update on Regional Extension Programs

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Metabolic Profile Research Update

Research was conducted to evaluate the relationship between dietary intake and various parameters of the metabolic profile. Blood samples were collected at the morning feeding during 3 wk before and 3 wk after calving (N=4129 dairy cows) in 8 Holstein herds in the summer and winter, as well as in 8 Jersey herds in the summer. The samples were refrigerated, processed, and stored at -20 °C until laboratory analysis. On the day of sampling, total mixed ration samples were collected for subsequent analysis. Associations were tested by logistic regression (pregnancy at 90 [P90] and 150 days in milk (DIM) [P150]), correlation analysis (dietary and metabolic profile concentrations), and analysis of variance (days to first service [DFS] and days open [DO]). Herd records were collected and health events were extracted from herd records including dystocia, still births, twins, retained placenta, hypocalcemia, ketosis, and mastitis. Cows that were over-

Table 1. Mean and SD ration composition during the prepartum period.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Winter Holsteins</th>
<th>Summer Holsteins</th>
<th>Summer Jerseys</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
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<tr>
<td>P</td>
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<td>0.06589</td>
<td>0.347778</td>
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<tr>
<td>DM</td>
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<tr>
<td>CP</td>
<td>15.15</td>
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<td>14.6</td>
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<tr>
<td>Adj. Prot</td>
<td>15.025</td>
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<td>1.296667</td>
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The Mid-South Ruminant Nutrition Conference does not support one product over another and any mention herein is meant as an example, not an endorsement.
conditioned or under-conditioned and evidence of lameness was noted at sampling.

The mean and standard deviation (SD) for the ration composition by season for the Holsteins and for summer sampling for the Jerseys are shown in Table 1 for the prepartum period and Table 2 for the postpartum period.

The time of sample collection was categorized into weeks relative to calving (D 0) with wk -3 from D -24 to D -18; wk -2 from D -17 to D -11; wk -1 from D -10 to D -4; wk 0 from D -3 to D 3; wk 1 from D 4 to D 10; wk 2 from D 11 to D 17; and wk 3 from D 18 to D 24. Pearson correlation coefficients were determined between serum values for magnesium (Mg), potassium (K), calcium (Ca), sodium (Na), and phosphorus (P) and the mineral level in the prepartum or postpartum ration associated with the herd of origin, season, and day relative to calving. Pearson correlation coefficients between serum urea and albumin concentration and ration concentration of adjusted protein, soluble protein (SP), rumen degradable protein (RDP), and crude protein (CP) were determined. Correlations were calculated for the individual weeks of wk -3, -2, -1, 1, 2, and 3; for the combined prepartum period of wk -3, -2 and -1; for the combined postpartum period of wk 1, 2, and 3; and over the entire period except week 0.

For serum urea, the highest correlation coefficients were with ration CP (P < 0.0001), particularly during the prepartum period. Although serum albumin was significantly correlated with SP, RDP, and CP; the correlations were not strong, ranging from 0.15 to -0.06. Serum Ca and ration Ca,

<table>
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<tr>
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<th>Summer Jerseys</th>
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</thead>
<tbody>
<tr>
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<td>Mean</td>
<td>SD</td>
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were correlated over all weeks (excluding wk 0), for wk -2, wk -1, wk 3, prepartum and postpartum with the highest correlation of 0.155 occurring in wk -2. Ration and serum K concentrations were correlated over all weeks (excluding wk 0), wk 1, wk 2, and postpartum. Over all Mg was correlated; however, serum Mg in the postpartum period, combined or by individual week, was not correlated. The correlation was approaching significance (P < 0.102) by week 3, although the correlation was low (0.086). In the prepartum period, Na tended to have a slightly negative correlation (-0.04, P < 0.097) and overall the correlation was negative (P < 0.0001); however postpartum as a group or by individual week correlations between ration and serum concentrations were not significant.

Ration and serum P concentrations were correlated for all time periods evaluated, although the highest correlation was 0.166. Previously we reported to this group that when serum from Holstein cows within the transition period were evaluated for P on a week by week basis (week zero = -3 d prepartum to 3 d post calving), week 1 was the only week where serum P values differed (Lager et al., 2011). This would mean that P levels decrease around 10 d postpartum. There was not an effect of number of lactation. Further, our group collected samples from summer and winter to provide seasonal analysis and it was discovered that P levels are impacted by season.

**CONCLUSION**

The metabolic profile is a useful tool that has evolved over time. This evolution or adaptation is necessary to account for changes in feeding management and animal genetics. The key is ensuring that the reference values match the stage of lactation. From this evaluation, it is apparent that correlations do exist between ration nutrients and some parameters analyzed as part of the metabolic profile; however, during the transition period evaluated these correlations although significant aren’t strong, which may be related to the changes in nutrient composition which occurs during this 6 wk period. Because of the prevalence of disease within the periparturient period, a reference profile based on mid-lactation cows limits the interpretation of data from cows within the transition period. Due to the number of ration manipulations frequently occurring during this period some analytes may not be reflective of the current nutrition program and over interpretation should be avoided. There is certainly a need to understand the fluctuations that occur in serum biochemical analytes over the course of a lactation, especially within the transition period. With recent data displaying an impact of breed and season on the metabolic profile as well as the documented variability within the transition period, it may be necessary to account for each factor as well as be cognizant of when a sample is collected to be sure that the results received will be of value.

**ACKNOWLEDGEMENTS**

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