

A New Technology to Lower the Incidence of Uterine Infections, Improve Reproductive Performance and Productivity of Dairy Cows

Dr. Burim Ametaj, University of Alberta

Why is this important?

Reproduction failure is the number one cause for culling of dairy cows in Canada. According to DHI records 20% (~57,592 cows) of all dairy cows were culled during 2013, because they failed to remain pregnant. Uterine infections after calving are one of the main reasons why cows fail to become pregnant. Various antibiotics used for treating uterine infections lack efficiency and aggravate the inflammation process; moreover, milk is discarded because of residues. Hormonal treatments also have not shown enough efficiency to be embraced by veterinary practitioners. This has prompted increasing efforts in the research community to find a 'green' and efficient technology that helps heal the cow's uterus.

What did we do?

Two consecutive research trials were conducted during 2008 to 2014 with cows at the Dairy Research and Technology Centre, University of Alberta. Cows were treated intravaginally with a cocktail of probiotic (i.e., good) bacteria starting at 2 weeks before the expected day of calving and also after calving. The beneficial bacteria that we used were isolated and identified from the vaginal mucus of healthy dairy cows. They were grown in our lab and prepared in a dry form that was infused as a solution intravaginally. These treatments had multiple beneficial effects on the cow's reproductive health, overall health and their productivity as described below.

What are the beneficial effects of using probiotics?

#1 *Accelerated healing of the uterus*

After calving, the uterus is large and needs to return to its normal size within 3-5 weeks. Presence of pathogenic (i.e., bad) bacteria in the uterus hampers the speed of recovery and the rate at which it shrinks. Administering probiotics for 2-3 times intravaginally before and after calving accelerated uterine shrinking by 2 weeks, increased the number of cows that resumed ovarian cyclicity (i.e., coming into heat) earlier, improved first service conception (i.e., successful insemination), lowered the number of days that cows remained open by 21 days, and lowered the incidence of ovarian cysts in the treated cows. There are potentially large economic benefits of these improvements.

#2 *Improved uterine and overall health status of the cows*

Data from our studies indicated that cows treated with probiotics had lower incidence rate of uterine infections (i.e., metritis, endometritis, and pyometra), compared with the cows that were not treated with probiotics. Metritis is regarded as one of the most widespread and costly uterine health disorders and has a negative impact on milk production, reproductive performance, and on-farm profitability. Probiotics also improved the immune health of the treated cows both locally and systemically by increasing concentrations of immunoglobulins in the blood and vaginal mucus. Immunoglobulins are antibodies that prevent pathogenic bacteria from attaching to the walls of the vaginal tract and initiating infection in the uterus.

#3 Improved composition of microbiota in the vaginal mucus

Billions of good bacteria in the vaginal tract of cows find shelter and nutrients in the vagina and help the cow by preventing pathogenic bacteria from attaching and growing. In the cow's vagina there are also a limited number of pathogenic (disease-causing) bacteria. Immediately after parturition when the immune guard of the cow decreases temporarily, pathogenic bacteria start growing in numbers. Then, they attack the host in an attempt to cross barriers and gain access to better nutrient resources and in the process causing inflammation, damage to uterine barriers and overall sickness. The good bacteria fight bad bacteria by restricting them access to niches and nutrients. The greater the numbers of good bacteria present in the uterus, the better the health of the cow. Interestingly the good bacteria (i.e., probiotics) that we infused into the vaginal tract persisted for 10 weeks (time that we conducted the experiment) after administration. The survival of probiotic bacteria supported the growth of good bacteria in the vaginal tract of dairy cows.



A graduate student infusing probiotics into the vaginal tract of cows with a sterile insemination pipette and syringe

#4 Increased milk production and changes in immunoglobulin levels

One of the most exciting findings of our study was that cows treated with intravaginal probiotics produced 2 L of milk per day more than the untreated cows, during the first 56 days in milk (i.e., length of study). Another important finding of this study was that intravaginal probiotics increased concentration of immunoglobulin G in the milk. This immunoglobulin is very important for protection of newborn calves from early age diseases like diarrhea and pneumonia. Moreover, probiotic supplementation was associated with lower concentration of haptoglobin in the milk. This is a molecule that is released in case there are bacterial infections in the udder. Haptoglobin binds to iron and prevents its uptake from bacteria, which stops bacterial growth in the mammary gland.

What does this mean?

Results of this study suggest that using probiotics is very beneficial in terms of:

- Accelerated uterine involution
- Lowering the incidence rate of uterine infections
- Lowering the number of days open
- Improving immune status of dairy cows
- Increasing beneficial bacteria in the reproductive tract of cows
- Increasing milk production and its value for the newborn calf



This research was supported by funding from Alberta Livestock and Meat Agency (ALMA) and Alberta Milk and the summary is based on previously published data: Ametaj et al. 2014. Research in Veterinary Science. Vol. 96, 2: 365-370. For further information relating to this research please contact Dr. Burim Ametaj at burim.ametaj@ualberta.ca. Dr. Burim N. Ametaj was the Principle Investigator of this project with Dr. Michael Gaenzle as Co-Principal Investigator. The author would also like to acknowledge the following team members for their involvement in the study: Qilan Deng, John Odhiambo, Tran Lam, Umar Farooq, and Suzanna Dunn.