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rumen-protected niacin

Niacin feeding to just-fresh dairy cows: Immediate and long-term effects on health, milk production and fertility.

During the just-fresh period immediately after calving through about 28 days post-partum, dairy cows may be under substantial metabolic stress. These cows are frequently in negative energy balance (NEB) due to rapid energy demands to support rapidly rising milk output at a time of relatively low dry matter (DM) intake. This NEB makes cows susceptible to ketosis, fatty liver, metritis and displaced abomasum, which can lead to decreased milk production and eventual culling from the herd. A proposed treatment to improve the metabolic state of just-fresh dairy cows is supplemental feeding of the B-vitamin niacin (Ni). While results of Ni supplementation have varied, many studies of both rumen-unprotected and protected (RP) Ni supplementation has reduced plasma b-hydroxybutyrate (BHBA) and non-esterified fatty acids (NEFA) levels of fresh cows. As Ni is known for its anti-lipolysis properties, its supplementation to diets of just-fresh cows could be expected to reduce the amount of NEFA available for ketogenesis, thereby reducing hyperketonemia. If cows survive the just-fresh period, then it is necessary that they reduce their NEB to support high milk production. As well, cows in NEB have low fertility. Reducing the extent of NEB and fresh cow diseases is key to a successful lactation.

Thus our first objective was to determine effects of RPNi on lipolysis during the just-fresh period, primarily by using blood NEFA and BHBA levels as indicators of ketosis. Our second objective was to

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a carryover effect, after cessation of RPNi feeding, on milk production and fertility.

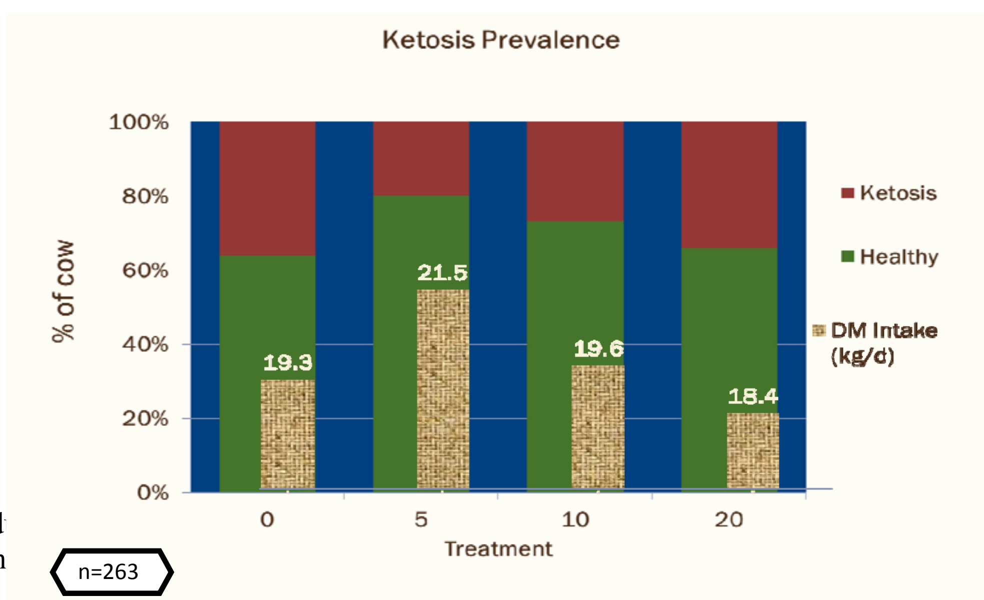
Methods

Multiparity Holstein cows on a commercial dairy in California were used in a two part study, where Phase 1 tracked cows from ~14 d prior to calving through the just-fresh period (i.e., 28 days in milk (DIM)), and Phase 2 followed the same cows once they entered a high pen through 150 DIM.

During Phase 1, the just-fresh cows were fed the same total mixed ration (TMR) diet, except for inclusion of a ruminally-protected niacin (RPNi) product at 0, 5, 10 or 20 g/cow/d. Pre- and post-partum blood samples were collected for NEFA and BHBA assay, as well as other metabolically relevant blood parameters. Body condition score (BCS) was measured pre- and post-partum, as well as monthly, through mid-lactation. Milk tests were every 2 weeks during the fresh period, and monthly for early to mid-lactation cows.

Results

Compared to control cows, the 5 g/d RPNi feeding level decreased ketosis prevalence (i.e., % of cows with BHBA ≥1.44 mg/dl) from 36.3% to 20.0% and increased DM intake from 19.3 to 21.5 kg DM/d, in the just-fresh period. The treatment effect increased with time of RPNi feeding.



Milk, milk fat and milk energy yields all increased for cows fed 5 g/d, especially at their 2nd milk test in the fresh pen (avg. 21 DIM; 48.0 vs 49.4 kg milk/d; 1.90 vs 2.07 kg fat/d; 148 vs 157 MJ energy/d). However at the first milk test after cessation of feeding RPNi, milk, milk fat and milk energy yields slumped resulting in lower yields vs control cows (53.2 vs 51.8 kg milk/d; 1.75 vs 1.67 kg fat/d; 148 vs 142 MJ energy/d, respectively). Over the following 3 monthly milk tests, milk and milk component yields of cows fed 5 g/d RPNi converged with those of control cows. In addition, the BCS of cows fed 5 g/d RPNi decreased to a greater extent than control cows in early lactation, maintaining a lower BCS through ~80 DIM but, by mid-lactation, there was no difference in BCS between treatments.

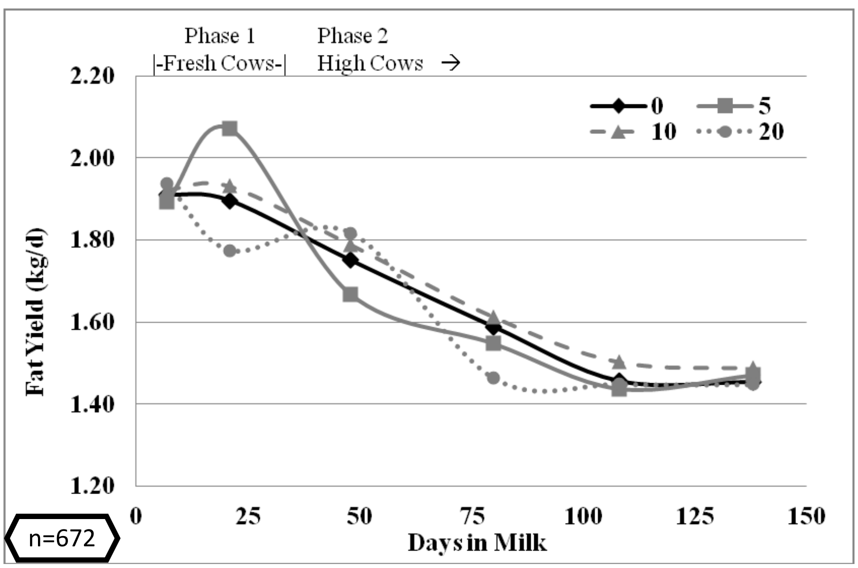
Conversely, the 20 g/d RPNi feeding level in the just-fresh pen had no effect on ketosis prevalence or DM intake. Milk, milk fat and milk energy outputs decreased with time of RPNi feeding for cows fed 20 g/d compared to control cows (48.0 vs 44.9 kg milk/d; 1.90 vs 1.77 kg fat/d; 148 vs 138 MJ/ energy/d, respectively). After cessation of RP Ni feeding, milk and milk component yields of the 20 g/d cows rebounded by the first milk test in the early lactation pen (53.2 vs 55.25 kg milk/d; 1.75 vs 1.82 kg fat/g; 148 vs 153 MJ energy/d, respectively). The BCS of cows fed 20 g/d of RPNi decreased from the just-fresh period through early lactation, and continued to decrease through mid-lactation compared to control cows.

Mid-level RPNi feeding (i.e., 10 g/d) in the fresh pen resulted in intermediary effects of the 5 and 20 g/d treatments, with a small decrease in ketosis prevalence and a small increase in DM intake. Milk and milk components were similar, or slightly higher, than control cows at all times.

There was no observed influence on reproduction for any of the treatments tested. This could be due to the initiation of feeding after calving and not during the close-up phase. The prevention of the spike in NEFA's at calving that has been correlated with decreased fertility may have been missed due to the required design of the study.

Conclusions

The results of this study indicated that RPNi when fed at the 5 g/hd/d level reduced the prevalence of ketosis and increased dry matter intake. Milk fat was, also, increased during the feeding of the 5 gm/hd/d level but did have a drop at cessation of feeding. It is hypothesized, that to avoid this from occurring, the feeding of RPNi at this level could be continued until dry matter intake is maximized. The intermediate level, 10 gm/hd/d of RPN, showed a reduction in ketosis which was intermediate between the lowest and highest levels. The highest level of RPN didn't appear to provide any advantage to the performance of fresh cows.



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