Can rumen protected methionine improve reproduction in dairy cows?

PART 1: Transition period – Body condition and uterine inflammation

Dairy rations are most often evaluated on the ability to produce milk flow and components. This is very reasonable as those production parameters are how the dairy gets paid. Least cost formulation for dairy diets has the opportunity to minimize other factors that are not possible to measure in the bulk tank, but can affect the health and reproductive performance of dairy cows.

AMINO ACID BALANCING HAS SHOWN:

- positive effects on immune response
- improved reproductive efficiency

Generally, the first three rate-limiting amino acids for milk production are methionine, lysine, and histidine. In addition, many amino acids can have positive effects on physiological processes that are independent of their effects on production of proteins. This has been termed "functional effects" of amino acids. Methionine and arginine are the best studied "functional amino acids" with links to reproduction (Bazer et al., 2010).

The loss of body condition during the transition period has long been known to be a driver of reproductive failure and is often tied to uterine health (Walsh et al., 2011). There has been a series of research trials conducted at the University of Illinois, Wisconsin and Cornell that demonstrate how methionine supplementation improves reproductive performance by minimizing body condition loss and creating a healthy immune response.

MINIMIZE BCS LOSS

Supplementing rumen protected methionine (RPMet; Smartamine® MetaSmart®) pre- (-21 d) and post-partum (+30 d) promoted greater DMI (42.3 vs. 37.9 lb/d), which helped to maintain BCS through the transition period (Zhou et al., 2016; Osorio et al., 2014). Additionally, supplementation of RPMet during the peripartum period, specifically, reduced the incidence of ketosis and retained placenta (Zhou et al., 2016).

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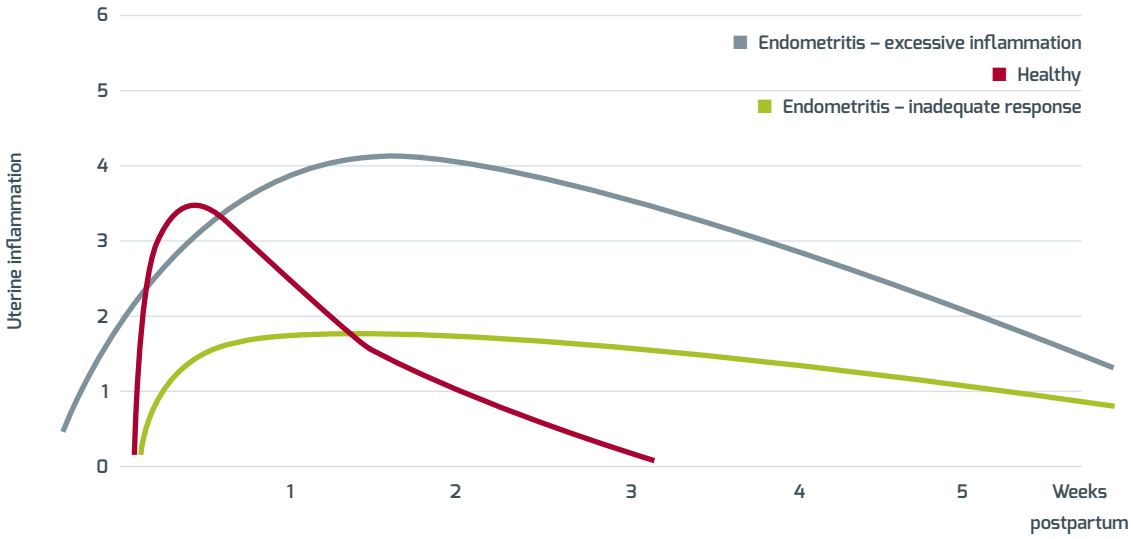
HEALTHY IMMUNE RESPONSE

A certain level of inflammation during the first 2 weeks after calving is necessary for uterine involution in preparation for the next gestation (Figure 1; Leblanc, 2014), indicating that promoting a "healthy inflammation" can bring positive outcomes.

Figure 1: Inflammation responses for postpartum cows



LeBlanc, 2014

Healthy Inflammation – the ideal situation where there is a sharp increase in inflammation that clears pathogens and returns to basal levels quickly. **Excessive inflammation** – inflammation that is severe or prolonged that impairs rather than aid reproductive performance. **Inadequate Inflammation** – the immune system that fails to clear uterine pathogens within 3 weeks after calving.

It has been estimated that 30% of cows experience some type of metritis and endometritis post calving. Excessive uterine inflammation after calving is not uncommon and contributes to uterine involution. However, excessive inflammation will prevent a return to reproductive health and delay the ability of the cow to become pregnant.

The timing of inflammation also determines reproductive success. High inflammation around 60–70 DIM (i.e., insemination period) can affect the communication between the oocyte and spermatozoa preventing conception. The uterine inflammation reduces estradiol concentrations which limits the nutrients available in the uterine fluid and tone of the uterine lining, needed for implantation. Without adequate nutrients and enzymes in the oviduct, the spermatozoa cannot penetrate the zone pelucida for syngamy.

One way to measure a uterine infection is by determining the concentration of polymorphonuclear neutrophils (PMN) which are indicative of inflammation of the uterus. To evaluate the effect of methionine on post-partum inflammation, Stella et al. (2017) fed cows with RPMet and obtained PMN concentrations at 15, 30, and 72 DIM (Figure 2).

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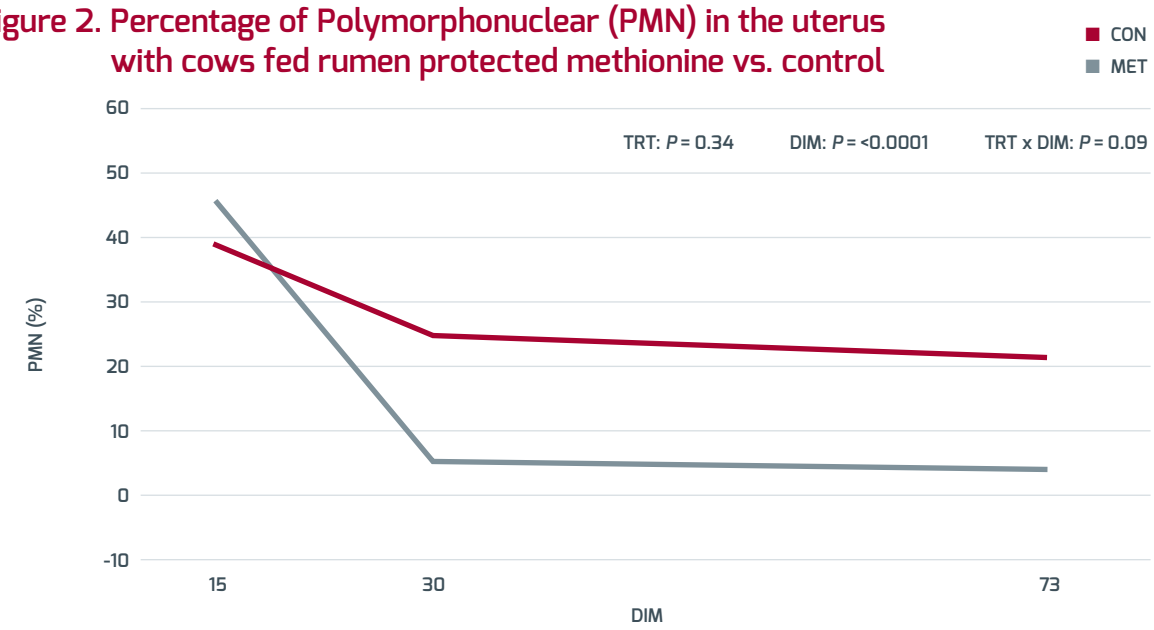
Figure 2. Percentage of Polymorphonuclear (PMN) in the uterus with cows fed rumen protected methionine vs. control



Least square means an associated standard errors of supplementing rumen protected methionine (MET, n=11) or not (CON, n=9) on percentage of polymorphonuclear neutrophils (PMN). Stella et al., 2017.

At day 15 there was no difference between PMN, but at day 30 and 73, cows fed RPmet maintained lower PMN percentage than the non-supplemented group. The fast decrease is indicative that the supplemented cows were able to quickly resolve any infection and return to baseline levels of circulating PMN's. A joint study between the University of Wisconsin and Cornell confirmed similar results of cows fed RPMet from -21 to 112 relative to calving (Stangaferro et al., 2017) observing a reduction of PMN, indicating improved immune status.

Methionine & Uterus =
Reduced BCS loss = more nutrients available for immune response = increased uterine health

SECTION CONCLUSION

Supplementing RPMet serves to minimize body condition loss and increased uterine health. This enables cows to return to reproductive health and conceive in fewer days in milk.

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