



# Systems approach to deciphering molecular mechanisms of infertility in lactating dairy cows with subclinical ketosis

**Duration: 2020-2023**

## Highlights

- Ketosis, especially subclinical ketosis is a very important metabolic disorder of lactating cows and it has significant negative impact on cow's health and reproductive performance.
- As reproductive failure is the major reason for culling of lactating cows from Canadian herds, understanding the mechanisms of ketosis and its impact on reproduction is important.
- This project aims to uncover the molecular mechanisms of subclinical ketosis and its impact on fertility in lactating Holstein cows.
- The results will help us develop therapeutic and management strategies to manage reproductive performance of lactating cows.
- We are working with data milk BHB and reproductive performance indicators from over 30,000 cows.

## Objectives

We hypothesize that clinical and subclinical ketosis impact negatively on reproductive performance of lactating cows.

The objectives are:

- To analyze milk BHB data to categorize ketosis into multiple types based on the level and time of increase in milk BHB concentration.
- To analyze parameters indicative of reproductive performance in cows suffering from ketosis compared to health cows.

## Results and potential benefits

In the last 15 months, we have been investigating the reproductive performance of cows with milk BHB levels indicative of clinical and subclinical ketosis using data from Lactanet and CDN of >30,000 cows. Ketosis was categorized into multiple types based on the levels and time of milk BHB increase. Our preliminary results reveal that prevalence of clinical and subclinical ketosis within the first 42 days of lactation was about 27%. As expected, Type 2 ketosis (occurring in first 2 weeks of lactation) was three times more prevalent than Type 1 ketosis (occurring in 3-6 weeks of lactation). The 6% prevalence of Type 1 ketosis is also important as it seems to affect about 1800 cows among the animals in this study. This demonstrates that cows need to be monitored for clinical and subclinical ketosis throughout the first six weeks of lactation. Within Type 2 ketosis, Type 2 subclinical ketosis is more prevalent than Type 2 clinical ketosis. This demonstrates the importance of monitoring subclinical ketosis using BHB levels in milk.

We are now analyzing the impact of individual types of ketosis on reproductive performance of the affected cows compared to fertility of healthy cows. The parameters to be analyzed are: 1) calving to first service interval, defined as number of days between calving and first service; 2) first service to conception, defined as number of days between first service after calving and conception; 3) days open, defined as the number of days between calving and service that resulted in a conception; and 4) calving interval, defined as number of days between two consecutive calving.



## Innovative aspects

- Systematic categorization of ketosis types to investigate their impact on reproductive performance of lactating cows.
- The data of milk BHB levels and reproductive performance indicators are obtained from Lactanet database involving data from over 30 000 cows.

## Professional trained

- Mr. **Teshome Alemu** (PhD student) – data analytics and bovine reproduction – this student received a scholarship for the first three years his doctoral studies.
- Dr. **Ejimedo Madogwe** – expert in bioinformatics and big data analytics. She received a postdoctoral fellowship for 2021-22 and is being partially funded by this project.

## For further information

This is an ongoing project. We will publish the results at international conferences (e.g. Canadian Society for Animal Science) and research article in reputed journals (e.g. J of Dairy Science or Theriogenology). Moreover, some conferences will be given to different organisation as example The Novalait Forum Techno.

## Financial contributions

Special call for proposals in dairy production and processing (2016–2021):

- Natural Sciences and Engineering Research Council of Canada (NSERC)
- Quebec consortium for industrial bioprocess research and innovation (CRIBIQ)
- Novalait

**Total budget: \$343,645**

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