Results of an Observational Study Describing the Relationship Between Milk Urea Concentrations and Feeding Management and Performance in Ontario Dairy Herds

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Introduction

A 13-month observational study of 60 Holstein herds in Ontario, Canada was performed to describe the relationship between milk urea nitrogen (MUN) concentrations, as measured by routine DHI testing, and nutritional management in commercial dairy herds. A second objective was to determine if MUN concentrations, as measured by routine DHI testing, were associated with performance in commercial dairy herds. Measures of performance included reproductive performance, production, and efficiency (cost) of production.

Material and Methods

Data collected described DHI test-day performance, reproductive performance, nutritional management and general herd management. MUN concentrations were measured from routine test-day milk samples at the Ontario Dairy Herd Improvement laboratory (150 Research Lane, Guelph, ON, N1G 4T2), using an automated infrared test method (Fossomatic 4000 Milk Analyzer. Foss North America, Eden Prairie, MN, 55344). The average test-day herd mean MUN concentration for study herds was 13.7 mg/dl, (std. dev. = 2.4; range = 7.3 to 24.1).

The quantity, type, and price of all feeds fed was reported monthly. NIR analysis was performed on all forages. This information was used to calculate the ration nutrient composition, ration cost, gross milk revenue, and income-over-feed costs. Because of large cow-to-cow variability in results, it has been recommended that MUN data be interpreted either by or herd level (Oltner et al., 1985; Broderick and Clayton, 1997). As such, emphasis was placed on interpreting and analyzing data either by group or herd.

Multiple logistic or linear regression analysis was used to test for the presence of associations between MUN concentrations and variables of interest while controlling for the effects of potential confounding variables and random herd effects (SAS Institute Inc., 1996).

Results and Conclusion

There was a positive association between herd mean MUN concentration and dietary levels of crude protein (CP), degradable intake protein (DIP), undegradable intake protein (UIP), and protein:non-fiber carbohydrate ratios ($P<0.05$). A negative relationship existed between herd mean MUN concentration and dietary levels of non-fiber carbohydrates (NFC) ($P<0.05$). These results are consistent with those of experimental studies performed using individual animals managed under research conditions (Oltner and Wiktorsson, 1983; Baker et al., 1995).

The group mean MUN concentration for the group of cows at risk of insemination (50-180 days in milk) was not associated with group reproductive performance. Performance was measured by the proportion of services occurring in the inter-test interval, either preceding or following test day, which resulted in pregnancy ($P>0.05$). These results are consistent with the findings of a review by Staples, et al. (1995) which concluded that there is no clear or predictable relationship between MUN concentrations and reproductive performance. These results indicate that MUN data produced by routine DHI testing will not be useful as a tool to monitor or predict reproductive performance.

Herd mean MUN concentrations were not associated with herd mean milk yield, having controlled for butterfat and total protein content as fixed effects in the regression model ($P>0.05$). Herd mean MUN concentrations were not associated with gross milk revenue ($/cow/day) ($P>0.05$), but were positively associated with feed costs ($/cow/day) ($P<0.05$). This was explained by the fact that herds with high mean MUN concentrations tended to be fed higher levels of more costly dietary protein in the ration. These results suggest that producers who feed rations which are balanced for efficient use of dietary protein, thus achieving lower herd mean MUN concentrations, may enjoy lower feed costs without sacrificing milk yield and milk revenue. Although this analysis was performed at the herd level, these results are consistent with those of a previous cow-level study which concluded that diets can be balanced efficiently so that cows can achieve lower concentrations of urea without sacrificing milk yield (Baker et al., 1995).

Results of this study indicate that MUN data produced by routine DHI testing will be useful to identify inefficiencies in protein utilization in commercial dairy herds. Producers should focus on using MUN data to monitor and optimize the efficiency of dietary protein utilization, with the goal of improving the efficiency of production (lower the cost).

References

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