fed CARB or ABF with AVI being intermediate; pigs fed ABF had a lower ADG compared to pigs fed AVI with CARB being the intermediate. The ABF and CARB fed pigs had a lower ADFI ($P = 0.037$) than CT with AVI being intermediate. There were no differences ($P > 0.10$) observed for FCR. There were no differences ($P > 0.10$) for % morbidity/pen; however, pigs fed ABF had a numerically higher % morbidity. Pigs fed feed grade antibiotics had a lower % mortality/pen ($P = 0.009$) in contrast with pigs fed ABF. In conclusion, the results of this experiment provide reference data for antibiotic-free feeding programs.

Key Words: antibiotic-free feeding program, feed grade antibiotics, performance
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221 Effects of feeding a multi-enzyme and probiotic bacteria blend (CORE) on performance of nursery pigs fed a highly digestible diet.

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The objective of this study was to evaluate whether performance of nursery pigs could be improved by using high levels of a multi-enzyme blend consisting of xylanase, phytase, cellulase, β-glucanase, α-amylase, and protease and a probiotic bacteria blend consisting of *Bacillus subtilis* and *Bacillus licheniformis* (CORE). For d 0 to 21, 0.3% CORE was added to two phases of a highly digestible basal diet (corn, soybean meal, fish meal, plasma, and phytase; NC1) and when CORE was added to NC1, the supplemental phytase was removed (CORE1). For d 21–42, the third phase was a corn-soy basal diet that included phytase and 3.5% added fat (NC2), and 0.3% CORE replaced the phytase and 2.5% added fat (CORE2). There were 462 weaned pigs used with an average BW of 5.2 kg with 22 pigs/pen and 10 to 11 replications/treatment in a commercial scale nursery research facility. At the beginning of the trial pigs were randomly assigned to their dietary treatment. Pens of pigs were weighed and feed disappearance was measured to calculate ADG, ADFI, and F:G for d 0, 21, and 42. Data were analyzed as a randomized complete block design using GLM procedure in Minitab with Fisher's LSD test to determine differences between dietary treatments. For d 0–21, the pigs fed CORE1 had a 7.7% higher ADG ($P = 0.024$) compared to pigs fed NC1. There was a tendency ($P = 0.090$) for pigs fed CORE1 to have a 5.9% higher ADFI than NC1. For d 21–42, where 0.3% CORE replaced both supplemental phytase and 2.5% added fat, ADG tended to increase by 5.1%. In conclusion, the addition of CORE to a highly digestible nursery diet, replacing supplemental phytase, resulted in improved ADG and ADFI, and, in late nursery, CORE successfully replaced supplemental phytase and 2.5% of added fat with no loss of performance.

Table 220. Summary of Day 0–21

	ABF	AVI	CT	CARB	SE	*P*-value
BW, kg	10.7[a]	11.0[a]	11.4[b]	11.0[a]	0.3	0.001
ADG, g	232[a]	254[b,c]	272[c]	248[a,b]	18	0.002
ADFI, g	310[a]	324[a,b]	341[b]	315[a]	21	0.037
FCR	1.34	1.28	1.26	1.27	0.12	0.541
% morbidity/pen	1.66	0.46	0.00	0.43	1.64	0.244
% mortality/pen	1.72[a]	0.00[b]	0.00[b]	0.40[b]	1.03	0.009

Key Words: multi-enzyme and probiotic blend, nursery pigs, performance
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222 Effects of dietary salt concentration on performance of 7 to 10 Kg nursery pigs.

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Two experiments evaluated the effects of added salt and Na on growth performance of 7 to 10 kg pigs. In both experiments, pigs were weaned at 21 d of age and allotted to pens by BW and gender in a randomize block design. After a 7-d common period, experimental diets were fed for 14 d. In Exp. 1, 325 barrows (DNA 200 × 400; initially 6.6 kg BW) were assigned to 1 of 5 dietary treatments with 13 replications/treatment and 5 pigs/pen. Dietary treatments included 10% dried whey, corn-soybean meal-based diets with 0, 0.2, 0.4, 0.6, or 0.8% added salt. Increasing salt increased (linear, $P = 0.015$) ADG (194, 216, 234, 254, and 253 g/d, respectively) and ADFI (309, 305, 319, 326, and 334 g/d, respectively) while G:F (0.626, 0.705, 0.732, 0.779, and 0.758, respectively) improved (quadratic, $P = 0.019$) up to 0.6% added salt (0.37% Na and 0.75% Cl). In Exp. 2, 360 pigs (DNA 241 × 600; initially 6.9 kg BW) were assigned to 1 of 4 dietary treatments with 15 replications/treatment and 6 pigs/pen. Four experimental diets included a 10% dried whey diet with 0.6% added salt (0.37% Na and 0.75% Cl); or 3 diets with 7.2% crystalline lactose containing either: 0.35% added salt (0.18% Na and 0.47% Cl); 0.78% added salt (0.35% Na and 0.72% Cl); or 1.15% potassium chloride and 0.4% sodium bicarbonate (0.35% Na and 0.45% Cl). Pigs fed the dried whey diet with 0.6% added

Table 221. Summary of performance data

Day 0–21	NC1	CORE111	SE	*P*-value
D 21 BW, kg	11.3[a]	11.8[b]	0.4	0.015
ADG, g	291[a]	313[b]	19	0.024
ADFI, g	337[y]	357[z]	24	0.090
F:G	1.16	1.14	0.041	0.648
Day 21–42	NC2	CORE2	SE	*P*-value
D 42 BW, kg	22.4[a]	23.3[b]	0.8	0.035
ADG, g	527[y]	554[z]	31	0.083
ADFI, g	746[a]	817[b]	53	0.015
F:G	1.42[a]	1.48[b]	0.033	0.003

salt or crystalline lactose diet with 0.78% added salt had increased ($P = 0.05$) ADG compared to pigs fed crystalline lactose with 0.35% added salt. Pigs fed the dried whey diet with 0.6% added salt had greater ($P = 0.05$) ADFI than those fed the crystalline lactose diet with 0.35% added salt, with other treatments intermediate. There was no evidence that feed efficiency was affected by dietary treatment. In conclusion, ADG and ADFI of 7 to 10 kg pigs were enhanced with a dietary Na concentration of at least 0.35%.

Key Words: Na, nursery pig, salt
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223 Evaluation of nursery diet complexity on growth performance and carcass traits of pigs. A. Tekeste*, H. Manu, P. Ren, D. Pangeni, B. Tostenson, X. Yang, S. K. Baidoo, *Southern Research and Outreach Center, University of Minnesota, Waseca.*

The study was conducted to investigate the effect of nursery diet complexity on growth performance and carcass traits of pigs. A total of 126 piglets (initial BW 6.30 ± 0.68 kg and 18 d old) were blocked by body weight and randomly allotted to 1 of 3 treatments, with 7 pigs/pen and 6 pens/treatment. In the nursery period (weeks 1–2, 3–4, 5–6 as phases 1, 2, and 3, respectively), piglets were fed 1 of 3 experimental diets: (1) positive control (PC; with spray-dried porcine plasma, fishmeal, antibiotics, and zinc oxide), (2) PC without antibiotics (PC-AB), and (3) negative control (NC; without spray-dried porcine plasma, fishmeal, antibiotics, zinc oxide). During the growing-finishing period, pigs were fed common diets containing no animal proteins and antibiotics. Data were analyzed using mixed model of SAS, with treatment as fixed effect and block as random effect. Tukey test was used for multiple comparisons. In phase 1, the NC group had lower ($P < 0.05$) ADG, ADFI than the other two groups and lower ($P < 0.05$) G:F compared with the PC group. The NC pigs ate less ($P < 0.05$) and tended ($P < 0.10$) to gain less than the PC-AB pigs in phase 2, Nevertheless, the NC group had higher ($P < 0.05$) G:F than the PC group in phases 2 and 3. During the entire nursery period, the NC group had lower ($P < 0.05$) ADG and ADFI than the PC-AB group, but no difference ($P > 0.05$) in G:F was observed among treatments. For the overall experimental period, the NC group ate less ($P < 0.05$) than the other two groups, and tended ($P < 0.10$) to have lower ADG relative to the PC group, but there were no effects ($P > 0.05$) of dietary treatments on feed efficiency. No difference ($P > 0.05$) on growth performance during the entire nursery phase and the whole experiment period was noticed between the PC and PC-AB groups. For the whole nursery period, ADG was 494, 532, 457 g/d, ADFI was 727, 763, 656 g/d, and G:F was 0.681, 0.698, 0.697 for the PC, PC-AB, and NC groups, respectively. Dietary treatments did not impact ($P > 0.05$) carcass characteristics. In conclusion, feeding simple nursery diets had a negative impact on growth performance in the nursery period, which could be carried over to the growing-finishing period.

Table 222.

Exp. 2 (d 0–14):						
Lactose source:	Whey	Lactose	Lactose	Lactose		
Na source:	0.6% salt	0.35% salt	0.78% salt	KCl and $NaHCO_3$	SEM	$P <$
ADG, g	281[a]	251[b]	287[a]	270[ab]	9.5	0.038
ADFI, g	445[a]	390[c]	427[ab]	408[bc]	11.2	0.004
G:F, g/kg	631	643	671	661	13	0.075

[abc] Means with different superscripts differ $P < 0.05$.

Key Words: carcass traits, growth performance, nursery diet complexity
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224 Effects of mixture of organic acids and medium chain fatty acids on growth performance, diarrhea incidence, and fecal microbial flora in weaning pigs orally challenged with enterotoxigenic *Escherichia coli* K88. D. H. Nguyen*, X. J. Lei, J. W. Park, D. H. Baek, I. H. Kim, *Department of Animal Resource and Science, Dankook University, Cheonan, South Korea.*

The experiment was conducted to evaluate the effects of mixture of organic acids (OAs) and medium chain fatty acids (MCFAs) on the growth performance, fecal microbial flora, and diarrhea score in weaning pigs challenged with enterotoxigenic *Escherichia coli* K88. A total of 30 weaning pigs (28 ± 1 d of old, 6.24 ± 0.36 kg) were randomly divided into 1 of 3 dietary treatments on the basis of initial body weight (BW) and sex (5 replicate pens per treatment with 1 barrow and 1 gilt per pen). The dietary treatments were: (1) CON, basal diet; (2) CON + 0.2% mixture of OAs and MCFAs (MOM2); 3) CON + 0.4% mixture of OAs and MCFAs (MOM4). The mixture of OAs and MCFAs used in the experiment was provided by a commercial company (Morningbio Co., Ltd., Cheonan, South Korea). The active ingredients were 17% fumaric acid, 13% citric acid, 10% malic acid, and 1.2% MCFAs (capric and caprylic acid). During d 8 to 10, pigs were orally challenged with 5 mL enterotoxigenic *Escherichia coli* K88 (10^9 CFU/mL). Individual BW and feed consumption on the pen basis were recorded at the beginning, d 7, d 14, and d 21 to obtain average daily gain (ADG), average daily feed intake (ADFI), and gain to feed ratio (G:F), respectively. Throughout the experiment, compared with CON treatment, MOM2 and MOM4 groups had increased ($P < 0.05$) ADG, ADFI, and G:F with the exception of G:F during d 8 to 14. During pre- and post-challenge (d 8 to 14), the diarrhea score was lower ($P < 0.05$) in MOM2 (3.25 and 3.61, respectively) and MOM4 (3.25 and 3.68, respectively) treatments than that in CON (3.50 and 4.29, respectively) treatment. However, diarrhea score did not differ between dietary treatments between d 15