Effects of Timing of Feed Delivery on Daily Rhythms in Glucose and Insulin in Blood Plasma and Glucose Tolerance in Dairy Cows

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Traditional feeding time for dairy operations is in the early morning. Recent studies have shown beneficial effects of evening feeding in beef cattle and dairy cattle. Studies in humans have proven that a night-time insulin resistance resulting in poor glucose tolerance exists. Daily rhythms in glucose tolerance have not yet been confirmed in dairy cattle. Synchronizing timing of feed delivery with these rhythms may improve milk fat and energy balance in high producing dairy cows.

To examine this possibility, 8 Holstein cows were used in a replicated 4x4 Latin Square with four periods. Each period lasted 21 days (14 d adaptation + 7 d sampling). Fresh total mixed ration containing higher concentrate (HC) or lower concentrate (LC) was delivered either at 9 am (AM) or at 9 pm (PM). The HC diet contained 62% of dry matter as concentrate. The LC diets contained 51% of dry matter as concentrate. Treatments were 1) HC + AM, 2) HC + PM, 3) LC + AM, and 4) LC + PM. Each sampling week, blood samples were taken every 2 hr for 2 days via jugular catheters. A glucose tolerance test was performed at noon of the last day of periods 2, 3 and 4. Feeding time had a significant effect on daily glucose and insulin rhythms, but had no effect on glucose tolerance or insulin response to glucose injection at noon. The PM fed cows had a lower glucose and higher insulin level at 2 h post-feeding than the AM fed cows, but from 6-8 hrs post-feeding both glucose and insulin was higher in PM fed cows than in AM fed cows. These results suggest a possible night-time insulin resistance. We have, therefore, recently completed a more thorough glucose tolerance study, in which we compared the glucose tolerance of AM and PM fed cows at different times of the day.

Implications: Feeding dairy cows in the evening alters post-feeding glucose metabolism and this may improve dairy cattle productivity.