

# Description of the intramammary infections dynamics in early lactation heifers on organic dairy farms

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## Introduction

Mastitis is one of the most important diseases affecting dairy cows. Mastitis-causing microorganisms are usually classified based on their epidemiology and phenotypic characteristics: *Staphylococcus aureus* (SAU), non-aureus *Staphylococci* (NAS), *Streptococcus* spp. and *Streptococcus* like organisms (SSLO) and Gram-negative bacteria (GNB). Reports from previous research have shown that organic farms have an increased prevalence of SAU-intramammary infections (IMI) compared to conventional dairy farms. However, little information exists about the dynamics of IMI in early lactation heifers on organic dairies. The objective of this study was to describe the IMI dynamics in early lactation heifers on organic dairy farms.

## Materials and methods

This prospective cohort study enrolled 501 heifers from 5 organic dairy farms from February 2019 to January 2020. Quarter-level milk samples were collected aseptically on a weekly basis in the first 5 weeks of lactation. Samples were pooled into composite samples inside a sterilized laminar hood and submitted for milk culture at the Udder Health Laboratory at the University of Minnesota. Contaminated samples (> 3 different isolates) and cows with results for only 1 or 2 sampling days were excluded from the analysis. In total, 1,697 samples from 397 cows were analyzed. The prevalence, cumulative incidence (overall and by week), and proportion of persistent-IMI (defined as harboring the same microorganism for  $\geq 2$  samples) were calculated using R version 3.6.2.

## Results

The cumulative incidence during the first 5 weeks after calving was 19.1% for SAU, 52.1% for NAS, 33.0% for SSLO and 9.3% for GNB. The weekly incidence of SAU-IMI was 14.4% (sample (S) 1), 3.6% (S2), 1.2% (S3), 0.7% (S4) and 0.7% (S5). The weekly new NAS-IMI was 30.0% (S1), 17.0% (S2), 10.9% (S3), 5.5% (S4) and 7.3% (S5). New SSLO-IMI were 16.1% (S1), 9.1% (S2), 6.3% (S3), 5.0% (S4) and 5.1% (S5). Lastly, GNB had a weekly IMI incidence of 3.0%, 2.4%, 2.4%, 1.7% and 1.4% for samples 2 to 5, respectively. The majority of the new IMI were observed on the first

postpartum sample (75.0% (SAU), 57.5% (NAS), 48.9% (SSLO), 32.4% (GNB)). The proportion of persistent-IMI differed between the studied microorganisms. For instance, 86.8% of the cows with SAU-IMI and 71.7% of cows with *Staphylococcus chromogenes* (the most prevalent NAS) were present in multiple samples. On the other hand, other bacterial species had mostly transient infections (one sample only) and a small proportion of them had IMI by the same microorganisms in multiple time points during the follow-up period: 27.5% of SSLO-IMI, 25.8% of NAS-non chromogenes-IMI and 4.8% of GNB-IMI. Different from weekly incidence results, the prevalence of all studied microorganisms was similar throughout the 5 weeks of experiment. The prevalence of SAU-IMI ranged between 11.4% and 14.4%. In case of NAS-IMI, the prevalence ranged between 25.6% and 30.2%. The prevalence of SSLO-IMI ranged between 9.0% and 16.1%. Lastly, GNB-IMI prevalence ranged between 1.2% and 3.0%.

## Significance

The dynamics of IMI varied according to the bacterial population investigated. A large proportion of the new IMI were observed on the first postpartum sample, especially for SAU and NAS, indicating that IMI may have occurred prior to calving. Additionally, the IMI-incidence tended to decrease as a function of increased days in milk. Based on our findings, sampling at calving would be recommended to identify a SAU-IMI in primiparous dairy cows. A greater proportion of SAU and *Staphylococcus chromogenes*-IMI were persistent when compared to SSLO, GNB, NAS-non chromogenes-IMI, which could have implications in the udder health for the oncoming lactation. Because the prevalence is the result of the cumulative incidence and the length of infection, microorganisms associated with persistent-IMI had a numerically higher prevalence with regard to the overall cumulative incidence (SAU, NAS) compared to microorganisms associated with transient-IMI (SSLO, GNB).

