Transition cow nutrition and metabolic health.

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SUMMARY

- Supporting hepatic metabolic function is necessary to meet the energy and glucose demands of lactation.
- Supplementation with conjugated linoleic acid can marginally reduce milk fat synthesis and increase milk volume synthesis.
- Detecting and treating metabolic disorders is critical to enable transition cows to reach genetic milk production potentials. Many tools are available to detect hyperketonemia at the individual cow and herd level and can be integrated into management and nutrition strategies.
- Prefresh body condition score and body condition score changes across the transition to lactation period may increase postcalving blood BHBA.
- Previous lactation residual feed intake did not change hyperketonemia incidence or blood BHBA postcalving.

INTRODUCTION

The transition to lactation in the dairy cow lifecycle is a metabolically challenging period that reflects a coordinated response to calving and the onset of lactation. Central to a successful transition period is the ability of the liver to make enough glucose to support milk production, specifically during a period characterized by reduced feed intake. When nutrition and metabolism cannot keep up with the demands of milk production, cows fail to reach their genetic potential for milk production and develop metabolic disorders. Included in these metabolic disorders, ketosis effects 40 to 60% of early-lactation dairy cows and costs an average of $289 per case (McArt et al., 2012, 2014). Ketosis, sub-clinical or clinical, results in decreased milk production, increased risk of displaced abomasum, and decreased reproductive efficiency. Often developing alongside ketosis, fatty liver is associated with decreased milk production, decreased lifespan, increased veterinary costs, and longer calving intervals and affects 60% of dairy cows. Therefore, strategically feeding the transition dairy cow provides an opportunity to maximize milk production and improve metabolic health.

USE OF CONJUGATED LINOLEIC ACID

One strategy for sparing energy during the transition to lactation period is to marginally depress milk fat in order to spare energy from milk fat synthesis to milk volume synthesis. It is well documented that *trans*-10, *cis*-12 CLA is a potent inhibitor of milk fat synthesis and reduces milk fat yield up to 50% during supplementation; however, the depression is recovered shortly after supplementation is ended (Baumgard et al., 2000; 2001; 2002; Peterson et al., 2002). Milk fat is the most energetically expensive component of milk, representing 50% of milk energy and can account for up to 35% of net energy intake in early lactation (Bauman & Currie, 1980; Kay et al., 2006). A decrease in milk fat excretion could spare energy for other uses such as milk production, production of other milk components, or body growth. In cases of early lactation CLA supplementation, reduction of milk fat content was accompanied by increased milk production (Bernal-Santos et al., 2003; Moallem et al., 2010; Schlegel et al., 2012). These studies were university research settings where nutrition and management were closely controlled.

In a recent study on a commercial dairy, primiparous and multiparous cows were supplemented with CLA during the transition to lactation period (Chandler et al., 2015c,d). Supplementation was provided for 21 days before calving (in the prefresh pen) to 30 days after calving for multiparous cows and 70 days after calving for primiparous cows (through automatic milk system robots). Cows supplemented with CLA had increased milk production both during the supplementation period and an increased milk production over 100 days in milk (Chandler et al., 2015a,b). Milk fat percent was decreased as expected; however, because milk volume also increased, milk fat yield was not altered. This study demonstrated that supplementation of CLA was effective at reducing milk fat concentration but concomitantly increased milk yield and therefore did not change fat yield in multiparous and primiparous animals in a commercial setting.

Overall, feeding rumen-protected CLA mixtures containing *trans*-10, *cis*-12 CLA may have beneficial applications, including strategies to increase milk yield, and maintain performance during the transition to lactation period. This study demonstrated that supplementation of CLA was effective at reducing milk fat concentration but concomitantly increased milk yield and therefore did not change fat yield in multiparous and primiparous animals in a commercial setting.

DETECTION OF HYPERKETONEMIA

A final strategy is reducing the risk for, and early detection and treatment of, metabolic diseases. The negative impacts of ketosis, specifically decreased milk production, can be ameliorated by early detection and treatment (McArt et al., 2014). Ketosis can be detected on farm with urine, milk, and blood testing; however, these methods vary in accuracy and can be both labor intensive and expensive. Milk fat:protein ratios have historically been used as an indicator of ketosis on farm; however, this ratio is only weakly correlated with ketosis incidence.

An alternative strategy is to monitor herd level ketosis prevalence and employ individual cow testing when prevalence exceeds the goal. Regression analysis of milk component data and cow information collected from herd data management software is used to predict herd prevalence of ketosis with 90% accuracy (Chandler et al., 2015b). This tool, the KetoMonitor (AgSource, Verona, WI), aids in management decisions by allowing for monitoring prevalence over time and across intentional and unintentional changes. Furthermore, using a herd-level prevalence tool can reduce unnecessary individual cow testing when herd prevalence is low.

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NUTRITIONAL INFLUENCES ON HYPERKETONEMIA

A recent study examined the relationship between body condition score, residual feed intake (as a measure of feed efficiency), and hyperketonemia in transition cows that were sampled twice weekly postcalving. Animals with a BCS of 4 or greater prior to calving, or those that lost one ormore body condition unit over the transition period, were more likely to develop HYK, emphasizing the importance of avoiding over conditioning of cows in the dry period and excessive BCS loss throughout the transition period. There was no relationship between RFI and HYK which supports the continued selection for efficient cattle without the increased risk of HYK onset in subsequent lactations.

CONCLUSIONS

Together these strategies provide valuable tools to improve transition cow health and productivity. Understanding liver metabolism and the role of these strategies in improving liver health can guide nutritional decisions on commercial dairies.

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