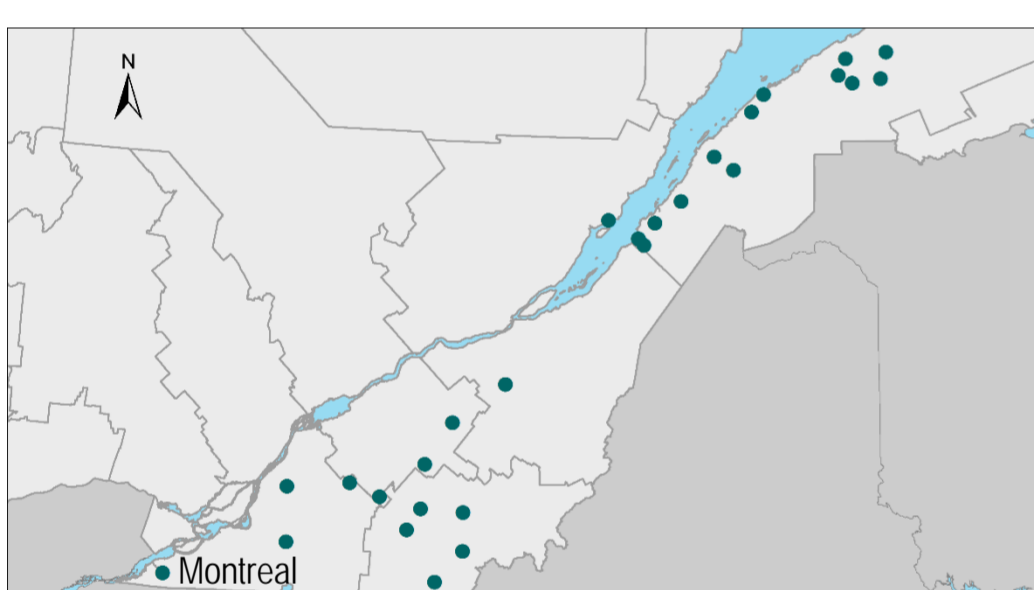
OBJECTIVES

The main objectives of this project were to 1) estimate the prevalence and risk factor for subclinical mammary gland infection and increased somatic cell count in lactating ewes and 2) determine the antimicrobial resistance in *Mannheimia haemolytica* isolates.

METHOD

Sampling plan & protocol

A cross-sectional study was conducted from May to September 2017 in commercial meat-producing sheep flocks located in Quebec, Canada (fig. 1).



All flocks with at least 25 lambings expected during the study period were invited to participate and recruited on a voluntary basis. In each flock, a milk sample was collected in each half-udder of 25 randomly selected lactating ewes (fig. 2).

Analysis

Milk samples were cultured and tested using the California Mastitis Test (CMT) as an indirect evaluation of somatic cell count. Isolates were identified using MALDI-TOF Mass Spectrometry. The bacteriological status of samples was established according to the chart of the Canadian Bovine Mastitis Research Network with adaptations for ovine mastitis. *Mannheimia haemolytica* isolates were tested for antimicrobial resistance using disk diffusion testing. Multi-level regressions were used for risk factor analysis.



RESULTS

Prevalence

A total of 756 ewes from 30 flocks were included in the study. For the purpose of this study, here are the relevant definitions:

- ① a **positive CMT**: milk sample with a CMT score of 1+ and over
- ② a **mammary gland infection**: positive milk sample for bacteriological analysis
- ③ a **subclinical mastitis**: positive milk sample to both ① and ②

The most frequent mammary gland pathogens isolated from ewes were coagulase-negative *Staphylococcus spp* (CNS, 14.9%), *Staphylococcus aureus* (5.7%), *Streptococcus spp* (3.6%) and *Mannheimia haemolytica* (1.7%) (fig. 3).

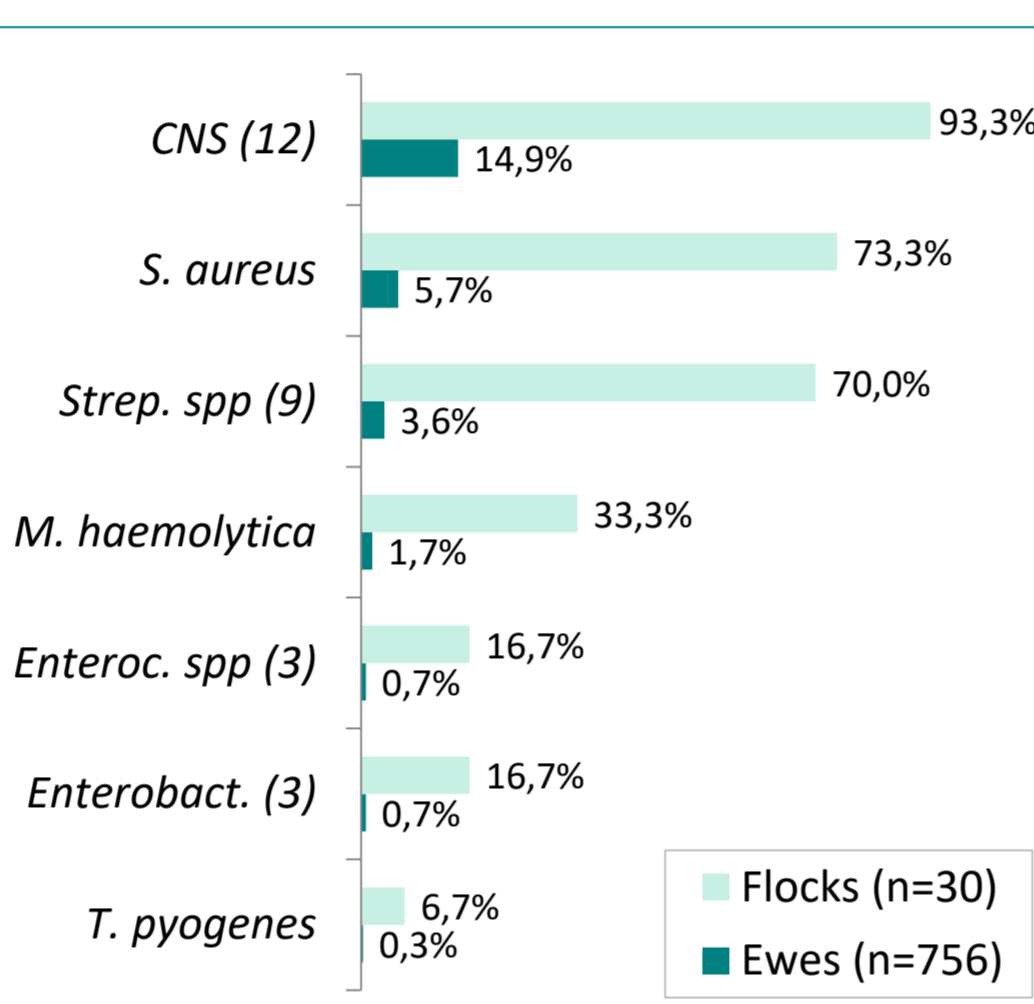


Fig. 3 Prevalence of pathogens at ewe and flock levels (written in brackets are the number of species identified with MALDI-TOF Spectrometry)

The prevalence of ewes with subclinical mastitis in participating sheep flocks ranged from 0 to 36%, with a mean of 17,7% (fig. 4). The pathogens most frequently associated with these subclinical mastitis in sheep flocks were *Coagulase-negative Staphylococci* (90,0%), *Streptococcus spp.* (66,7%), *Staphylococcus aureus* (56,7%) and *M. haemolytica* (33,3%).

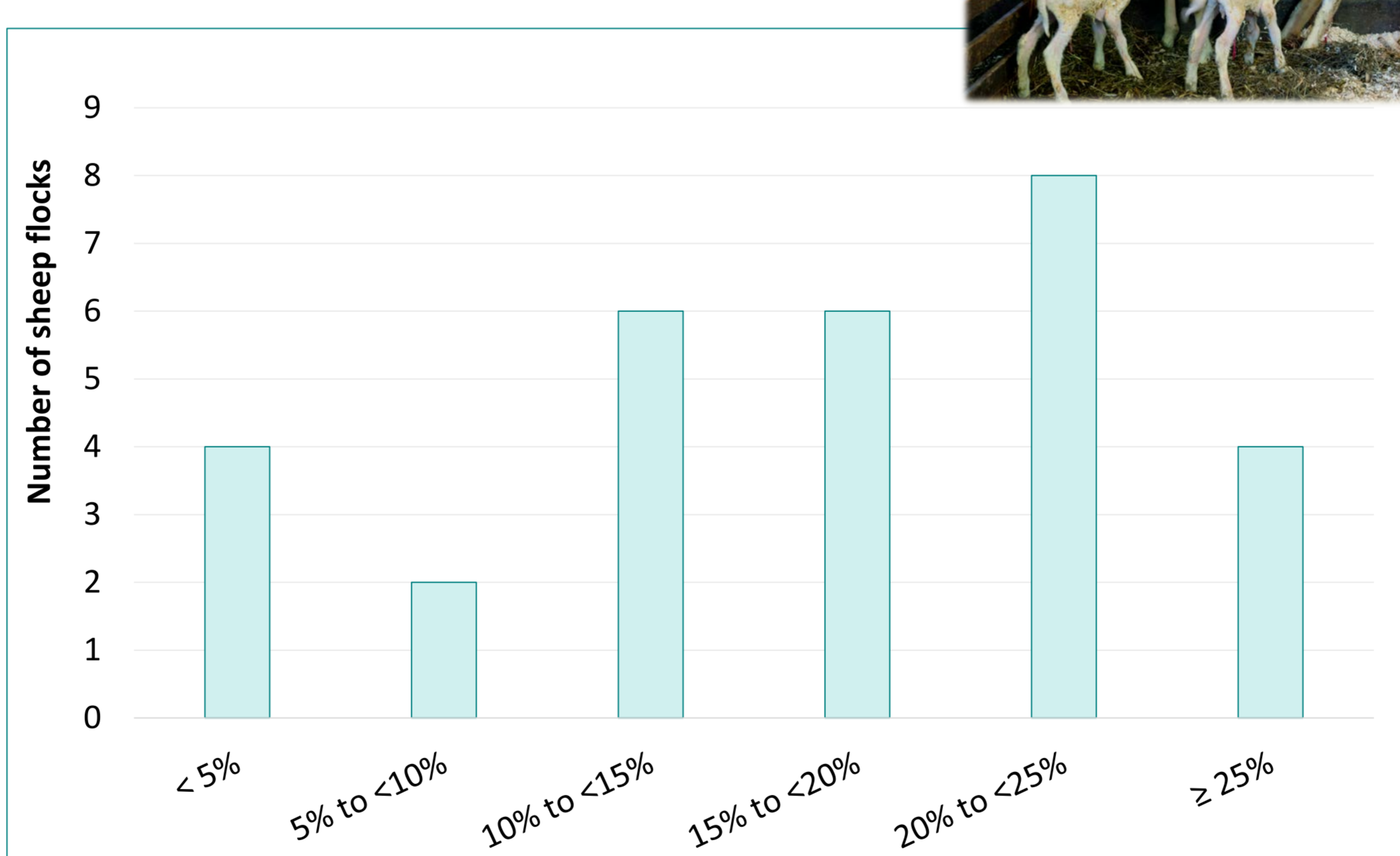


Fig. 4 Distribution of participating sheep flocks according to the prevalence of subclinical mastitis (n=30)

Risk factors

Subclinical mastitis was associated with increased parity, days in milk, and litter size. Multiparous ewes (parity > 4) and those after 30 days in milk had a significantly higher risk of testing CMT-positive and having a positive bacteriological status. The risk of contracting a subclinical mastitis was also higher in ewes with three lambs or more (Table 1).

| Characteristics | Number of samples | % positive |
|---|-------------------|--------------------|
| Parity | | |
| 1 | 117 | 12,8 ^a |
| 2-3 | 143 | 14,7 ^a |
| 4-5 | 82 | 30,5 ^b |
| ≥ 6 | 70 | 32,9 ^b |
| Days in milk | | |
| 0-15 | 91 | 12,1 ^a |
| 16-30 | 223 | 19,7 ^{ab} |
| > 30 | 85 | 27,1 ^b |
| Litter size (nb of lambs raised) | | |
| 1 | 142 | 17,6 |
| 2 | 344 | 17,2 |
| > 3 | 128 | 21,1 |

^{abc} Variables within a same category with different letters are statistically significant according to a univariate logistic regression model adjusted for the aggregation of ewes per flock (random effect).



DISCUSSION

What did we learn from this study?

This study provided insights into the current situation regarding the health of the mammary gland in lactating ewes in Quebec. A large proportion of *M. haemolytica* isolates were resistant to tetracycline, which is of concern considering the high pathogenicity of this bacterium and the reported use of this antimicrobial for the treatment of clinical mastitis by 50% of the participating producers. A better understanding of the aetiological role and persistence of the different pathogenic agents found, as well as their impacts on milk production, is needed.

Intervention strategies

Based on these findings, here are some of our recommendations for the sheep producers:

- Increase note-taking on the udder health state.
- Promote the use of CMT at dry-off as an early detection tool for subclinical mastitis, in order to cull or treat accordingly.
- In the event of a mastitis, carefully establish a treatment plan with your veterinarian to limit bacterial resistance to *M. haemolytica*.
- Regarding *Staph. aureus* – positive ewes: as this pathogen is carried for life, and then dispersed in the environment, culling should be considered for these animals.

NEXT STEPS

- Explore further the relationship between udder health and lamb growth, including a standardised monitoring of lamb performance.
- Carry out a prospective study to determine if an ewe's CMT or bacteriological status during the dry cycle affects the mammary gland, and lamb growth and mortality during the next lactation.
- Determine if genetic traits are associated with an increased risk of mastitis in order to promote genetic selection.
- Compare the effectiveness between intramammary and parenteral treatment for clinical mastitis in ewes.

ACKNOWLEDGEMENTS

We acknowledge the contributions of members of CEPOQ (Johanne Cameron, agr. MSc., Marie-Claude Litalien, tsa), MAPAQ (Isabelle Côté, DVM, PhD, Stéphanie Landry, agr.), FMV (Gabrielle Claing, DVM, MSc student), Hôpital vétérinaire de Sherbrooke (Richard Bourassa, DVM) and the participating sheep producers.

Antimicrobial resistance in *M. haemolytica*

Among the 12 strains of *M. haemolytica* isolated from cases of subclinical (10) or clinical (2) mastitis, 5 were resistant to tetracycline, all were intermediate to erythromycin and all were susceptible to the other 13 antimicrobials tested. All strains were sensitive to trimethoprim-sulfadoxine, an antibiotic commonly used in sheep production.

