The Professional Animal Scientist 24 (2008):149–155

The Effect of Diets Varying in Dietary Cation-Anion Difference Fed in Late Gestation and in Lactation on Sow Productivity[1]

M. L. Roux,* S. L. Johnston,* R. D. Lirette,* T. D. Bidner,* L. L. Southern,*[2] PAS, and P. W. Jardon†

*School of Animal Sciences, Louisiana State University Agricultural Center, Baton Rouge 70803-4210; and †West Central, Ralston, IA 51459

ABSTRACT

Eighty-six primiparous or multiparous sows and their pigs were used to evaluate the effects of changing DCAD in late gestation and in lactation on sow productivity. Sows were allotted to treatment based on parity and their farrowing date. Experiment 1 was a preliminary experiment conducted to determine the level of DCAD that would reduce urinary pH. Twenty sows were used in Exp. 1, and the dietary treatments consisted of a corn-soybean meal diet with 4 levels of DCAD (140, 103, 80, and 56 mEq/kg). These DCAD were achieved by addition of 4 levels of chloride (SoyChlor; 0, 1.5, 2.5, and 3.5% of the diet). The diets were fed from d 107 of gestation to weaning. Urinary pH was linearly decreased ($P < 0.001$) as DCAD decreased in the diet. In Exp. 2, 66 sows were used and the dietary treatments consisted of diets providing DCAD of 140 and 56 mEq/kg. The diets were fed from d 111 of gestation to weaning. Reducing DCAD from 140 to 56 mEq/kg reduced ADFI from d 111 of gestation to d 1 postfarrowing ($P < 0.02$), but ADFI was not affected by DCAD during any other period. Reducing DCAD did not affect reproductive performance of the sows, litter response variables, or plasma Ca. Decreasing DCAD in the diet decreased urinary pH ($P < 0.001$). Twenty-seven sows fed the postive control diet and 21 sows fed the reduced DCAD diet were evaluated during their subsequent farrowing. Sows that were fed the reduced DCAD diet in their previous lactation had increased total number of pigs born ($P < 0.08$) and pigs born alive ($P < 0.02$) in the subsequent farrowing. Reducing DCAD had little effect on sow and litter response variables in the lactation in which it was fed, but it decreased urine pH. Reducing DCAD increased total number of pigs born and pigs born alive in the subsequent farrowing.

Key words: electrolyte balance, reproduction, sow, urinary pH

INTRODUCTION

Dietary cation-anion difference is the difference between strong fixed cations and strong fixed anions. These differences in dietary strong cations and anions will indicate whether the diet will elicit an alkaline or acidic metabolic response, respectively, when fed to the animal.

SoyChlor (West Central, Ralston, IA) is an anionic salt feed additive that is commonly fed to dairy cattle to make the diet more acidic, thereby reducing the incidence of milk fever (parturient paresis). Cows affected with milk fever have reduced feed intake, reduced urination and defecation, and if left untreated, become comatose and die (Horst et al., 1997). Milk fever contributes to a severe economic loss because milk production declines in the subsequent lactation (Block, 1984) and medication costs for treatment increases (Block and LeClerc, 1989). Changing dietary electrolyte balance has been shown to have positive effects on adaptive stress in broilers (Olanrewaju et al., 2007). Sows usually are not affected with milk fever, but urinary tract infections can reduce herd health and cause the swine industry to suffer economic loss due to reduced herd health. The purpose of this research was to determine if reducing DCAD in the diets would affect sow productivity when fed during late gestation and in lactation.

[1]Approved for publication by the director of the Louisiana Agric. Exp. Stn. as manuscript as Publ. No. 07-18-0267.
[2]Corresponding author: lsouthern@agctr.lsu.edu

MATERIALS AND METHODS

The Louisiana State University Agricultural Center Animal Care and Use Committee approved all methods used in these experiments. Primiparous and multiparous Yorkshire and crossbred (Yorkshire × Landrace or Yorkshire × Duroc) sows from the Louisiana State University Agricultural Center Swine Unit were allotted to dietary treatments on d 107 of gestation for Exp. 1 and d 111 of gestation for Exp. 2. Before starting dietary treatments, all sows were fed a typical corn-soybean meal gestation diet that met or exceeded the nutrient requirements (NRC, 1998) of gestating sows. The sows were allotted to their respective treatments within each farrowing group based on parity and the date of d 107 of gestation for Exp. 1 and d 111 of gestation for Exp. 2.

The sows were penned in a mechanically ventilated farrowing house with 28 individual farrowing crates and an under-floor flush system. Cooling was achieved by drip-coolers and fans, and heating was achieved by natural gas heaters. The experiments were conducted from April 2004 to May 2005. The farrowing crates were 1.5 × 2.1 m with a cast iron-floor for the sow and plastic slotted floor for the pigs. Each crate contained a stainless steel feeder and nipple waterer for the sow and a nipple waterer for the pigs. Within 24 h of farrowing, litters were weighed, ear-notched, given a 1-mL shot of iron dextran (Phoenix Scientific Inc., St. Joseph, MO), umbilical cords were sprayed with iodine, and needle teeth were clipped. During processing, litters were also adjusted by cross-fostering within respective treatments to approximately 10 pigs per litter if necessary.

Treatment diets (Table 1) fed during both experiments were formulated on a total amino acid (**AA**) basis from analyzed AA values for SoyChlor and NRC (1998) values for corn and soybean meal. Proximate analysis (CP, ash, moisture, crude fat, and crude fiber) and NDF were conducted on SoyChlor for calculation of ME [NRC, 1998; ME = 1,107 + (0.64 × ME) + (22.9 × % ether extract) + (6.9 × % CP)]. The nutrient content of SoyChlor was determined as follows using AOAC (2000) methods (Table 2): AA [Official Method 982.30 E (a,b,c)]; CP (Official Method 990.03); Kjeldahl [Official Method 984.13 (A-D)]; ash (Official Method 942.05); crude fat by ether extraction [Official Method 920.39 (A)]; crude fiber (Official Method 978.10), and moisture (Official Method 934.01). Minerals were determined by inductively coupled plasma-optical emission spectoscopy sequential inductively coupled plasma-optical emission spectroscopy. The diets were formulated to contain 3,300 kcal/kg ME and 1.02% total Lys. The diets met or exceeded 105% of the requirement (NRC, 1998) for lactating sows, anticipating no lactation weight loss with pigs gaining 250 g/d. Sows were fed the treatment diets from the time they were moved into the farrowing house until weaning. Upon entering the farrowing house until d 1 postfarrowing, the sows were fed approximately 2.5 kg/

Table 1. Composition of experimental diets, as-fed basis

	Dietary cation-anion difference, mEq/kg[1]			
Item	140[2,3]	103[2]	80[2]	56[2,3]
Ingredient, %				
Corn	66.00	65.08	64.46	63.85
Soybean meal	28.09	27.79	27.59	27.38
SoyChlor 16-7[1]	—	1.50	2.50	3.50
Monocalcium phosphate	2.01	1.99	1.99	1.99
Limestone	1.53	1.40	1.32	1.23
Dry fat	1.17	1.03	0.94	0.85
Vitamin premix[4]	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50
Choline chloride, 60%	0.10	0.10	0.10	0.10
Trace mineral premix[5]	0.10	0.10	0.10	0.10
Calculated composition				
ME, kcal/kg	3,300	3,300	3,300	3,300
Lys, %	1.02	1.02	1.02	1.02
Met, %	0.30	0.30	0.30	0.30
Trp, %	0.22	0.22	0.22	0.22
Na, %	0.22	0.22	0.22	0.22
K, %	0.82	0.82	0.82	0.82
Cl, %	0.35	0.49	0.59	0.68
S, %	0.21	0.22	0.22	0.23
Ca, %	1.00	1.00	1.00	1.00
Mg, %	0.20	0.23	0.26	0.28
P, %	0.80	0.80	0.80	0.80

[1]Dietary cation-anion difference was achieved by adding SoyChlor at 0, 1.5, 2.5, and 3.5% of the diet, respectively. DCAD = [(Na + K + 0.15 × Ca + 0.15 × Mg) − (Cl + 0.20 × S + 0.30 × P)].

[2]Dietary treatments fed in Exp. 1.

[3]Dietary treatments fed in Exp. 2.

[4]Provided the following per kilogram of diet: vitamin A,11,023 IU; vitamin D_3, 3,307 IU; vitamin E, 88 IU; menadionine, 8.3 mg; riboflavin,13 mg; Ca-D-pantothenic acid, 50 mg; niacin, 88 mg; vitamin B_{12}, 61 µg; D-biotin, 441 µg; folic acid, 3.3 mg; pyridoxine, 4.4 mg; thiamin, 4.4 mg; and vitamin C,110 µg.

[5]Provided the following per kilogram of diet: Zn,127 mg; Fe,127 mg; Mn, 22 mg; Cu, 12.7 mg; I, 0.80 mg; and Se, 0.3 mg.

Table 2. Analysis of SoyChlor

Item	%
CP	22.10
Crude fat	6.81
Crude fiber	4.90
Ash	16.14
Moisture	10.77
NDF	18.47
Thr	0.84
Cys	0.39
Val	1.12
Met	0.34
Ile	0.85
Leu	2.43
His	0.58
Lys	0.77
Arg	0.98
Try	0.10
Ca	3.40
Mg	2.73
P	0.41
K	0.56
Na	0.11
S	0.61
Cl	9.49

d, but feed refusals were recorded. On d 1 postfarrowing and throughout lactation, sows were fed 3 times per day to attempt ad libitum intake.

Experiment 1 was a preliminary experiment designed to determine the lowest dietary DCAD level that would decrease urinary pH but not affect ADFI. Diets for Exp. 1 consisted of a positive control (**PC**) corn soybean meal (**C-SBM**) diet and a C-SBM diet plus 1.5, 2.5, or 3.5% SoyChlor 16-7 to achieve DCAD levels of 140, 103, 80, and 56 mEq/kg. Experiment 1 was conducted with one farrowing group with n = 6, 3, 6, and 5 for 140, 103, 80, and 56 DCAD levels, respectively. Sows were weighed and moved into the farrowing house on d 107 of gestation. Pigs were weaned at an average of 19 d postfarrowing.

Experiment 2 was conducted to determine the effect of reduced dietary DCAD on sow and litter responses. In Exp. 2, dietary treatments consisted of the same PC C-SBM (140 mEq/kg) and the C-SBM diet with reduced DCAD (56 mEq/kg). Sows were weighed and moved into the farrowing house on d 111 of gestation. Experiment 2 was conducted with 3 farrowing groups with a total n = 33 for each treatment. Pigs were weaned at an average of 18, 16, and 15 d postfarrowing. There were 27 sows fed the PC diet and 21 sows fed the reduced DCAD diets that were evaluated during their subsequent farrowing. During this farrowing period, sows were not fed the treatment diets.

For both experiments, pigs were weaned on the same day regardless of their farrowing date. At weaning, the sows and feed containers were weighed to determine lactation weight change per day and lactation ADFI from d 1 postfarrowing to weaning. Within 2 d of weaning, sows were checked daily for signs of estrus.

Blood Collection

On d 1 postfarrowing, approximately 6 mL of blood was collected from the anterior vena cava with a 16-gauge needle and placed into a 10-mL tube (BD Vacutainer, Franklin Lakes, NJ) that contained Na heparin. The sample of blood was immediately centrifuged in an Allegra 6R centrifuge (Beckman Coulter Inc., Palo Alto, CA.) at 1,500 × g at 4°C for 25 min. After centrifugation, the plasma was poured into 5-mL tubes and stored at 20°C until analysis. The plasma samples were analyzed using flame atomic absorption spectrophotometry (AAnalyst 300; Perkin Elmer, Waltham, MA) after a 1:100 dilution with 0.5% lanthanum oxide. For Exp. 1, the samples were analyzed once, whereas in Exp. 2, samples were analyzed 2 times and then averaged for a mean for plasma Ca concentration.

Urine Collection

A midstream urine sample was collected from each sow for pH determination when sows averaged 11 ± 2 d postfarrowing in Exp. 1 and 12 ± 3 d postfarrowing in Exp. 2. Two urine samples were collected on 2 consecutive days from each sow and averaged together. Each urine collection period lasted 3 d. The pH was determined by a handheld pH-mV-temperature meter with an attached ISFET stainless steel, nonglass pH probe (IQ 150-77; IQ Scientific Instruments, model 150-77, Carlsbad, CA).

Response Variables

The sow response variables for Exp. 1 were urinary pH and plasma Ca concentration. The sow response variables for Exp. 2 were urinary pH; plasma Ca concentration; weight at d 111 of gestation, d 1 postfarrowing, and at weaning; weight change per day from prefarrowing, lactation, and overall; ADFI, ADG, and G:F prefarrowing, during lactation, and overall; lactation length; days to estrus; and total number pigs born, pigs born alive, stillbirths, and mummies. The litter response variables were live and total birth weights, number weaned, number nursed, initial litter weight after cross-fostering, initial litter weight adjusted for mortality, final litter weight, litter weight gain, and percent survivability.

Statistical Analysis

Data were analyzed by ANOVA procedures appropriate for a randomized complete block design (Steel and Torrie, 1980) using the GLM procedures of SAS (SAS Inst. Inc., Cary, NC). All data were analyzed with treatment as the main effect with farrowing group in the model. All data were analyzed with the sow as the experimental unit. In both experiments, covariates were used to analyze some response variables. Orthogonal contrasts appropriate for unequally spaced treatments (140, 103, 80, and 56 mEq/kg; linear and quadratic) were used in Exp. 1 to determine treatment differences. There were no covariates used for the following data: sow 107- and 111-d weight, lactation length, total number pigs born, pigs born alive, stillbirths, mummies, live and total birth weights, initial litter weight after cross-fostering, and initial litter weight adjusted for mortality. Sow gestation weight at d 107 and 111 was used as a covariate for sow d 1 postfarrowing and weaning weight; prefarrrowing, lactation, and overall weight change per day; ADG; ADFI; and G:F. Sow d-111 weight affected ($P < 0.02$) ADFI from d 111 of gestation to d 1 postfarrowing. Lactation length was used as a covariate for ADFI during lactation and overall, number of pigs nursed, final litter weight, litter weight gain, days to estrus, and percent survivability. Initial litter weight after cross-fostering and lactation length were covariates for final litter weight and litter weight gain. Neither of the covariates were significant ($P > 0.10$) for the response variables final litter weight and litter weight gain. Number of pigs nursed was used as a covariate for number of pigs weaned. For both experiments, an alpha level of 0.10 was used to indicate significant treatment differences.

RESULTS AND DISCUSSION

Experiment 1

Experiment 1 was a preliminary study conducted to determine the level of SoyChlor needed to change DCAD as measured by urinary pH that would not affect ADFI. Reducing DCAD linearly ($P < 0.001$) decreased urinary pH (Table 3). The results indicate that changing DCAD to 56 mEq/kg resulted in the greatest decrease in urine pH; this DCAD was then used in Exp. 2.

Experiment 2

Sow Response Variables. In Exp. 2 (Table 4), ADFI from d 111 of gestation to d 1 postfarrowing decreased as DCAD decreased ($P < 0.02$). However, ADFI during lactation and overall were not affected ($P > 0.10$) by DCAD. Neither ADG nor G:F was affected by DCAD ($P > 0.10$). Sows fed the reduced DCAD diet tended to have reduced weight change during prefarrowing (–18.71 vs. –15.11), lactation (–8.67 vs. –6.84), and overall (–27.42 vs. –21.94), but the effects were not significant ($P > 0.10$). DeRouchey et al. (2003) conducted a pilot study and fed DCAD (Na + K – Cl) of –200, –100, 0, 100, and 200 mEq/kg. The results showed that negative DCAD reduced feed intake, and the lowest DCAD that should be fed to lactating sows was 0 mEq/kg. The authors also reported that increasing DCAD (0, 100, 200, 350, and 500 mEq/kg) had no effect on ADFI (DeRouchey et al., 2003). Research in dairy cows and in growing pigs suggests that feeding diets with a negative DCAD (Na + K – Cl) decreases feed intake (Escobosa et al., 1984; Patience et al., 1987).

Sows fed the PC diet had decreased days to estrus compared with sows fed the reduced DCAD diet ($P < 0.04$). There were 6 sows fed the PC and 2 sows fed the reduced DCAD diet that did not return to estrus within 7 d postweaning. The DCAD diet did not affect total number pigs born, pigs born alive, stillbirths, or mummies ($P > 0.10$). Dove and Haydon (1994) fed sows diets with DCAD (Na + K – Cl) levels of 130.8, 161.2, and 250.8 mEq/kg and reported no differences in feed intake, days to estrus, percent survivability in pigs, or litter weight gain regardless of dietary treatments. Our results are not really comparable to those of Dove and Haydon (1994) because they did not decrease acid-base balance below 130 mEq/kg. In our experiment, the highest DCAD was 140 mEq/kg.

Litter Response Variables. Reducing DCAD did not affect any litter response variable. Reducing DCAD tended to result in a higher number of pigs weaned (8.79 vs. 8.43) and an increase in survivability (89.42 vs. 85.77%), but the effects were not significant ($P = 0.19$). DeRouchey et al.

Table 3. The effects of dietary cation-anion difference on sow urinary pH and plasma Ca concentrations, Experiments 1 and 2

	Dietary cation-anion difference, mEq/kg[1]							P = F
Response	140	103	80	56	SEM	Linear	Quadratic	P value
Experiment 1[2]								
Urinary pH[3]	7.28	7.13	6.85	6.21	0.17	0.001	0.23	—
Plasma Ca, mg/dL	7.70	7.70	7.97	7.98	0.16	0.15	0.97	—
Experiment 2[4]								
Urinary pH[5]	7.03	—	—	5.66	0.07	—	—	< 0.0001
Plasma Ca, mg/dL	9.00	—	—	8.92	0.20	—	—	0.65

[1]Dietary cation-anion difference was achieved by adding SoyChlor at 0, 1.5, 2.5, and 3.5% of the diet, respectively.

[2]n = 6, 3, 6, and 5 for 140, 103, 80, and 56 dietary cation-anion difference, respectively.

[3]Urinary pH = an average of 2 urine samples taken on 2 consecutive days from each sow 11 ± 2 d postfarrowing.

[4]n = 33 sows for 140 and 56 dietary cation-anion difference, respectively; n = 11 per treatment over 3 farrowing groups.

[5]Urinary pH = an average of 2 urine samples taken on 2 consecutive days from each sow 12 ± 3 d postfarrowing.

Table 4. The effects of dietary cation-anion difference on sow and litter response variables, Experiment 2[1]

Response	Covariate	Dietary cation-anion difference,[2] mEq/kg		SEM	*P* value
		140	56		
Sow					
Day 111 wt, kg	262.00	—	270.00	6.25	0.74
24 h wt, kg	Sow d 111 wt	247.00	251.00	1.98	0.21
Weaning wt, kg	Sow d 111 wt	239.00	244.00	2.51	0.13
ADG 1,[3] kg	Sow d 111 wt	–3.50	–3.07	0.48	0.53
ADG 2,[4] kg	Sow d 111 wt	–0.51	–0.44	0.12	0.67
OADG,[5] kg	Sow d 111 wt	–1.25	–1.00	0.12	0.13
ADFI 1,[3] kg	Sow d 111 wt	2.80	2.06	0.22	0.02
ADFI 2,[4] kg	Lactation length	5.04	5.55	0.24	0.15
OADFI,[5] kg	Lactation length	4.44	4.65	0.19	0.43
G:F 1,[3] kg	—	–1.88	–2.20	0.53	0.67
G:F 2,[4] kg	—	–0.11	–0.09	0.03	0.58
OG:F,[5] kg	—	–0.31	–0.24	0.04	0.18
Parity	—	1.45	1.58	0.26	0.74
Lactation length, d	—	16.24	16.30	0.46	0.93
Days to estrus, d	Lactation length	4.19	4.58	0.12	0.04
Total pigs born	—	12.09	11.64	0.62	0.61
Pigs born alive	—	10.15	10.18	0.61	0.97
Stillbirths	—	1.55	1.27	0.22	0.39
Mummies	—	0.39	0.18	0.13	0.25
Litter					
Birth wt live, kg	—	15.15	15.36	0.81	0.85
Birth wt total, kg	—	17.30	16.94	0.78	0.75
Nursed[6]	Lactation length	9.61	10.02	0.30	0.33
Weaned	Nursed	8.43	8.79	0.19	0.18
Initital litter wt, kg (ACF)[7]	—	14.63	15.44	0.54	0.29
Initial litter wt, kg (AM)[8]	—	12.77	13.98	0.56	0.13
Final litter wt, kg	Lactation length and ILW[9] (ACF)	44.55	45.24	1.24	0.70
Litter wt gain[10]	Lactation length and ILW (ACF)	1.91	1.96	0.07	0.62
Survival,[11] %	Lactation length	85.77	89.42	1.95	0.19

[1]Data are means of 33 sows per treatment over 3 farrowing groups.

[2]Dietary cation-anion difference was achieved by adding SoyChlor at 0 and 3.5% of the diet.

[3]ADG 1, ADFI 1, and G:F 1 are measurements taken from d 111 until farrowing.

[4]ADG 2, ADFI 2, and G:F 2 are measurements taken on d 1 postfarrowing until weaning.

[5]Overall ADG (OADG), overall ADFI (OADFI), and overall G:F (OG:F) are measurements taken from d 111 until weaning.

[6]Nursed = the number of pigs the sow nursed after cross-fostering occurred.

[7]ACF = after cross-fostering.

[8]AM = initial litter weights adjusted for mortality once cross-fostering had occurred.

[9]ILW = initial litter weight.

[10]Litter weight gain = [final litter weight – initial litter weight (AM)]/lactation length.

[11]Survival % = pigs weaned/pigs nursed × 100.

(2003) reported that increasing DCAD (Na + K – Cl) reduced percent survivability of pigs and number weaned. In our experiment, results indicate that reducing DCAD (56 mEq/kg) tended to improve percent survivability of pigs and number weaned.

DeRouchey et al. (2003) reported that when DCAD was reduced below a standard C-SBM diet, sow's milk production increased, which may increase percent survivability in pigs. Overall, our results and those reported by DeRouchey et al. (2003) are in agreement. Feeding reduced DCAD diets did not affect live and total birth weights, number nursed, initial litter weight after cross-fostering, final litter weight, or litter weight gain ($P > 0.10$).

Sows fed reduced DCAD ($P < 0.001$) had decreased urinary pH compared with sows fed the PC diet. Acidifiers are included in the diet because they may affect metabolic processes such as bone metabolism, Ca metabolism, blood pH maintenance, and uri-

Table 5. The effects of dietary cation-anion difference on sow response variables in subsequent farrowings, Experiment 2

	Dietary cation-anion difference, mEq/kg[1]			
Response	140	56	SEM	*P* value
N	27	21	—	—
Total number pigs born	9.63	11.48	0.73	0.08
Pigs born alive	8.26	10.38	0.59	0.02
Stillbirths	1.00	0.86	0.26	0.71
Mummies	0.41	0.26	0.16	0.59
Mortality[2]	0.61	0.97	0.18	0.19
Birth wt. live,[3] kg	14.32	16.09	1.21	0.31
Birth wt. total,[4] kg	15.69	17.07	1.21	0.43

[1]Dietary cation-anion difference was achieved by adding SoyChlor at 0 and 3.5% of the diet and was fed during the previous lactation.

[2]Mortality was analyzed using pigs born alive as a covariate.

[3]Birth weight live = the weight of all pigs born alive.

[4]Birth weight total = the weight of all pigs born alive and dead.

nary pH reduction. DeRouchey et al. (2003) reported that increasing DCAD linearly increased urinary pH and bacterial counts in the urine. Sows with reduced bacterial concentrations had a reduced risk of urinary tract infections. Sows that farrow in areas contaminated with excess fecal matter are at risk for bacterial infections, which may decrease rebreeding performance and litter health.

Plasma Ca concentrations were not affected ($P > 0.10$) by DCAD. DeRouchey et al. (1998) reported that Ca concentrations in the blood decreased as DCAD increased. This response does not agree with our results. Jackson and Hemken (1994) reported that plasma Ca is similar among treatments regardless of DCAD or Ca% in the diet. Tucker et al. (1988) and Waterman et al. (1991) used dairy cows to investigate plasma Ca in response to high and low DCAD diets and found no relationship between the 2. These observations agree with our results.

There were 27 sows (Table 5) fed the PC diet and 21 sows fed the reduced DCAD diets that were evaluated during their subsequent farrowing. The sows that were fed the reduced DCAD diet during the previous lactation had an increased total number of pigs born ($P < 0.08$) and pigs born alive ($P < 0.02$). Reducing DCAD did not affect stillbirths, mummies, mortality, or live and total birth weights ($P > 0.10$).

IMPLICATIONS

The primary goal for incorporating an anionic salt into a sow diet is to enhance reproductive performance. However, adding anionic salts at high levels can cause a decrease in feed intake, which may decrease animal performance. In this study, adding SoyChlor at 3.5% of the diet did not negatively affect overall feed intake. Although SoyChlor did not have much of an effect during the present lactation, it increased total number of pigs born and number born alive in the subsequent farrowing. During the subsequent farrowing, sows were not fed the treatment diets; instead they were fed a typical lactation diet. A question for future research would be to feed higher levels of anionic salts to sows to determine when negative effects are observed, and to follow the sows through a second and third subsequent farrowing to determine how long the carryover effects of SoyChlor are observed.

ACKNOWLEDGEMENTS

The authors thank West Central, Ralston, IA, for providing SoyChlor and their financial support, and A. Jackson, S. Powell, D. Lauzon, J. Spradlin, and the Louisiana State Univ. Agric. Center Swine Unit for their help with data collection and analyses.

LITERATURE CITED

AOAC. 2000. Official Methods of Analysis. 17th ed. Association of Official Analytical Chemists, Gaithersburg, MD.

Block, E. 1984. Manipulating dietary anions and cations for prepartum dairy cows to reduce incidence of milk fever. J. Dairy Sci. 67:2939.

Block, E., and H. LeClerc. 1989. Effects of reducing dietary cation-anion balance for prepartum dairy cows with specific reference to hypocalcemic parturient paresis. Can. J. Anim. Sci. 69:411.

DeRouchey, J. M., J. D. Hancock, R. H. Hines, H. Cao, D. J. Lee, C. A. Maloney, and J. S. Parks. 1998. Effects of inorganic and organic acids on urine pH in lactating sows. P. 21 in Swine Day 1998, Kansas State University, Manhattan.

DeRouchey, J. M., J. D. Hancock, R. H. Hines, K. R. Cummings, D. J. Lee, C. A. Maloney, D. W. Dean, J. S. Parks, and H. Cao. 2003. Effects of dietary electrolyte balance on the chemistry of blood and urine in lactating sows and sow litter performance. J. Anim. Sci. 81:3067.

Dove, C. R., and K. D. Haydon. 1994. The effect of various diet nutrient densities and electrolyte balances on sow and litter performance during two seasons of the year. J. Anim. Sci. 72:1101.

Escobosa, A., C. E. Coppock, L. D. Rowe, Jr., W. L. Jenkins, and C. E. Gates. 1984. Effects of dietary sodium bicarbonate and calcium chloride on physiological responses of lactating dairy cows in hot weather. J. Dairy Sci. 67:574.

Horst, R. L., J. P. Goff, T. A. Reinhardt, and D. R. Buxton. 1997. Strategies for preventing milk fever in dairy cattle. J. Dairy Sci. 80:1269.

Jackson, J. A., and R. W. Hemken. 1994. Calcium and cation-anion balance effects on feed intake, body weight gain, and humoral response of dairy calves. J. Dairy Sci. 77:1430.

NRC. 1998. Nutrient Requirements of Swine. 10th rev. ed. Natl. Acad. Press, Washington, DC.

Olanrewaju, H. A., J. P. Thaxton, W. A. Dozier, III, and S. L. Branton. 2007. Electrolyte diets, stress, and acid base balance in broiler chickens. Poult. Sci. 86:1363.

Patience, J. F., R. E. Austic, and R. D. Boyd. 1987. Effect of dietary electrolyte balance on growth and acid-base status in swine. J. Anim. Sci. 64:457.

Steel, R. G. D., and J. H. Torrie. 1980. Principles and Procedures of Statistics: A Biometrical Approach. 2nd ed. McGraw-Hill Book Co., New York.

Tucker, W. B., G. A. Harrison, and R. W. Hemken. 1988. Influence of dietary cation-anion balance on milk, blood, urine, and rumen fluid in lactating dairy cattle. J. Dairy Sci. 71:346.

Waterman, D. F., T. S. Swenson, W. B. Tucker, and R. W. Hemken. 1991. Role of magnesium in the dietary cation-anion balance equation for ruminants. J. Dairy Sci. 74:1866.