The effect of feeding zeolite A during the prepartum period on peripartum performance 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).
- Supplementing zeolite A in prepartum rations improves Ca status during the peripartum period (Thilsing et al., 2006; Pallesen et al., 2008).
- In European studies, feeding zeolite A for the 2 weeks prior to calving resulted in no differences in milk yield (Thilsing et al., 2007; Grabherr et al., 2009).
- To our knowledge, reproductive performance, oxidant status, rumination, and colostrum quality have not been evaluated in cows supplemented with zeolite A.

Objective

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

Materials & 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-Zelit, Protekta Inc., Lucknow, Ontario, CA/Vilofoss, Graasten, DK) at 3.3% of DM, targeting 500 g/d as fed
- Rumination, DMI, and milk production were recorded daily. Milk samples (1x/wk) were analyzed for composition, colostrum was measured for IgG, and select plasma samples were analyzed for oxidant status (reactive oxygen and nitrogen species / antioxidant capacity; d -28, -7, -3, 3, 7, 14 relative to calving).
- Prepartum and postpartum data were analyzed separately. Data were analyzed in SAS v. 9.4 with PROC MIXED and repeated measures analysis was conducted for measures with multiple timepoints and *P* values were corrected for multiple comparisons using Tukey HSD. Least squares means and standard errors are reported, unless otherwise noted.
  - Fixed effects were trt, time, parity (2nd vs. 3rd+), all 2-way interactions, and random effect was cow within trt.
- A Kaplan-Meier analysis using the LIFETEST procedure was used to test the difference in time to pregnancy by 150 DIM for trt and hypocalcemia status with the log-rank test.
- A Cox Proportional Hazards model using PROC PHREG was used to analyze the effect of trt, parity, and hypocalcemia status on time to pregnancy by 150 DIM.

Results

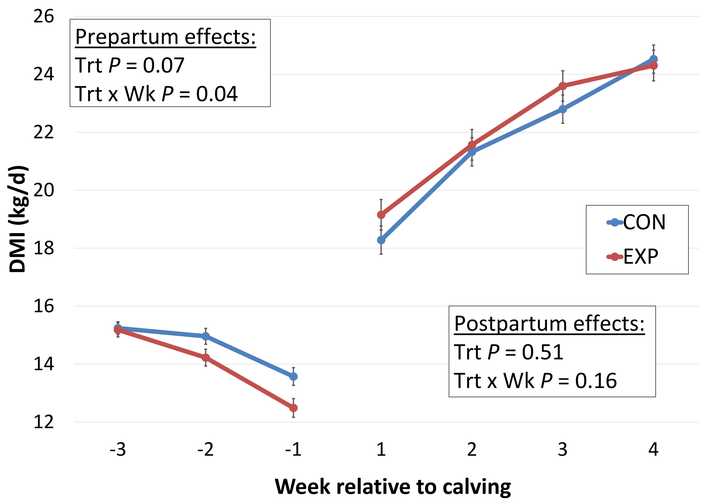

Figure 1. Dry matter intake from wk -3 to wk 4 relative to calving.

Results

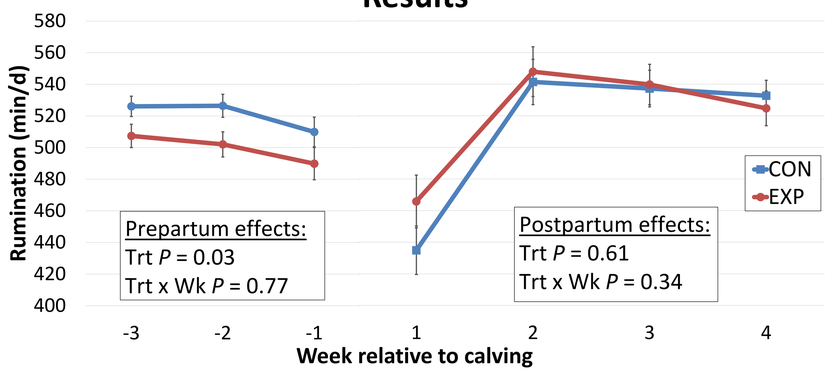

Figure 2. Rumination from wk -3 prepartum to wk 4 postpartum.

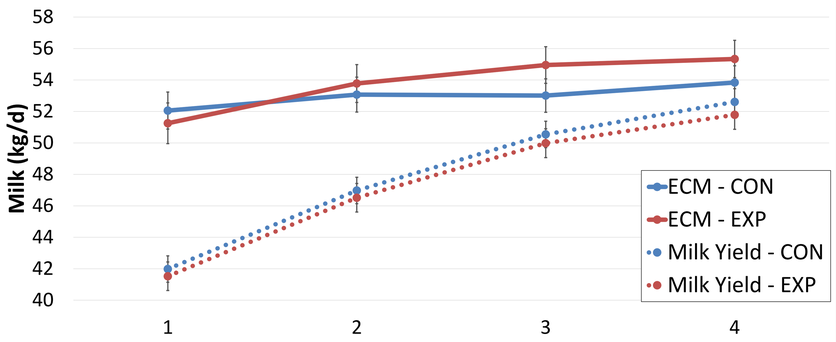

Figure 3. Milk yield and energy corrected milk (**ECM**) for CON and EXP fed cows from wk 1 to 4 postpartum. No trt or trt x wk effects for milk yield (*P* = 0.58; *P* = 0.99, respectively) or ECM (*P* = 0.50; *P* = 0.57, respectively) were observed.

Table 1. Milk yield and milk composition over the first 4 wk of lactation, colostrum IgG, and oxidant status index (**OSi**; reported as geometric means and back-transformed 95% CI) of cows fed CON or EXP.

	Treatment			P-value	
Variable	**CON**	**EXP**	**SEM**	**Trt**	**Trt x Wk**
Milk Yield (kg/d)					
Week 1 – 4	48.0	47.5	0.7	0.58	0.99
Week 1 - 9	51.7	50.7	0.7	0.37	0.84
Fat (%)	4.17	4.32	0.08	0.17	0.05
Fat (kg/d)	1.98	2.03	0.04	0.35	0.26
Protein (%)	3.19	3.30	0.05	0.09	0.24
Protein (kg/d)	1.51	1.55	0.03	0.33	0.88
Lactose (%)	4.58	4.59	0.02	0.78	0.59
Lactose (kg/d)	2.22	2.20	0.04	0.67	0.54
TS (%)	13.03	13.32	0.11	0.07	0.18
TS (kg/d)	6.23	6.30	0.10	0.65	0.66
ECM (kg/d)	53.0	53.8	0.9	0.50	0.57
ECM/DMI	2.47	2.47	0.05	0.95	0.47
MUN (mg/dL)	12.46	10.90	0.43	0.01	0.87
SCS	1.07	1.08	0.25	0.98	0.72
Colostrum IgG (mg/dL)	7628	8342	469	0.29	—
Colostrum IgG yield (g)	494	441	40	0.35	—
Prepartum OSi	1.70 (1.54–1.89)	1.78 (1.60-1.99)	—	0.54	0.81
Postpartum OSi	1.24 (1.12-1.37)	1.28 (1.15-1.42)	—	0.66	0.76

Results

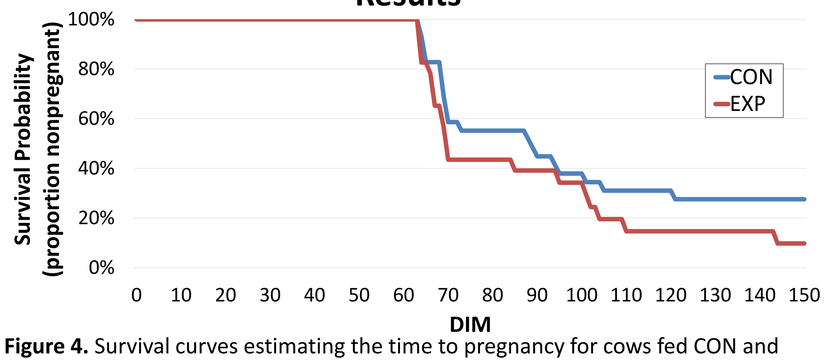

Figure 4. Survival curves estimating the time to pregnancy for cows fed CON and EXP. Median time to pregnancy for CON fed cows was 89 DIM and 70 DIM for EXP fed cows (*P* = 0.17).

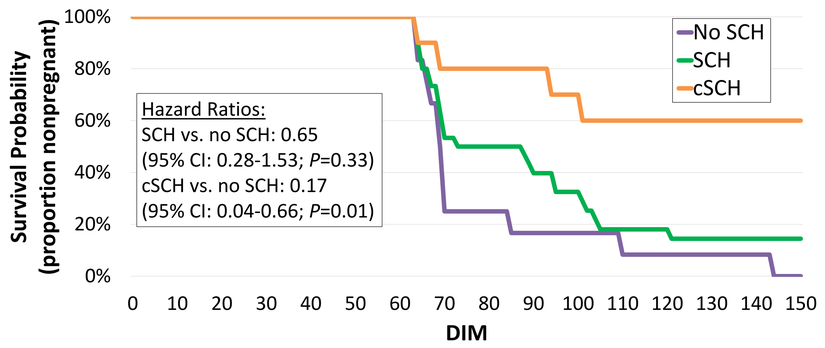

Figure 5. Survival curves estimating the time to pregnancy for multiparous cows categorized as being eucalcemic (**no SCH**; 0 samples with Ca < 8.5 mg/dL; n = 12), subclinical hypocalcemic (**SCH**; 1 to 3 samples with Ca < 8.5 mg/dL; n = 30), or chronic subclinical hypocalcemic (**cSCH**; 4 samples with Ca < 8.5 mg/dL; n = 10) between calving and 3 DIM (*P* < 0.01).

Conclusions

- Cows fed the EXP diet tended to have reduced DMI during the prepartum period but did not differ postpartum. Rumination was significantly lower in EXP fed cows during the prepartum period but was not different postpartum.
- Colostrum, milk yield, milk component yield, and oxidant status were similar between both treatments.
- Median time to pregnancy for cows fed EXP was 19 days earlier than for cows fed the CON diet.
- Cows with eucalcemic status had significantly improved time to pregnancy compared to chronic subclinical hypocalcemic cows.
- Cows without compromised Ca status had improved reproductive performance, which is in agreement with previous work (Caixeta et al., 2017).

Acknowledgements

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