The Effect of Non-nutritional Factors on Milk Urea Nitrogen Levels in Holstein Dairy Cows

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Introduction

The purpose of this study was to determine the effect on milk urea nitrogen of non-nutritional factors such as parity, days in milk, milk production, milk quality and milk components.

Materials and Methods

A total of 177 dairy farms in Prince Edward Island (PEI) containing 10,688 lactating Holstein cows participated in the research. Individual cow milk samples (n = 68,158) were collected monthly from July 1999 to June 2000 from each farm as part of the Dairy Herd Improvement (DHI) milk recording system. Milk urea nitrogen levels (MUN) were measured using a Fossomatic 4000 Milkoscan Analyzer at the PEI Milk Quality Laboratory. Milk fat, milk protein and somatic cell count (SCC) were also analyzed by the same machine during the same period. Milk production, days in milk, and parity data from each cow for each test date were obtained electronically from DHI. Certain observations with extreme values of one or more parameters were excluded from the statistical analyses.

Descriptive statistics for MUN, parity, days in milk, milk yield, fat and protein were calculated. The correlation among variables for regression analyses was assessed by Pearson correlations. Mixed linear regression models were used to investigate the relationships between MUN and the cow and test-day factors. The variables "cow" and "herd" were included as random effects to control for the effect of clustering of MUN test dates within cow, and clustering of cows within herd, respectively. Only significant ($P<0.05$) variables were allowed to remain in the final multiple variable models, and those are reported below.

Results and Conclusions

Pearson correlation coefficients among all independent variables were statistically significant ($P<0.01$). Most were small in value ($r<0.4$); therefore multicollinearity was not a major concern for the regression analyses. Milk yield had moderate negative correlation with days in milk ($r = -0.61$) and milk protein ($r=-0.54$). Milk protein was moderately positively correlated with days in milk ($r = 0.56$) and milk fat ($r= 0.48$). The overall average MUN was 11.79 mg/dl.

The relationship between parity and MUN values was not significant. The average milk urea concentration was low during the first month of lactation (10.97 mg/dl), increased to peak at 4 months of lactation (12.38 mg/dl), and decreased to the end of lactation (11.14 mg/dl). A positive relationship existed between MUN concentration and milk yield. With each liter increase in milk production per cow per day, the average MUN value increased by 0.05 mg/dl. A negative relationship existed between MUN and milk protein percentage and SCC. With each 0.1% increase in milk protein percentage, the average MUN value decreased by 0.2 mg/dl, while with each unit increase in linear score the average MUN value decreased by 0.4 mg/dl. A quadratic relationship was found between milk fat percentage and MUN concentration, with lower MUN values occurring at low and high fat percentages(at 3.0, 3.5 and 4.0% milk fat, average MUN was 12.39, 12.44, and 11.84 mg/dl, respectively).

MUN values were elevated in late winter/early spring (March, April) and through the summer/fall months, with the highest average MUN values occurring in July and August (13.55 mg/dl). Variation at

the herd and cow levels in the model were 19.7 and 19.0%, respectively, while variation at the test date level was 61.3%, suggesting that the majority of the changes in MUN values relate to unmeasured nutritional and non-nutritional changes between test dates. Only 13.3% of the variation in MUN values was explained by the combination of studied factors, but these factors should be kept in mind when assessing low and high MUN values on dairy farms.

A Population Approach to Assess Antimicrobial Resistance in Commensal Coliforms of Feedlot Cattle

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Introduction

The objective of this study was to determine the magnitude and duration of apparent antimicrobial resistance in commensal fecal coliforms using a population-based approach in feedlot cattle.

Materials and Methods

Angus steers (n=370), weighing approximately 600 lb (273 kg), were purchased directly from two ranches in western South Dakota and placed in 42 open, concrete floor pens at the SDSU Ruminant Nutrition Research Center. Cattle were fed typical receiving rations with no antimicrobials. Two cattle from each pen were randomly selected for fecal sampling at days 0, 14, 28 and 42. From half the pens, one sampled animal was selected to receive a single injection of florfenicol (18 mg/lb; Nuflor, Schering-Plough Animal Health) on Day 11. Fecal samples were plated onto MacConkey agar. Ten lactose-positive colonies were selected and used for antimicrobial susceptibility testing to ten antimicrobials using the disk diffusion method. Antimicrobial sensitivity was dichotomized as sensitive or not sensitive. Data were summarized as proportion of cattle at each sampling day with all ten isolates susceptible.

Results and Conclusions

On Day 0 sampling, 57.9% of the cattle displayed pansusceptible flora to all antimicrobials tested. Antimicrobials where susceptibility was observed in less than 95% of cattle included tetracycline (63.9%), sulfasoxizole (85.5%), streptomycin (81.9%), and ampicillin (94.0%).

Source of cattle appeared to affect antimicrobial resistance patterns ($P<0.02$). In cattle administered florfenicol, antimicrobial susceptibility was greatly affected and declined in Day 14 samples for chloramphenicol (0%), ampicillin (0%), sulfasoxizole (0%), tetracycline (0%), amoxicillin/clavulanic acid (9.5%), and cephalothin (14.3%; $P<0.05$). The change in susceptibility in treated cattle began to return to levels consistent with non-treated cattle at Day 28 and further by Day 42, though antimicrobial susceptibility remained lower for chloramphenicol and amoxicillin/clavulanic acid ($P>0.05$), indicating a longer term antimicrobial susceptibility effect. Tetracycline susceptibility appeared to decline with time in non-treated steers ($p=0.04$) despite no exposure to tetracycline.