Effect of Frequency of Supplementation with Megalac-R on Non-esterified Fatty Acids and Blood Urea Nitrogen Concentration in Lactating Beef Cows

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Synopsis
Beef cows in early lactation, consuming similar overall quantities of an energy supplement, but supplemented 3, 5, or 7 days a week had similar concentrations of non-esterified fatty acid (NEFA) and blood urea nitrogen (BUN); therefore, indicating similar energy balance levels. Reducing the frequency of supplementation may help decrease the costs associated with feeding management such as labor and fuel, without negatively affecting animal performance.

Summary
During the spring of 2015, an experiment was conducted to determine the effects of supplementing a ruminally protected lipid (Megalac-R) either 3, 5, or 7 days per week on concentrations of serum non-esterified fatty acid (NEFA) and blood urea nitrogen (BUN) of beef cows in early lactation. For two weeks (Phase 1, adaptation period, d 0-14), eighteen Angus crossbred cows (first 90 d of lactation) were individually supplemented with 10 lb/wk (as is) of corn gluten feed (CGF) pellets, at three different frequencies: 3, 5, or 7 d/wk. During the last three days of the adaptation phase, blood samples were collected from each cow before supplementation (h 0), and 8 and 16 h after supplementation. On d 14 to d 34 (Phase 2) Megalac-R was added to the CGF supplement at a rate of 3.5 lb/wk (as is). On the final three days of Phase 2 blood samples were collected from each cow immediately before supplementation (h 0), and 8 and 14 h after supplementation. Serum NEFA and BUN concentration were analyzed. Concentrations of NEFA and BUN were similar among treatments. A treatment x sampling day interaction was observed for NEFA concentrations (P<0.001); however, within each sampling day, there were no differences among treatments, except on d 13, when cows receiving supplement 3× per week had reduced (P=0.03) concentrations compared to cows receiving supplement 5× per week. Concentrations of BUN were similar among treatments, but there was a difference in the concentrations among sampling days (P<0.001). Therefore, supplementing a ruminally protected lipid 3, 5, or 7 d/wk did not alter serum NEFA and BUN concentration in lactating beef cows, resulting in no significant differences in energetic balance of the cows, measured by these two parameters, remained similar among treatments. Supplementing lactating cows less than 7 days per week is a feasible option to reduce feeding costs without affecting animal performance.

Introduction
In North Florida, the breeding season of cow/calf operations usually occurs between December and May, which also occurs during the dormant stage of the warm season forages. This situation makes it necessary to apply feeding strategies to provide sufficient energy and protein to the lactating beef cows, in order to assure their weight recovery to support a subsequent pregnancy. Offering a feed supplement may offset the negative energy balance that the cow is experiencing during lactation; however, it may also increase the costs associated with management and feeding of the herd. Heifers receiving a high protein supplement 1× per week did not show differences in performance when compared with heifers receiving supplement 3× per week (Mathis, 2003). In addition, the authors reported a decrease of 60% in associated feed transport and labor costs. However, when they reduced the frequency of supplementation of an energy supplement, weight gain and conception rate were reduced (Mathis et al., 2003). When the performance of mid-to late gestation beef cows supplemented with hay only, distillers grain plus solubles (DDGS) offered 7 d/wk or 3 d/wk, plus hay every day, and alternating supplements; 4 d/wk hay only, and DDGS every other day was evaluated (Klein et al., 2014), cows receiving supplement 4 d/wk with hay and DDGS every other day had the least dry matter intake and hay intake, but had similar total BW gain.
and gain to feed ratio to the supplementation strategies that included feeding DDGS. Megalac-R (Church and Dwight Co., Princeton, NJ) is a rumen protected fat and a source of concentrated energy that has been reported to reduce the incidence of metabolic ailments during the transition period of dairy cows. Our objective was to measure non-esterified fatty acids (NEFA) and blood urea nitrogen (BUN) concentrations in blood serum, to determine differences in fat tissue mobilization and nitrogen utilization in lactating beef cows supplemented 3, 5, or 7 d/wk.

Materials and Methods
Eighteen early lactation beef cows (Average BW=1,100 ± 47 lb) in their first 90 d of lactation, were used at the UF - North Florida Research and Education Center (NFREC) Beef Unit in a completely randomized design study. The experiment was divided into two phases. Phase 1 (d 0-14) occurred when cows were individually supplemented corn gluten feed (CGF) pellets at a rate of 10 lb/wk (as is). The supplement was provided to the cows at 0700 h, at three different frequencies: 3 d/wk (F3), 5 d/wk (F5), or 7 d/wk (F7). Cows in F3 received 3.3 lb/d of CGF on Monday, Wednesday and Friday; cows in F5 received 2 lb/d of CGF from Monday to Friday, and cows in F7 received 1.4 lb/d daily. During the entire duration of the study, cows and calves had access to a ryegrass (Lolium multiflorum) pasture from where a sample was collected weekly and analyzed for nutritional value. During the last 3 days of Phase 1 (d 11-13), 10-mL blood samples were obtained via jugular venipuncture into vacuum tubes with no additives, before supplementation (0 h), 8 h and 16 h after supplementation. Phase 2 (d 14-34) had a similar supplementation system, with the only difference that Megalac-R (M-R) was added to the CGF pellets supplement at a rate of 3.5 lb/wk (as is). Cows in F3 received 1.2 lb/d M-R on Monday Wednesday and Friday, whereas cows in F5 received 0.7 lb/d M-R from Monday to Friday, and cows in F7 received 0.5 lb/d M-R daily. During the final 3 d of this period (d 32-34), blood samples were taken pre and post supplementation, in a similar fashion to Phase 1.

For both phases, immediately after finishing blood collection, blood tubes were allowed to stand for 1 h at room temperature in the laboratory, and then were placed in the refrigerator for 24 h. After 24 h refrigeration, samples were centrifuged for 15 min at 4,000 × g at 4°C. After centrifugation, serum was transferred into polypropylene vials (12 mm × 75 mm; Fisherbrand; Thermo Fisher Scientific Inc., Waltham, MA) and stored at -20°C for further analysis. Serum samples were thawed at room temperature before analysis. Serum NEFA was determined using the acyl-CoA synthetase, acyl-CoA oxidase method (NEFA-HR, Wako Pure Chemical Industries, Richmond, VA). Blood urea nitrogen was determined using a modification to the urease and glutamate dehydrogenase method (Liquid Urea Nitrogen BUN, Pointe Scientific Inc., Canton, MI). Data were analyzed using the MIXED procedure of SAS, using cow as the experimental unit considering double repeated measures (day and hour postfeeding within day). The model included the fixed effects of treatment, day, hour postfeeding, and their interactions.

Results
Mean concentrations of NEFA and BUN, per frequency of supplementation, are summarized in Table 1. There was no difference in NEFA and BUN concentration among treatments (P>0.10). A treatment × sampling day interaction occurred for NEFA concentration (P<0.001), as it is showed in Fig. 1. On d 13 (Sunday), which corresponds to the second consecutive day when only F7 cows were supplemented with CGF, NEFA concentrations of F3 cows were less than those in F5 (P=0.03). Perhaps the greater quantity of supplement received by cows in the F3 treatment on d 11 resulted in differences between the two treatments (i.e., 3.3 lb for F3 vs. 2 lb for F5). At the end of Phase 2, no differences between treatments were observed in blood NEFA concentrations in any of the days sampled (i.e., d 32-34).

Concentrations of BUN did not differ (P=0.74) among treatments, and no treatment × d or 3-way interactions were observed (P>0.10). However, concentrations of BUN differed across days of sampling. Concentrations of BUN were greater (P<0.05) during Phase 2 than Phase 1. In conclusion, reducing the
frequency of supplementation does not exert a negative effect on blood metabolites of lactating beef cows. Adding M-R to the supplement decreased blood NEFA, but increased concentrations of BUN.

Literature cited
Table 1. Mean non-esterified fatty acid (NEFA) and blood urea nitrogen (BUN) concentration in the serum of beef lactating cows per frequency of supplementation.

<table>
<thead>
<tr>
<th>Frequency of supplementation¹</th>
<th>F3</th>
<th>F5</th>
<th>F7</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEFA, mEq/L</td>
<td>0.45</td>
<td>0.53</td>
<td>0.53</td>
<td>48.44</td>
<td>0.41</td>
</tr>
<tr>
<td>BUN, mg/dL</td>
<td>19.3</td>
<td>19.27</td>
<td>18.42</td>
<td>0.9</td>
<td>0.73</td>
</tr>
</tbody>
</table>

¹F3 = 3 d/wk supplementation; F5 = 5 d/wk supplementation; F7 = 7 d/wk supplementation. Within a row, means without a common superscript differ (P<0.05).

Figure 1. Concentration of serum non-esterified fatty acids (NEFA) on d 11, 12, and 13 for lactating beef cows on a ryegrass pasture and different frequencies of supplementation. F3 = 3 d/wk; F5 = 5 d/wk; F7 = 7 d/wk. *F3 differs from F5 (P=0.03).