

Transitioning Our Thinking on Immunity and Health

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It's time to transition our thinking on immunity and health. During the recent 2019 Cornell Nutrition Conference, Dr. Lance Baumgard of Iowa State, presented the idea that many transition cow metabolic issues (ketosis, milk fever, and high NEFAs), and negative performance markers such as suppressed dry matter intake and low milk starts are symptoms of immune activation not the cause of, nor an actual "disease" of transition cows.

Traditionally, a number of studies have pointed to transition cow hypocalcemia (milk fever) as a precursor to ketosis, metritis, low dry matter intake, displaced abomasum, decreased milk yield, and even mastitis (Curtis et al., 1983; DeGaris and Lean, 2008; Goff, 2008; Martinez et al., 2012; Chapinel et al., 2012; Riberio et al., 2013; Neves et al., 2018a, b). The reasons for this way of thinking were from studies that suggested hypocalcemia leads to decreased skeletal muscle strength and gut motility (Goff, 2008; Oetzel, 2013; Miltenburg et al., 2016), decreased insulin secretion (Martinez et al. 2012, 2014), and the development of immunosuppression (Kimura et al., 2006). The observance of elevated NEFAs (non-esterified fatty acids) and ketosis have similarly been thought of as predictors of future low performance and continual health issues. Dr. Baumgard challenged us to think differently and consider those mentioned as symptoms of immune activation.

An indicator of immune activation is inflammation that is generally measured by lipopolysaccharides (LPS) and the proteins that carry them. LPS can be released intestinally as a result of mycotoxins in the feed or other causes of leaky gut, from the mammary tissues during mastitis infections, and in the reproductive organ tissues during incidences of metritis and uterine infections. Overstimulation of the immune system may also be increased by heat stress and psychological stressors. Many of these stressors and hindrances can occur all at once in our transition cows depending on our farm management protocols. Recently, (Horst et al., 2018a, b, 2019) along with others previous, have observed a significant and unexplainable decrease in blood calcium following LPS administration in lactating cows. Infection-induced hypocalcemia has also been observed across mammalian species including humans, dogs, horses, pigs, sheep, and in calves. Additionally, hypocalcemia occurs during bouts of ruminal acidosis in dairy cows (Minuti et al., 2014), which provides support for it as an indicator of inflammation and immune response. According to Baumgard, immune activation partitions significant levels of nutrients away from normal pathways and functions. This forces the cow to metabolically rearrange her use of nutrients to an "Option 2" for maintenance and survival.

Thinking in this manner, hypocalcemia may be one of these "survival" tactics. Baumgard's research group and others, believe that immune activation could be the origin of many transition cow metabolic and reproductive disorders, and partially explains incidences of milk fever postpartum, and severity of cases of delayed, persistent, and chronic (Caixeta et al., 2017; McArt and Neves (2019)). From the proceedings of the 2019 Cornell Nutrition Conference, Figure 1 shows the potential downstream consequences of immune activation, and that poor transition cow performance, health and disorders could be a reflection of prior immune stimulation.

Could inflammation level be the new way to monitor the health of our cows? Researchers are developing and testing practical ways to help farmers identify inflammation levels in cows on-farm, though that technology is still in the future. Currently, it is best to look to improve our management practices with the goal of reducing immune stressors in our cows. Supplying adequate lying and bunker

space, decreasing noise and stressful procedures during the transition period, and alleviating heat and cold stress for our dry and transition cows have been proven to increase their health and performance post calving. Making sure they receive the best quality (least mold, good fermentation, low mycotoxins) feed and water (clean, and tested for mineral imbalances if suspect) seems basic, but may go a long way in providing our cows the necessary nutrients for proper immune activation and health responses.

Additional sources provided upon request.

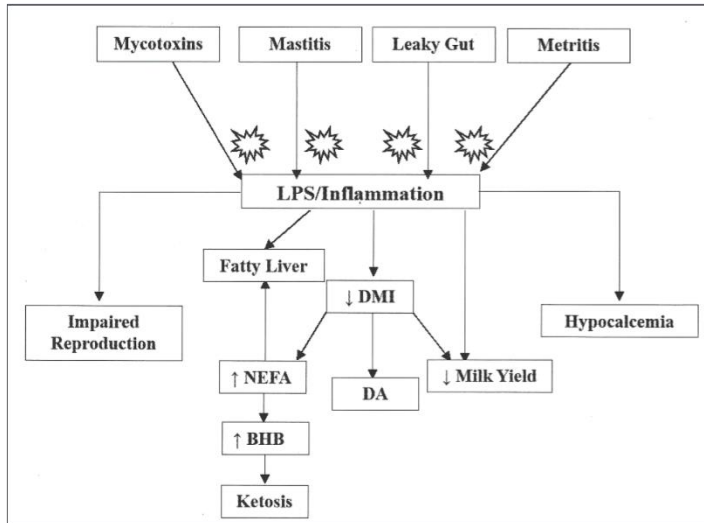
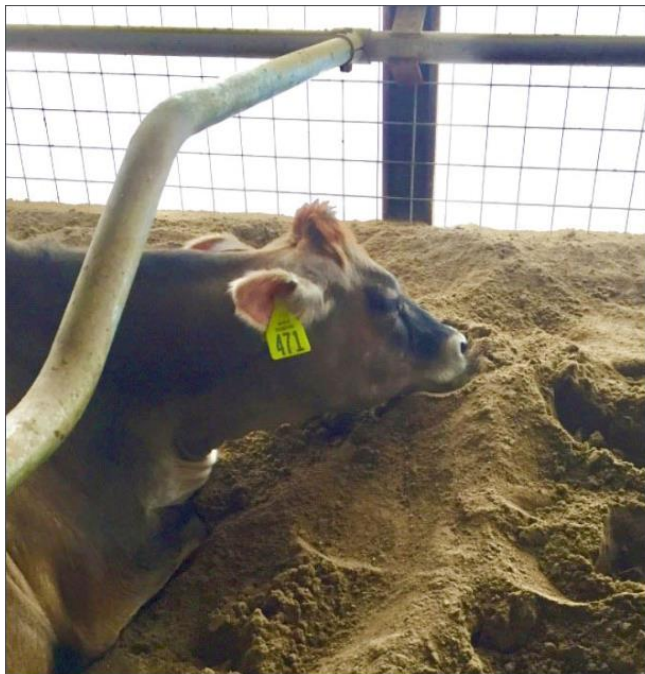


Figure 1. Proceedings from the 2019 Cornell Nutrition Conference held in Syracuse, NY. Dr. Lance Baumgard's presentation: "Inflammation and Calcium Homeostasis: Potential Implications for the Transition Period."



Cow with hypocalcemia (milk fever). Photo by: Margaret Quaassdorff.