Does the Milk Microbiome Play a Role in Reducing Susceptibility to Clinical Mastitis?

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The dairy industry continues to invest in discovery research to expand our understanding of the complex world of udder health. Here are some of the latest findings from research on the role the microbiome of milk plays in reducing the susceptibility to clinical mastitis.

Mastitis is a common health problem faced by the Canadian dairy industry.

COST:
This disease is costly, with **losses of more than $600 per cow annually.**

$600/cow/year

CAUSE:
Mastitis is commonly caused by bacterial infections into the udder, with coliform bacteria causing 40% of all clinical mastitis.

Infections into the udder

SYMPTOMS:
Among these coliform bacteria is ***Klebsiella pneumoniae,*** which is more commonly being recognized as a major pathogen **causing chronic and painful cases of mastitis.**

Chronic and painful

RESISTANCE:
Several strains of *Klebsiella* bacteria are **resistant to multiple antibiotics** making it difficult to treat.

Antibiotic resistant

SOLUTIONS:
To mitigate the impact this f these bacteria, it is critical to seek **novel and innovative solutions.**

Innovative solutions

Key Points

The microbiome, a collection of bacteria and other agents, exists in or on a host and can aid in preventing disease, potentially even mastitis.

***Klebsiella pneumoniae* is a bacterial cause of mastitis** which leads to quick and severe infections and a reduction in the diversity of the milk microbiome is found when an infection occurs.

To prevent *Klebsiella* infections, reducing fecal contamination of the environment is critical.

Future work is needed to evaluate the utility of manipulating or strengthening the milk microbiome with good bacteria through the use of prebiotics and probiotics.

Researchers collected quarter level milk samples bi-weekly from nearly 700 Holstein cows on 5 Quebec farms.

Milk samples from nearly **700** Holstein cows

From **5** Quebec dairy farms

The microbiome and mastitis

The microbiome is a collection of bacteria, viruses, fungi, and parasites that live on or in a host.

This collection of microorganisms has been shown to play important roles in defending against disease. Milk from cows contains a wide array of non-pathogenic commensal bacteria that may play a role in reducing mastitis susceptibility and in resolving cases of mastitis when they occur.

Researchers from McGill University and the University of Montreal explored the role the milk microbiome may play in mastitis. Using quarter level milk samples collected bi-weekly from nearly 700 Holstein cows on 5 Quebec dairy farms, samples from cows infected with *Klebsiella pneumoniae* were collected and analyzed. Specifically, milk samples from 10 cows with *K. pneumoniae* were compared to healthy cows before, during, and after the onset of clinical mastitis.

> ***Cows with Klebsiella pneumoniae* clinical mastitis had an increased somatic cell count even 2 weeks prior to the development of mastitis.**

With regard to the microbiome, when cows were experiencing the clinical case, they had a **reduced diversity of species** within the bacterial community of the milk and **increased level of *Enterobacteriaceae*** compared to healthy samples.

Furthermore, the researchers found no differences, in the composition of the milk microbiome between cows that were healthy and those with clinical mastitis two weeks prior to clinical mastitis—highlighting the quick onset of these infections. This study identified that the environment likely plays a large role in harboring *Klebsiella.*

Specifically, *Klebsiella* is known to be shed in the feces of dairy cattle **and can remain in bedding material if not cleaned.**

Based on these results, it can be concluded that *Klebsiella pneumoniae:*

- **Acts as an opportunistic pathogen in dairy cattle** causing quick and severe infections in cows with high somatic cell counts.
- **Is not commonly found in the milk microbiome** of healthy cows.
- **Is indigenous to the dairy environment, and may cause opportunistic infections in cows** that are already experiencing mastitis from other pathogens because of cross-contamination with contaminated material, such as bedding.

What does this mean and where is this heading?

Results of this research project emphasize the importance of maintaining a clean environment to reduce the risk of having a *Klebsiella* infection.

> **Specifically, focusing on having bedding material that isn't contaminated with feces is an excellent preventative practice.**

Moving forward, future research will work towards evaluating the role of other pathogens in shifting the microbiome with the goal to develop preventative strategies. Specifically, prebiotics or probiotics could be used to maintain the balance of good bacteria in the udder to fight off or even treat infections.

Funding Partners

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