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The effects of supplemental anionic salt fed during the periparturient period: Implications of milk production and feed intake of high producing dairy cows

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Abstract

The objective of this study was to determine the effect of a commercially available anionic salt supplement providing multiple sources of sulfur and chlorine fed during late gestation on intake, health, and production of Holsteins. Twenty-six mature cows were paired by expected calving date, lactation number, milk production potential, and body weight. Cows within pair were then randomly assigned to one of two diets. The dietary treatments were control (C) and supplemental anionic salt (A). Cows were fed the experimental diets as TMR via electronic feeding gates. Control diet was formulated to achieve a Dietary Cation-Anion Difference (DCAD) of +20 mEq/100 g dry matter. Control diet was predicted to provide 70g of calcium per cow per day. The treatment group was fed 454g per cow per day of a commercially formulated anionic salt supplement which lowered the DCAD level to -10 mEq/100 g dry matter. Treatment diets were formulated to provide a daily intake of 150g of calcium per cow per day. Diets were fed 30 days prior to expected day of calving. At calving, cows were fed standard lactation TMR for the first 6 weeks of lactation. Feed intake was measured daily. Urine pH was monitored twice each week using an electronic pH meter. Blood samples were collected weekly prepartum as well as on day -3 and day of calving. Postpartum blood samples were collected on day 1, 3, 7, 10 and 14 of lactation and then weekly until day 42. Blood samples were analyzed for Ca and NEFA. Daily milk yields and weekly milk component data were also collected. These data were analyzed for significance using SAS PROC MIX method. Cows fed anionic salts had lower urine pH compared to control cows (6.78 vs. 8.29; $P<0.0001$). Blood calcium was higher for anionic salt fed cows compared to control cows (8.70 vs. 8.53 g/dl; $P=0.061$). Plasma NEFA were lower for cows fed anionic salt diet (292 vs. 402 µeq/l; $P < 0.01$). Milk was greater over time for cows fed anionic salts versus control cows ($P = 0.0434$). Supplementation with a commercially available anionic salt supplement providing multiple sources of sulfur and chlorine improved calcium and energy balance associated with significant increase in milk production.

Introduction

- The transition dairy cow faces many potential metabolic disorders such as ketosis, displaced abomasum, retained fetal membranes, metritis, mastitis, and milk fever.
- Hypocalcemia (commonly referred to as milk fever) is a metabolic disorder which occurs due to the increased demand for calcium, without the active mechanisms to maintain the blood Ca concentration required.
- Potential losses which may occur due to the onset of hypocalcemia include:

  decreased milk production, predisposition to secondary disease problems, treatment costs, and possibly death

  \- Liesegang, A. (1998)
- Management of dietary cation anion difference (DCAD) can decrease the incidence of hypocalcemia.

  DCAD = mEq (Na+K) – mEq (Cl+S)
- Anionic salts are an efficient method for decreasing DCAD. Maintaining a lowered DCAD reduces blood pH, which improves responsiveness of tissues to parathyroid hormone. This then activates the mobilization of stored calcium throughout the body.
- Improved Ca status during the periparturient period reduces the risk of the other metabolic disorders (described above).
- Oetzel (1991) reported some sulfur based anionic salts to be unpalatable.
- The **objective** of this study was to determine the effects of feeding supplemental anionic salts during late gestation on the metabolic status of cows during the periparturient period.

Materials & Methods

- 26 multiparious Holstein cows were blocked by calving date, lactation number, previous lactation ME, body weight, and body condition score.
- Treatments were randomly assigned to the blocked pairs.

  Anionic Salt (A): -10 mEq/100 g DM

  Control (C): +20 mEq/100 g DM

Table 1: Experimental diets fed during prepartum

	% of Dry Matter	
Item	Control	Anionic
Corn	21.3%	18.3%
Corn Silage	17.3%	16.5%
Grass Hay	14.8%	18.0%
SBM 48%	10.0%	10.7%
Soy hulls	26.3%	22.0%
DiCal	-	1.5%
Limestone	0.9%	1.9%
Salt	0.1%	0.1%
Anionic Salt Pellet[1]	-	4.1%
Alfalfa Hay	8.9%	6.9%
Trace mineral + Vitamin	0.4%	-

[1]Anionic Salt Pellet was supplied by Dawe's Laboratories.

- Thirty days prior to the expected day of calving, cows were trained to use an automatic feeding systems (Calan). Following the training period beginning on d -21, diets were fed until calving.

- **Feed intake** was measured daily via Calan feeding system. **Urine pH** was measured twice weekly prepartum to monitor the change in body alkalinity. **Blood samples** were collected -21, -14, -10, -7, -3, day of calving, +1, +3, +7, +10, +14, +21 to monitor blood NEFA, BUN, glucose, calcium, chlorine, potassium, sodium, and phosphorous. **Body weight** and **body condition** scores were monitored twice weekly throughout the study. **Milk production** was recorded daily. **Milk components** (fat, protein, MUN, and SCC) were measured twice weekly post partum.

Results & Discussion

- The treatment LS Means for the entire study are reported in Table 2.
- Prepartum dry matter intake was not different over time due to treatment ($p = 0.78$) (Figure 1).
- DMI during weeks 1, 2, and 3 postpartum were higher for cows fed anionic salts pre-partum ($p=0.059$; Figure 2).
- Prepartum urine pH was significantly decreased when anionic salts were fed during late gestation ($p< 0.0001$). Given the rapid change in urine pH with the initiation of feeding the anionic salts and the consistent urine pH maintained over time, the effect of treatment over time was not significantly different ($p < 0.87$) (Figure 3).

Results & Discussion

- Serum calcium concentrations over time were significantly greater for the animals receiving the anionic salt treatment prepartum ($p < 0.0001$). Serum calcium was higher on day 3, 7 and 14 in cows fed anionic salts ($p < 0.002$) (Figure 4).
- Milk production was greater over time for cows fed anionic salt versus control cows due to a more rapid increase in milk production during early lactation ($p = 0.0434$) (Figure 5).
- Blood concentration of phosphorous, sodium, potassium and chlorine was 5.68, 142.27, 4.76, 101.95, and 5.96, 141.99, 4.64, and 101.67 for cows fed anionic salt and control diets, respectively. These parameters were not significantly different ($P>0.05$).

Table 2: Effects of treatment on production and metabolic parameters

Parameter	Control	Anionic	SE	p value
Dry Matter Intake (kg)				
Prepartum	13.6	14.2	1.3	0.74
Post Partum	17.7	20.1	1.0	0.11
Milk production (kg)	32.8	36.5	2.01	0.21
Serum Metabolites				
NEFA (µeq/l)	401.9	291.5	25.50	0.01
Glucose (mg/dl)	55.8	52.0	1.3	0.06
Urea - N (mg/dl)	13.6	15.4	0.42	0.01
Calcium (mg/dl)	8.5	8.7	0.06	0.06
Urine pH	8.29	6.79	0.07	<.0001
Body Weight (kg)				
Prepartum	690	693	35.8	0.90
Post Partum	601	621	36.3	0.41

Figure 1: Prepartum Dry Matter Intake

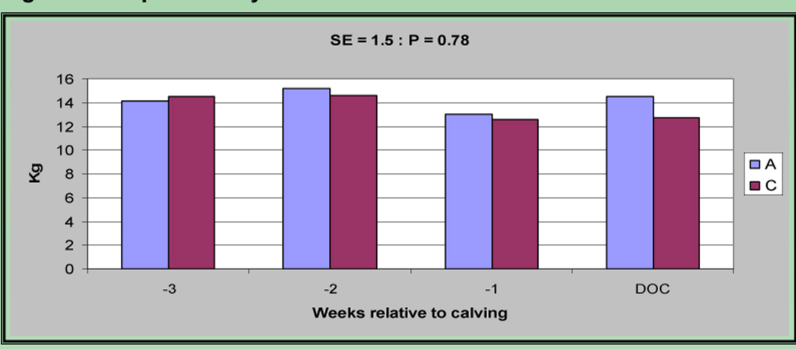
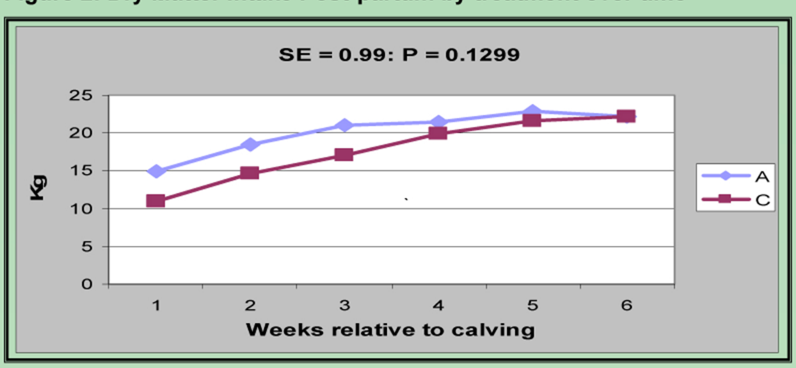


Figure 2: Dry Matter Intake Post-partum by treatment over time



Results & Discussion

Figure 3: Urine pH by Dietary Treatment by Day of Study

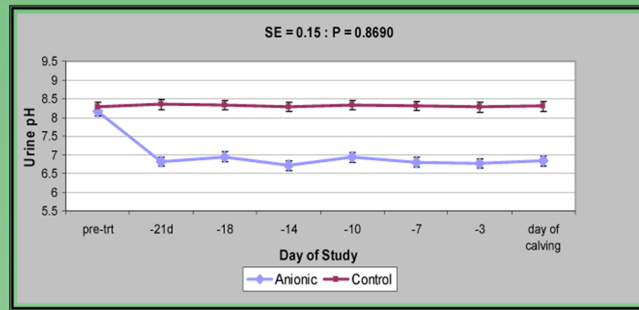


Figure 4: Blood Calcium levels by Treatment over Time

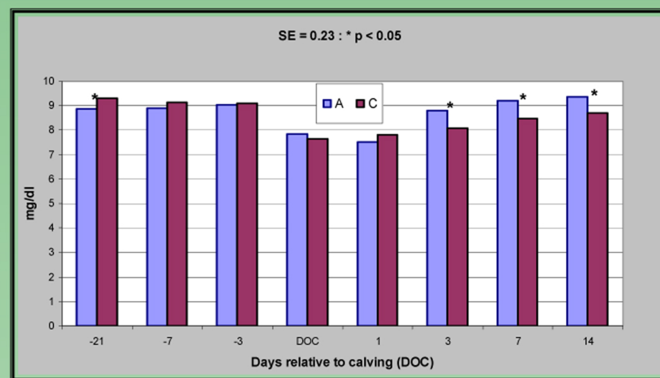
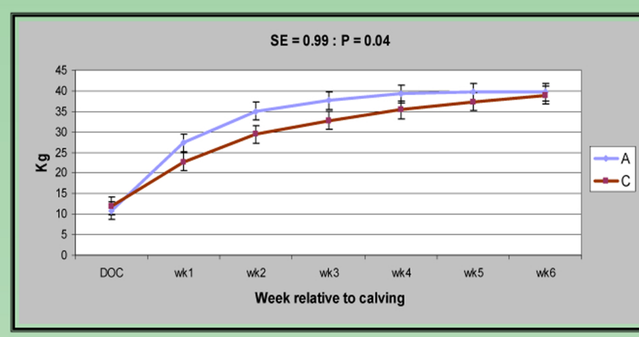


Figure 5: Milk Yield by treatment over time



Summary

Cows fed a commercially available anionic salt supplement providing multiple sources of sulfur and chlorine had:

- Improved Ca status during periparturient period
- Increased DMI during early lactation
- Improved energy status
- More rapid increase of milk production during early lactation

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