The effect of feeding zeolite A during the prepartum period on serum mineral concentrations in multiparous Holstein Cows

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Introduction

- Most cows undergo some level of hypocalcemia in the immediate postpartum period, with 40 to 70% of multiparous cows developing subclinical hypocalcemia (SCH; Reinhardt et al., 2011; Caixeta et al., 2015; Neves et al., 2017).
- Feeding prepartum rations low in Ca can improve Ca status postpartum (Kichura et al., 1982). In European studies, feeding zeolite A for the 2 weeks prior to calving has been shown to improve blood Ca status in the days following parturition (Thilsing et al., 2006; Pallesen et al., 2008). The objective of this feeding strategy in a 3 wk refresh program has not been demonstrated.

Objective

- To determine the effect of feeding multiparous Holstein cows synthetic zeolite A for 3 wk prior to expected calving on peripartum serum mineral status.

Materials and Methods

- 55 multiparous Holstein cows (2nd lactation = 24, 3rd lactation = 31) were enrolled 28 d prior to expected calving and randomly assigned to 1 of 2 dietary treatments (trt) starting at 21 d prior to expected calving:
  - Control (CON; n = 29) – 40% CS, 33% wheat straw, and 27% concentrate mix
  - Experimental (EXP; n = 26) – CON diet with the addition of synthetic zeolite A (X-Zeolit; Protekta Inc., Lucknow, Ontario, CA/Vilofoss, Graasten, DK) at 3% of DM, targeting 500 g/d as fed.
- Blood was collected 1x/wk from enrollment until 7 d prior to expected calving, daily from 7 d prior to expected calving until 7 DIM, and 3x/wk from wk 2-4, and 2 samples collected within 24 h of calving and a subset were analyzed for Ca, P, and Mg concentrations.
- Prepartum and postpartum data were analyzed separately. Data analyzed over time were subjected to repeated measures ANOVA using the MIXED procedure in SAS v.9.4, the REPEATED statement for time, and P values were corrected for multiple comparisons using Tukey HSD. Least squares means and standard errors are reported.
- Fixed effects were trt, time, parity (2nd vs. 3rd), all 2-way interactions, and random effect was cow within trt.
- The difference in prevalence of SCH between trt x d was tested with Fisher’s exact test.

Results

Table 1. Chemical composition (mean ± SD) of the CON, EXP, and postpartum diets. Weekly TMR samples were composited over 4-wk intervals for wet chemistry analysis (Cumberland Valley Analytical Services, Hagerstown, MD).

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>CON</th>
<th>EXP</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP (%)</td>
<td>14.6 ± 1.0</td>
<td>14.5 ± 0.7</td>
</tr>
<tr>
<td>NDF (%)</td>
<td>46.4 ± 1.4</td>
<td>46.0 ± 1.7</td>
</tr>
<tr>
<td>ADF (%)</td>
<td>16.8 ± 1.7</td>
<td>16.3 ± 0.3</td>
</tr>
<tr>
<td>Sugar (%)</td>
<td>3.2 ± 0.8</td>
<td>3.3 ± 0.4</td>
</tr>
<tr>
<td>Fat (%)</td>
<td>6.2 ± 0.5</td>
<td>7.9 ± 0.36</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>0.68 ± 0.05</td>
<td>0.65 ± 0.03</td>
</tr>
<tr>
<td>P (%)</td>
<td>0.39 ± 0.03</td>
<td>0.38 ± 0.02</td>
</tr>
<tr>
<td>Mg (%)</td>
<td>0.42 ± 0.05</td>
<td>0.42 ± 0.03</td>
</tr>
<tr>
<td>Ca (%)</td>
<td>1.14 ± 0.06</td>
<td>1.12 ± 0.04</td>
</tr>
<tr>
<td>S (%)</td>
<td>0.25 ± 0.00</td>
<td>0.24 ± 0.01</td>
</tr>
<tr>
<td>Na (%)</td>
<td>0.14 ± 0.03</td>
<td>0.50 ± 0.04</td>
</tr>
<tr>
<td>K (%)</td>
<td>0.31 ± 0.03</td>
<td>0.30 ± 0.03</td>
</tr>
<tr>
<td>DCAD (mEq/200 g of DM)</td>
<td>11.0 ± 2.06</td>
<td>26.87 ± 1.71</td>
</tr>
<tr>
<td>NEL (Mcal/kg)</td>
<td>0.66 ± 0.01</td>
<td>0.65 ± 0.01</td>
</tr>
<tr>
<td>MP (kg of DM)</td>
<td>87.24</td>
<td>85.41</td>
</tr>
<tr>
<td>MP intake (g/d)</td>
<td>1274</td>
<td>1196</td>
</tr>
</tbody>
</table>

Figure 1. Serum calcium concentrations in the peripartum period for cows fed EXP and CON diets. Significant differences (P ≤ 0.05) within day are depicted with an asterisk (*).

Figure 2. Serum phosphorous concentrations in the peripartum period for cows fed EXP and CON diets. Significant differences (P ≤ 0.05) within day are depicted with an asterisk (*).

Figure 3. Serum magnesium concentrations in the peripartum period for cows fed EXP and CON diets. Significant differences (P ≤ 0.05) within day are depicted with an asterisk (*).

Conclusions

- Serum Ca concentrations were higher for cows fed EXP compared to CON during both prepartum and postpartum periods; differences were greatest during the immediate periparturient period.
- Serum P concentrations were lower for cows fed EXP compared to CON during both prepartum and postpartum periods; differences were greatest prepartum and during the immediate postpartum period.
- Serum Mg concentrations were lower for cows fed EXP compared to CON during the prepartum and immediate postpartum periods.
- The prevalence of SCH in cows fed EXP was lower than cows fed CON during the immediate periparturient period and cows fed EXP did not experience chronic SCH while 35% of CON fed cows were affected.
- Normal Ca concentrations (≥ 8.5 mg/dL) were maintained in 50% of EXP fed cows from 0 to 3 DIM compared to 3% of CON fed cows.
- Supplementation synthetic zeolite A for 3 wk before expected parturition resulted in improved Ca status around calving yet it is unclear as to the biological impact of reduced P and Mg concentrations around calving.

Acknowledgments

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References


- **Formulated value predicted by Cornell Net Carbohydrate and Protein System v.6.55**
- *Based on actual intakes during the prepartum and postpartum period and predicted MP concentrations as fed.*