

# NSERC Industrial Research Chair in Dairy Nutrition: 5-Year Summary (Part 2)

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## Introduction

Dr. Steele was awarded an NSERC Industrial research chair in dairy nutrition in 2015. The purpose of this 5-year appointment is to develop feeding and management practices for calves that will promote proper gut microbial colonization and development, thereby decreasing susceptibility to enteric infections and use of antibiotics, while increasing growth and future productivity.

The first days of life are crucial for calf health and future productivity. Part 2 of this article series will focus on research results contributing to early life nutritional management strategies.

## Colostrum Feeding

The first study conducted in the NSERC IRC sought to determine how delaying the first colostrum feeding after birth can affect not only blood IgG concentrations, but also other indicators of calf health and development. Calves that were fed colostrum at 1 hour of life had higher blood IgG concentrations compared to calves fed colostrum at 6 and 12 hours after birth, which did not differ (Figure 1).

Importantly, calves fed at 12 h of life tended to have lower levels of beneficial bacteria and a higher abundance of opportunistic pathogens in the intestine compared to calves fed at 1 h of life. Calves fed later also had lower levels of hormones that play a key role in gut development and metabolism compared to calves fed earlier.

These results demonstrate that delaying colostrum feeding can compromise proper gut development and may also increase the risk of pathogen colonization and infection in newborn calves. In addition to the timely feeding of colostrum, other factors can influence passive transfer and gut development. For instance, previous research has found that the method of colostrum feeding - esophageal tube feeder vs. nipple bottle - can impact the success of passive transfer. However, a study we conducted in Westaskiwin, AB determined that tube feeding an adequate volume (> 3 L) of good-quality colostrum will result in equivalent blood IgG concentrations compared to calves fed via nipple bottle. This research was also the first study to demonstrate that feeding colostrum stimulates the production of beneficial gut hormones, glucagon-like peptide-1 and 2, which play a key role in gut development and energy use.

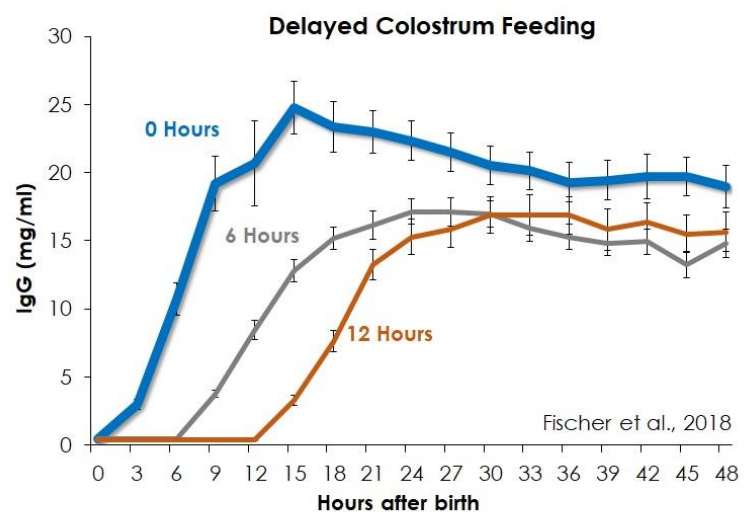


Figure 1. Blood IgG concentrations in calves after being fed colostrum at 0, 6 and 12 h after birth.

## Bioactive Compounds in Colostrum

We have begun to characterize the multitude of bioactive compounds, aside from IgG, that are present in colostrum. We found that colostrum contains high levels of oligosaccharides, which can promote the development of beneficial gut bacteria and positively influence the immune system. Colostrum also contains elevated levels of polyunsaturated fatty acids, as well as specific immune-related proteins. This research has also uniquely demonstrated that the cow's parity can influence the concentrations of bioactive compounds in colostrum, with multiparous cows often having higher levels compared to heifers. As such, we have become highly interested in the dam factors, such as health, nutrition, environment and parity, that might influence the composition of colostrum and have many plans to study this avenue of research in the future.



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## Transition Milk Feeding

Although IgG concentrations are low in transition milk, we have found that, similar to colostrum, transition milk is abundant in bioactive compounds. This suggests that feeding transition milk may be beneficial to the calf in promoting proper gut development and function, and thus reducing the high incidence of digestive disorders. A study at the University of Alberta found that calves fed either colostrum or a 50:50 mixture of colostrum (to simulate transition milk) after the first colostrum feeding were better able to maintain high blood IgG concentrations over the first 3 days of life compared to calves fed whole milk. Additionally, calves fed colostrum or the transition mixture had greater small intestinal growth and development compared to calves fed whole milk.

From these results, feeding transition milk or a mixture of colostrum and whole milk are possible strategies that producers can implement to promote calf gut development and function. In the future, we aim to determine whether these effects are due to an increased amount of nutrients in colostrum and transition milk compared to whole milk, as well as to investigate how these feeding practices may influence long-term productivity and health.

### Coming up in Part 3...

Part 3, the final article in this series, will focus on nutritional management strategies for the first weeks of life and the first months of life. Plane of nutrition and fluid feeding strategies are important considerations for calf management. In addition, weaning strategies are essential for minimizing stress and weight loss. Finally, maintaining effective management after weaning will improve heifer development and reproductive efficiency. Part 1 and 3 of this series is available [here](#).