
Subclinical hypocalcemia prevalence remains high postpartum despite use of negative DCAD diets and vitamin D$_3$. We hypothesized that feeding 25-(OH)D$_3$, (25D) during lactation, and in transition in conjunction with negative DCAD diets, would improve milk production, reproduction, and health. Dairy cows were used in 2 randomized exposure experiments. Experiment 1; cows in Control [CON; n = 645; no 25D] or Treatment [TRT; n = 537; 2 mg/d of 25D prepartum and 1 in lactation] groups assigned and fed from ~21 d prepartum were monitored for milk yield and composition, and health and reproductive measures. Experiment 2; 4 groups of cows (median 147 DIM) were monitored per Experiment 1 to the end of that lactation (L1), subsequent transition and lactation (L2). Groups were (1) CON-CON (no 25D), (2) TRT-TRT (1 mg/d of 25D in L1 and L2 and 2 prepartum), (3) CON-TRT (1 mg/d of 25D in L2 and 2 prepartum), and (4) TRT-CON (1 mg/d of 25D in L1). For L1, 1,032 cows entered control groups 1 or 3 and 1,032 in groups 2 or 4. The n/group that entered L2 was 521, 523, 273, and 248, respectively. Analysis used mixed linear and survival models (STATA V15, Statacorp LP, College Station, TX). Blood Ca, P, and 25D concentrations (n = 17/group) were evaluated at 5 times. Experiment 1, TRT cows had 0.2 lower LN SCC than CON cows (P = 0.002) and multiparous (multi) TRT cows had 21.4 ± 7.8% and 30.3 ± 16.6% greater odds of pregnancy, respectively, (P = 0.016). Multi CON-CON and TRT-TRT cows had 41.1 ± 7.8% and 30.3 ± 16.6% greater odds of mastitis/d than primiparous CON cows. In Experiment 2, TRT-TRT cows had 15.5–28.9% lesser odds to be bred/d than other groups (P = 0.016). Multi CON-CON and TRT-CON cows had 21.4 ± 7.8% and 30.3 ± 16.6% greater odds of pregnancy, respectively, than multi TRT-TRT cows. Serum Ca concentrations were not affected by group (P = 0.988), (P = 0.003) and 25D concentrations (P < 0.001) were highest in the TRT-TRT cows. Duration on transition diet improved production measures. Treatment lowered SCC and provided other benefits, particularly for multi cows including the time to pregnancy, responses varied across treatment groups.

Key Words: calcidiol, calcium, prepartum


Selenium (Se) is an essential trace mineral that if deficient in the soil will therefore be deficient in diets fed to dairy cows. Selenium supplements exists in inorganic and organic forms, with the organic form being seleno-yeasts (SY) or pure forms such as selenomethionine or hydroxy-selenomethionine (OH-SeMet). The objective was to determine the amount of Se that was transferred to milk and blood of mid to late lactation dairy cows when supplemental Se from a OH-SeMet (Selisseo 2% Se, Adisseo France SAS) was fed compared with an unsupplemented group and a group supplemented with a SY. Twenty-four lactating Holstein cows, 12 multiparous and 12 primiparous (178 ± 43 d in milk (DIM)) were used in a randomized complete block design for 91 d (7 d for covariate and 84 d for treatments). Treatments were 1) basal (practical) diet with an expected Se background of 0.2 mg Se per kg as-fed (negative control), 2) basal diet + 0.3 mg Se per kg as-fed from SY (positive control SY-0.3), 3) basal diet + 0.1 mg Se per kg as-fed from OH-SeMet (OH-SeMet-0.1), and 4) basal diet + 0.3 mg Se per kg as-fed from OH-SeMet (OH-SeMet-0.3). Blood (at 1030h) and milk samples (am and pm milking) were obtained from each on the last 3 d of the covariate week and wk 1, 2, 3, 4, 6, 8, 10 and 12 of the study. Data were analyzed using the PROC MIXED procedures of SAS with REPEATED measures. Significance was declared at P ≤ 0.05. Plasma and milk Se concentrations was highest for OH-SeMet-0.3 (Table 1). However, there was no difference on the plasma glutathione peroxidase activity between groups. Those results are a confirmation that organic Se forms can increase milk and plasma Se concentrations. Moreover, when administered at the same level of supplementation, OH-SeMet showed to be more efficient than SY to improve those Se concentrations.

Key Words: selenium, selenomethionine, milk

90 Effect of electrochemically activated drinking water on production performance and somatic cell counts in dairy cows. E. Vargas-Bello-Pérez*, S. Cruz-Morales, R. Dhakal, and H. H. Hansen, Department of Veterinary and Animal Sciences, Faculty of Health and Medical Sciences, University of Copenhagen, Frederiksberg C, Denmark.

Electrochemically activated water (ECW) can be used for the prevention and control of microorganism, however, there is scarce information about its use in dairy farms. Thus, the objective of this study was to determine the effect of ECW on production performance and somatic cell counts in dairy cows. For 6 mo, 2 groups of lactating Red Danish cows were fed regular drinking water (n = 27) and ECW (n = 27) water dosed with 4 ppm of 29 mg/L of chlorate (Neuthox, Danish Clean Water, Denmark). Monthly records from milk production, milk composition and somatic cell counts were analyzed. Milk production, composition and SCC data were analyzed with linear mixed models using R version (3.5.1). Bacteriological conditions (BC) at the beginning of the study for non-dosed and dosed drinking troughs were >200 MPN/100 mL of coliform bacteria at 37°C, 120 MPN/100 mL of Escherichia coli, >3000 cfu/mL of bacterial count at 22°C and 1100 cfu/mL of bacterial count at 37°C. Then, after 6 mo, BC in dosed drinking troughs were <1 vs. >200 MPN/100 mL of coliform bacteria at 37°C, <1 vs. 200 MPN/100 mL of Escherichia coli, 160 vs. >3000 cfu/mL of bacterial count at 22°C and 150 vs. >3000 cfu/mL of bacterial count at 37°C. Milk yield (32.4 ± 3.2 kg/cow), milk fat (4.55 ± 0.16%) and milk protein (3.78 ± 0.16%) were similar (P > 0.05). Somatic cell counts (× 10$^5$/dL) were significantly (P < 0.05) lowered by ECW (162 ± 42) compared with non-dosed animals (411 ± 202). Overall, results showed that ECW could be an alternative to reduce somatic cell counts without detrimental effects on milk production and milk composition.

Key Words: milk production, electrochemical water, somatic cells

Table 1 (Abstr. 89). Average plasma and milk Se concentration and plasma glutathione peroxidase activity

<table>
<thead>
<tr>
<th>Item</th>
<th>Negative control</th>
<th>Positive control SY-0.3</th>
<th>OH-SeMet-0.1</th>
<th>OH-SeMet-0.3</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasma Se, ng/mL</td>
<td>120$^{a}$</td>
<td>134$^{a}$</td>
<td>122$^{c}$</td>
<td>142$^{c}$</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Milk Se, ng/mL</td>
<td>57$^{a}$</td>
<td>97$^{a}$</td>
<td>78$^{a}$</td>
<td>116$^{a}$</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Glutathione peroxidase, nmol/mL</td>
<td>90.58</td>
<td>91.63</td>
<td>91.00</td>
<td>92.85</td>
<td>0.859</td>
</tr>
</tbody>
</table>

$^{a}$Means within rows differ at P < 0.05.

Ruminal acidosis is a major issue affecting modern cattle industry. Buffers such as sodium sesquisulfate are normally fed to reduce negative effects of acidosis; however, some mineral sources may play a role as controllers of ruminal pH. We aimed to evaluate the effects of inclusion of CaMgCO$_3$ and CaMg(OH)$_2$ on microbial fermentation, hypothesizing that their inclusion as supplemental sources of inorganic Mg (iMg) would allow for similar ruminal fermentation conditions to those observed in a positive control diet formulated with MgO as the sole source of iMg plus a buffer. Four treatments were defined by the main source of iMg in the diet: (1) CO$_3$ (100% iMg from CaMg(CO$_3$)$_2$); (2) CO$_3$/OH [50% iMg from CaMg(CO$_3$)$_2$, 50% iMg from CaMg(OH)$_2$]; (3) OH [100% iMg from CaMg(OH)$_2$]; (4) MgO/Na (100% iMg from MgO, plus 0.6% sodium sesquisulfate). Nutrient concentration was the same across treatments (16% CP, 30% NDF, 1.69 MCal NE$_{L}$/kg, 0.68% Ca, and 0.22% Mg from which 0.05% corresponds to iMg). Four fermenters were used in a 4 × 4 Latin square design with 4 periods of 10 d each. In the last 3 d of each period samples were collected for analyses of nutrient digestibility, soluble Mg, VFA, and NH$_3$-N, while pH was measured at 0, 1, 2, 4, 6, 8, and 10 h post morning feeding to estimate hours below pH of 6 (pH < 6) and area under the pH curve (pH AUC). Bacteria pellets were harvested for $^{15}$N analysis and estimates of N metabolism. Treatment effects were analyzed using the MIXED procedure of SAS, while effects of CaMgCO$_3$ and CaMg(OH)$_2$ were evaluated by orthogonal contrasts. Inclusion of CaMg(OH)$_2$ increased pH AUC ($P < 0.02$); molar proportion of butyrate ($P < 0.02$), showing a similar effect to that one observed in the positive control treatment formulated with MgO and buffer. No effects of CaMgCO$_3$ and CaMg(OH)$_2$ were found on soluble Mg, nutrient digestibility, and N metabolism. Results indicate that feeding CaMg(OH)$_2$ as a mineral source may aid in the control of ruminal pH.

Key Words: in vitro, acidosis, buffers


Manure acidification is an effective strategy to lower ammonia emissions from manure and increase its value as fertilizer. Lowering dietary cation and anion difference (DCAD) can reduce urine pH and this may acidify manure depending on the degree of pH reduction in dairy cows. However, reducing DCAD can negatively affect DMI, production and fiber digestibility. The objective was to examine lactating cows fed a diet with reduced DCAD on production, fiber digestibility, and urine pH. Twenty cows were used in a randomized block design and fed 1 of the following 3 diets: a diet with DCAD of 220, 150, or 75 mEq/kg (n = 6, 7, and 7, respectively; DCAD, Na + K – Cl – S; 16.8% CP; 33% NDF on DM basis). SoyChlor replacing soybean meal and corn grain was used to decrease DCAD. The experiment was conducted for 5 wk to monitor DMI and production and spot fecal samples were collected in wk 5 to estimate fecal output and apparent total-tract nutrient digestibility. In wk 5, urine samples were also collected (every 4 h in a 24-h cycle) to estimate urine volume (creatinine) and measure urine pH. Data were analyzed using the MIXED procedure of SAS (block as random and diet as fixed effect). Reducing DCAD lowered (25.3 to 23.6 kg/d; $P = 0.02$) DMI in a linear manner. Milk yield, ECM, and ECM/DMI were not different ($P > 0.26$) among treatments. Milk component contents and yields were not affected by level of DCAD. Total-tract apparent digestibility of DM and NDF did not differ among treatments. Estimated urine volume increased (36 to 44 kg/d; $P < 0.01$) and urine pH decreased (8.25 to 7.86; $P < 0.01$) in a linear manner with decreasing DCAD. In conclusion, lowering DCAD of a lactation diet from 220 to 75 mEq/kg decreased DMI and numerically decreased milk yield (38.4 to 36.9 kg/d). However, the decreases in DCAD did not affect DM and NDF total-tract digestibility. Although an increase in urine volume and decrease in urine pH with decreasing DCAD was observed, we do not know whether these changes are effective in lowering ammonia emission from manure.

Key Words: dietary cation and anion difference, digestibility, and urine pH

93 Effects of dietary antioxidants and modulators of immune response on animal performance and metabolism of Holstein cows during heat stress. A. Ruiz Gonzalez*1, W. Suissi1, L. H. Baumgard2, P.-Y. Chouinard1, R. Gervais1, and D. E. Rico1, 1Université Laval, Quebec, QC, Canada, 2CRSAD, Deschambault, QC, Canada, 3Iowa State University, Ames, IA.

Twelve multiparous Holstein cows (42.2 ± 5.6 kg milk/d; 83.4 ± 27.1 DIM) were used in a split-plot design testing the effects of mineral and vitamin supplementation on animal performance and metabolism during heat stress. The main plot was the level of dietary vitamin E and Se (HVE: 200 IU/kg and 1.2 ppm; LVE 20 IU/kg and 0.3 ppm; respectively). Within each plot, cows were randomly assigned to 1) Heat stress (HS), 2) Pair-feeding (PF), or 3) HS with Vitamin D and Ca supplementation (HS+DCa; 1820 IU/kg and 1.5% Ca) in a Latin square design with 14-d periods. Milk components were analyzed by mid-infrared spectroscopy from samples taken on d 0, 3, 7, 10, and 14. This statistical model included the random effects of cow and period, and the fixed effects of plot, treatment, day and their interactions. No 3-way interactions were detected for any variable. Heat stress progressively decreased dry matter intake (DMI) before stabilizing on d 7 (30% reduction; Time $P < 0.001$) and was not affected by treatment. Milk yield decreased progressively in all treatments and was higher in PF relative to both HS and HS+DCa cows from d 3 to 14 ($P < 0.05$). There was a treatment by day interaction for milk fat and protein concentrations ($P < 0.05$). Milk fat was 10% lower in HS relative to PF on d 10 and 14, but not different between PF and HS+DCa, whereas milk protein was 7.5% lower in HS and HS+DCa relative to PF from d 3 to 14. Pre-prandial NEFA were 64% lower, whereas pre-prandial insulin was 58% higher in HS and HS+DCa than in the PF on d 7 and 14 ($P < 0.05$). Mineral and vitamin supplementation seems to have a moderate effect on the performance and metabolic responses of cows to heat stress.

Key Words: heat stress, dairy cows, nutrition