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Pigs Weaned from Sows Fed a Feed Flavor Had Improved Nursery Performance, but Feed Flavor in the Nursery Diets did not Impact Performance

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Abstract

A total of 360 weaned pigs (DNA 241 × 600: initially 12.6 lb) were used to evaluate the effects of previous sow feed flavoring treatment (control vs. flavor) and nursery diets formulated with or without a feed flavor on growth performance in a 38-d trial. Pigs were weaned at approximately 19 d from sows fed diets with or without 0.05% of the feed flavor (Krave AP, Adisseo, Alpharetta, GA). Pigs were placed in pens (5 to 6 pigs per pen) within sow treatment and were randomly assigned to 1 of 2 dietary nursery treatments. There were 14 to 17 replications per treatment. Nursery treatments were either a control diet or a diet containing a feed flavor (Delistart #NA 21, Adisseo, Alpharetta, GA) added at 0.05% of the diet. Dietary treatments were arranged in a 2 × 2 factorial with main effects of sow and nursery treatment. Offspring from sows fed the flavor diet had a higher ($P < 0.001$) BW at weaning, which was maintained throughout the study. No significant differences were observed for ADG, ADFI, or F/G during phase 1. During phase 2, there was a tendency ($P < 0.10$) for a main effect of both nursery and sow diet on ADG. Pigs from sows fed the flavor diet had greater ADG compared to pigs from sows fed the control diet, and pigs fed the control diet had increased ADG compared to those fed the flavor diet. During phase 2, there was a tendency ($P < 0.10$) observed for a main effect of sow treatment on ADFI, with pigs from sows fed the flavor diet having greater ADFI. During phase 3, there was a main effect ($P < 0.05$) of nursery treatment on both ADFI and F/G where pigs fed the feed flavor diet had greater ADFI but poorer F/G. A tendency ($P < 0.10$) was observed for an interaction between sow and nursery diet for ADG with pigs fed the flavor diet that were obtained from sows fed the flavor diet having greater ADG but no difference was observed when pigs were obtained from sows fed the control diet. Overall, progeny from sows fed a diet containing a feed flavor had greater ADG ($P = 0.038$) and ADFI ($P = 0.043$) and final BW ($P < 0.001$) during the trial. In conclusion, offspring from sows fed a feed flavor had increased ADG, ADFI, and BW, but the presence of a feed flavor in the nursery did not elicit better overall nursery performance.

Keywords

feed flavor, nursery pig, lactation, sows

Authors

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K-STATE Research and Extension

SWINE DAY 2022

Pigs Weaned from Sows Fed a Feed Flavor Had Improved Nursery Performance, but Feed Flavor in the Nursery Diets did not Impact Performance

Mikayla S. Spinler, Jordan T. Gebhardt,[1] Joel M. DeRouchey, Mike D. Tokach, Robert D. Goodband, and Jason C. Woodworth

Summary

A total of 360 weaned pigs (DNA 241 × 600: initially 12.6 lb) were used to evaluate the effects of previous sow feed flavoring treatment (control vs. flavor) and nursery diets formulated with or without a feed flavor on growth performance in a 38-d trial. Pigs were weaned at approximately 19 d from sows fed diets with or without 0.05% of the feed flavor (Krave AP, Adisseo, Alpharetta, GA). Pigs were placed in pens (5 to 6 pigs per pen) within sow treatment and were randomly assigned to 1 of 2 dietary nursery treatments. There were 14 to 17 replications per treatment. Nursery treatments were either a control diet or a diet containing a feed flavor (Delistart #NA 21, Adisseo, Alpharetta, GA) added at 0.05% of the diet. Dietary treatments were arranged in a 2 × 2 factorial with main effects of sow and nursery treatment. Offspring from sows fed the flavor diet had a higher ($P < 0.001$) BW at weaning, which was maintained throughout the study. No significant differences were observed for ADG, ADFI, or F/G during phase 1. During phase 2, there was a tendency ($P < 0.10$) for a main effect of both nursery and sow diet on ADG. Pigs from sows fed the flavor diet had greater ADG compared to pigs from sows fed the control diet, and pigs fed the control diet had increased ADG compared to those fed the flavor diet. During phase 2, there was a tendency ($P < 0.10$) observed for a main effect of sow treatment on ADFI, with pigs from sows fed the flavor diet having greater ADFI. During phase 3, there was a main effect ($P < 0.05$) of nursery treatment on both ADFI and F/G where pigs fed the feed flavor diet had greater ADFI but poorer F/G. A tendency ($P < 0.10$) was observed for an interaction between sow and nursery diet for ADG with pigs fed the flavor diet that were obtained from sows fed the flavor diet having greater ADG but no difference was observed when pigs were obtained from sows fed the control diet. Overall, progeny from sows fed a diet containing a feed flavor had greater ADG ($P = 0.038$) and ADFI ($P = 0.043$) and final BW ($P < 0.001$) during the trial. In conclusion, offspring from sows fed a feed flavor had increased ADG, ADFI, and BW, but the presence of a feed flavor in the nursery did not elicit better overall nursery performance.

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Introduction

It is not uncommon for weaning stress to result in a 24- to 48-h period where pigs may not consume any food, which can lead to reduced growth performance and increased mortality. Adding ingredients to the diet that stimulate feed intake after weaning can help maximize post-wean performance.

Krave AP is a feed additive developed by Adisseo USA (Alpharetta, GA) and is formulated from a specific combination of natural and artificial flavoring compounds believed to be attractive to pigs. Delistart #NA 21 is another feed additive developed by Adisseo that has similar flavoring compounds to Krave AP, but is specifically designed to be fed to newly weaned pigs. By utilizing the same flavor compounds in the sow and nursery diets, it is thought that sensory imprinting will be achieved to further stimulate feed intake of newly weaned pigs. In a study conducted at the University of Minas Gerais (unpublished), pigs obtained from sows fed Krave AP had increased post-wean feed intake and gain, but those that were also offered Delistart K-Link (similar product to Delistart #NA 21) in nursery diets had the greatest ADFI and ADG. However, to our knowledge there is no published research, nor any research conducted in the U.S. showing the benefits of these feed additives on weanling pig growth performance. Therefore, the objective of this study was to determine the effect on nursery pig growth performance of supplementing Delistart #NA 21 in nursery diets and to determine if pigs obtained from sows that were fed Krave AP in lactation diets exhibited differences in nursery performance when fed diets with or without Delistart #NA 21.

Procedures

The Kansas State University Institutional Care and Use Committee approved the protocol used in this experiment. The study was conducted at the Kansas State University Swine Teaching and Research Center in Manhattan, KS. Pens were 4 × 4 ft in size, resulting in approximately 2.7 sq ft per pig in pens of 6 pigs and 3.2 sq ft in pens of 5 pigs. Each pen contained one 4-hole dry self-feeder and a nipple waterer, and pigs were given *ad libitum* access to feed and water.

Animals and diets

A total of 360 weanling pigs (DNA 241 × 600: initially 12.6 lb) were used in a 38-d study with 14 to 17 pens per treatment. Nursery pigs were the offspring of sows fed either a control diet or a diet containing the lactation feed flavor Krave AP from d 110 of gestation through the end of lactation. All weaned pigs considered healthy were placed on test. Pigs were weaned at approximately 19 days of age and placed into pens of 5 or 6 pigs, and given either a control diet or a diet containing a feed flavor (Delistart #NA 21, Adessio, Alpharetta, GA) at an inclusion rate of 0.05% of the diet added at the expense of corn. Dietary treatments were arranged in a 2 × 2 factorial design with effects of sow treatment (control vs. flavor) and nursery treatment (control vs. flavor). There were 14 to 17 replications per treatment because of differences in the number of pigs weaned between the two sow treatments.

The treatment diets were fed in three phases. The basal phase 1 diet was manufactured at a commercial feed mill (Hubbard Feeds, Beloit, KS), and then evenly split and the feed flavor was added to the flavor diet, or an equivalent amount of corn added to the control diet at the Kansas State University O.H. Kruse Feed Technology Innovation Center, Manhattan, KS, after which diets were pelleted. Both phase 2 and 3 diets were

manufactured (Hubbard Feeds, Beloit, KS) and fed in a mash form. Phase 1 was fed until d 9 post weaning, phase 2 from d 9 to 24, and phase 3 from d 24 to 38. Phase 1 diets were formulated to 1.40% SID Lys, and phases 2 and 3 were formulated to 1.35% SID Lys. All other nutrients were formulated to meet or exceed the 2012 NRC[2] requirement estimates.

Pigs and feeders were weighed on d 0, 3, 9, 17, 24, 31, and 38 to determine ADG, ADFI, and F/G. The phase 1 diet contained an indigestible marker, iron oxide, to help determine when pigs started to eat. Starting 10 hours after weaning, fecal swabs were taken from all pigs with a cotton tip applicator to determine the percentage of pigs that consumed feed. The color of fecal swabs was used to determine eaters vs. non-eaters, with a red tint defined as an eater. Pigs that tested negative on the first sampling were re-sampled every 12 hours until all pigs were defined as eaters. Feeders were weighed every day for the first 9 days post weaning to determine feed disappearance during the early post-weaning period. The percentage of pigs that lost weight from weaning to d 3 and from d 3 to d 9 was calculated based on initial weights determined at weaning.

Statistical analysis

Performance data was analyzed using R software, version 1.4.171. Growth performance was analyzed in a completely randomized design with pen acting as the experimental unit. Sow treatment and nursery treatment main effects and their interactions were tested. Results were considered significant at $P \leq 0.05$ and marginally significant at $0.05 < P \leq 0.10$.

Results and Discussion

Progeny from sows fed the feed flavor in lactation entered the nursery at a greater BW ($P < 0.001$: 13.2 vs. 12.0 lb; Tables 2 and 3) than offspring from sows fed the control diet and this BW advantage became 2.1 lb by the end of the study. There was no sow by nursery interaction for BW throughout the 38 days of the trial.

There was no evidence of differences in ADG, ADFI, or F/G from weaning until d 3 post weaning for either sow or nursery flavor addition to diets. From d 3 to 9, pigs fed the flavor diet had improved ($P = 0.016$) F/G compared to those fed the diet without flavor. Offspring from sows fed the flavor diet had increased ADG ($P = 0.038$) from d 3 to 9. Overall, for phase 1 (d 0 to 9), there was no difference in growth performance between treatments.

During phase 2 (d 9 to 24), there was a tendency for a main effect of both sow ($P = 0.054$) and nursery ($P = 0.052$) treatment to impact ADG, where pigs from sows fed the flavor diet had greater ADG compared to pigs from sows fed the control diet, and pigs fed the diet without flavor had increased ADG compared to pigs fed the flavor diet. A tendency ($P = 0.094$) for a main effect of sow treatment was found for ADFI with pigs from sows fed the flavor diet having a greater ADFI. There was no evidence of differences for F/G during phase 2.

[2] National Research Council. 2012. Nutrient Requirements of Swine: Eleventh Revised Edition. Washington, DC: The National Academies Press. doi./10.17226/13298.

During phase 3 (d 24 to 38), there was a tendency ($P = 0.075$) for an interaction of sow and nursery flavor treatment for ADG. Pigs from sows fed flavor diets, that were also fed flavor in nursery diets, had improved ADG compared to those that did not have flavor in nursery diets. There was no difference between nursery treatments for pigs from the sows fed the control diet. There was a tendency ($P = 0.064$) for pigs from sows fed the flavor diet to have an improved ADFI and pigs fed the flavor diet to have ($P = 0.010$) greater ADFI during phase 3. However, pigs fed the flavor diet also had poorer ($P = 0.032$) F/G compared to pigs fed the control diet without flavor.

For the overall period, d 0 to 38, pigs from sows that were fed the feed flavor had increased ADG ($P = 0.038$), ADFI ($P = 0.043$), and BW ($P < 0.001$) when compared to pigs from sows that were fed the control diet without flavor. No differences in F/G were observed. There were no overall differences in performance based on the presence or absence of feed flavor in the nursery diets.

There was no difference in the number of hours it took pigs to begin eating after weaning based on nursery ($P = 0.714$) or sow ($P = 0.979$) treatment (Figure 1). The mean amount of time it took for the marker to be detectable in feces was 75 hours (3.14 d) after weaning. There was a tendency ($P = 0.073$) for an effect of sow treatment on number of pigs that lost weight from d 0 to 3. Fewer pigs from sows on the control diet lost weight compared to pigs from sows on the flavor diet. From d 3 to 9, there was a tendency ($P = 0.079$) for an interaction between sow and nursery treatment. Pigs from sows fed the flavor diet, that were fed the control diet in the nursery, showed the highest number of pigs that lost weight during this time (Figure 2).

In conclusion, offspring from sows fed a diet containing a flavor had increased ADG, ADFI, and BW overall. Pigs fed the feed flavor during the nursery portion of the trial had significantly increased ADFI for phase 3 of the study, but overall, no treatment differences were observed based on the presence of a feed flavor in nursery diets.

Table 1. Diet composition (as-fed basis)[1]

Ingredients, %	Control Phase 1	Control Phase 2	Control Phase 3
Corn	44.50	58.41	64.74
Soybean meal	18.44	25.49	31.29
Fish meal combined	4.50	0.00	0.00
Milk, whey powder	25.00	10.00	0.00
Corn oil	1.50	0.00	0.00
Calcium carbonate	0.30	0.90	0.85
Calcium phosphate	0.48	1.10	1.00
Sodium chloride	0.30	0.55	0.60
L-Lys-HCl	0.43	0.53	0.52
DL-Met	0.21	0.22	0.21
L-Thr	0.18	0.22	0.22
L-Trp	0.05	0.05	0.05
L-Val	0.12	0.14	0.13
Vitamin premix with phytase[2]	0.25	0.25	0.25
Trace mineral premix[3]	0.15	0.15	0.15
Iron oxide	0.60	---	---
Microbially-enhanced soy protein[4]	3.00	2.00	---
Feed flavor[5]	±	±	±
Total	100.0	100.0	100.0

continued

Table 1. Diet composition (as-fed basis)[1]

Ingredients, %	Control Phase 1	Control Phase 2	Control Phase 3
SID amino acids, %			
Lys	1.40	1.35	1.35
Ile:Lys	57	55	55
Leu:Lys	111	112	114
Met:Lys	37	36	36
Met and Cys:Lys	57	57	57
Thr:Lys	63	63	63
Trp:Lys	20	20	20
Val:Lys	70	69	69
His:Lys	32	34	36
Total Lys, %	1.54	1.48	1.49
NE, kcal/lb	1,166	1,111	1,099
SID Lys:NE, g/Mcal	5.44	5.51	5.57
CP, %	21.1	20.5	21.2
Ca, %	0.69	0.77	0.69
P, %	0.66	0.65	0.61
STTD P with phytase, %	0.61	0.56	0.50

[1]Phase 1 diets were fed from d 0 to 9 (approximately 12.6 to 14.3 lb BW), phase 2 were fed from d 9 to 24 (approximately 12.6 to 24.3 lb BW), and phase 3 were fed from d 24 to 38 (approximately 24.3 to 43.5 lb BW).
[2]Ronozyme HiPhos GT 2700 (DSM Nutritional Products, Parsippany, NJ) provided 566 FTU/lb and an expected STTD P release of 0.14%. Provided per lb of premix: 750,000 IU vitamin A; 300,000 IU vitamin D; 8,000 IU vitamin E; 600 mg vitamin K; 6 mg vitamin B_{12}; 9,000 mg niacin; 5,000 mg pantothenic acid; 1,500 mg riboflavin
[3]Provided per lb of premix: 33 g Zn from zinc sulfate; 33 g Fe from iron sulfate; 10 g Mn from manganese oxide; 5 g Cu from copper sulfate; 0.09 g I from calcium iodate; 0.09 g Se from sodium selenite.
[4]Access starter protein-V, Hubbard Feeds, Mankato MN.
[5]Delistart #NA 21 (Adessio, Alpharetta, GA) included at 1 lb per ton in the flavor diet, added at the expense of corn.

Table 2. Interactive effects of sow and nursery pig diets supplemented with a feed flavor on growth performance of nursery pigs[1]

Sow treatment[2]:	Control		Flavor			*P* =		
Nursery treatment[3]:	Control	Flavor	Control	Flavor	SEM	Sow × nursery	Sow	Nursery
Body weight, lb								
d 0	12.0	12.1	13.2	13.2	0.11	0.986	<0.001	0.140
d 3	12.4	12.5	13.5	13.5	0.19	0.879	<0.001	0.482
d 9	13.6	13.8	14.8	15.0	0.26	0.904	<0.001	0.147
d 24	23.7	23.3	25.3	25.1	0.68	0.908	<0.001	0.359
d 38	42.6	42.3	44.2	45.0	1.07	0.336	<0.001	0.687
d 0 to 3								
ADG, lb	0.14	0.14	0.10	0.09	0.05	0.863	0.118	0.846
ADFI, lb	0.19	0.19	0.17	0.17	0.03	0.690	0.171	0.847
F/G	1.54	1.48	1.90	1.97	0.22	0.305	0.306	0.306
d 3 to 9								
ADG, lb	0.19	0.21	0.22	0.24	0.03	0.999	0.038	0.115
ADFI, lb	0.48	0.47	0.50	0.48	0.03	0.687	0.228	0.246
F/G	2.61	2.27	2.41	2.08	0.27	0.956	0.146	0.016
Phase 1 (d 0 to 9)								
ADG, lb	0.17	0.19	0.18	0.19	0.03	0.906	0.711	0.370
ADFI, lb	0.38	0.38	0.39	0.38	0.03	0.654	0.630	0.326
F/G	2.37	2.10	2.26	2.08	0.28	0.755	0.614	0.111
Phase 2 (d 9 to 24)								
ADG, lb	0.67	0.63	0.70	0.67	0.03	0.813	0.054	0.052
ADFI, lb	1.02	0.99	1.07	1.03	0.05	0.839	0.094	0.184
F/G	1.52	1.56	1.53	1.54	0.05	0.526	0.831	0.318
Phase 3 (d 24 to 38)								
ADG, lb	1.26	1.25	1.26	1.33	0.04	0.075	0.111	0.210
ADFI, lb	1.75	1.78	1.76	1.90	0.07	0.111	0.064	0.010
F/G	1.38	1.43	1.40	1.43	0.04	0.807	0.645	0.032
Overall								
ADG, lb	0.79	0.77	0.80	0.81	0.03	0.194	0.038	0.993
ADFI, lb	1.15	1.15	1.17	1.21	0.04	0.360	0.043	0.479
F/G	1.47	1.50	1.48	1.49	0.03	0.525	0.933	0.207

[1]A total of 360 weaned pigs (initially 12.6 lb BW) weaned at approximately 19 d of age were used in a 38-day nursery trial with 14 to 17 pens per treatment with 5 or 6 pigs per pen.
[2]Sow treatment consisted of providing a control diet or a feed flavor diet with inclusion of Krave AP at 0.05% of diet (Adisseo, Alpharetta, GA) from d 110 of gestation until weaning.
[3]Nursery treatment consisted of providing a control diet or a feed flavor diet with the inclusion of Delistart #NA 21 at 0.05% of diet (Adisseo, Alpharetta, GA) in phases 1, 2, and 3.

Table 3. Main effects of the presence of a feed flavor in diets fed to sows or nursery pigs on growth performance of nursery pigs[1]

	Sow treatment[2]				Nursery treatment[3]			
Item	Control	Flavor	SEM	*P* =	Control	Flavor	SEM	*P* =
Body weight, lb								
d 0	12.0	13.2	0.04	<0.001	12.6	12.7	0.04	0.140
d 3	12.4	13.5	0.08	<0.001	12.9	13.0	0.07	0.482
d 9	13.7	14.9	0.09	<0.001	14.2	14.4	0.09	0.147
d 24	23.5	25.2	0.34	<0.001	24.5	24.2	0.33	0.359
d 38	42.5	44.6	0.39	<0.001	43.4	43.6	0.38	0.687
d 0 to 3								
ADG, lb	0.14	0.10	0.03	0.118	0.12	0.12	0.03	0.846
ADFI, lb	0.18	0.17	0.01	0.171	0.18	0.18	0.01	0.847
F/G	1.51	1.93	0.22	0.305	1.70	1.69	0.22	0.306
d 3 to 9								
ADG, lb	0.20	0.23	0.01	0.038	0.21	0.23	0.01	0.115
ADFI, lb	0.47	0.49	0.02	0.228	0.49	0.47	0.02	0.246
F/G	2.44	2.24	0.11	0.146	2.51	2.18	0.11	0.016
Phase 1 (d 0 to 9)								
ADG, lb	0.18	0.19	0.01	0.711	0.18	0.19	0.01	0.370
ADFI, lb	0.38	0.38	0.02	0.630	0.39	0.37	0.02	0.326
F/G	2.24	2.17	0.10	0.614	2.31	2.09	0.10	0.111
Phase 2 (d 9 to 24)								
ADG, lb	0.65	0.69	0.03	0.054	0.69	0.65	0.03	0.052
ADFI, lb	1.00	1.05	0.03	0.094	1.04	1.01	0.03	0.184
F/G	1.54	1.53	0.02	0.831	1.52	1.55	0.02	0.318
Phase 3 (d 24 to 38)								
ADG, lb	1.26	1.29	0.02	0.111	1.26	1.29	0.02	0.210
ADFI, lb	1.76	1.83	0.02	0.064	1.75	1.84	0.02	0.010
F/G	1.40	1.41	0.02	0.645	1.39	1.43	0.02	0.032
Overall								
ADG, lb	0.78	0.80	0.01	0.038	0.79	0.79	0.01	0.933
ADFI, lb	1.15	1.19	0.02	0.043	1.16	1.18	0.02	0.479
F/G	1.48	1.49	0.01	0.933	1.47	1.50	0.01	0.207

[1]A total of 360 weaned pigs (initially 12.6 lb BW) weaned at approximately 19 d of age were used in a 38-day nursery trial with 17 replications of progeny from the sows and pigs fed the control diet, 16 replications of progeny from the sows fed the control diet and pigs fed the flavor diet, 15 replications of progeny from sows fed the flavor diet and pigs fed the control diet, and 14 replications of progeny from sows and pigs fed the flavor diet with 5 or 6 pigs per pen.

[2]Sow treatment consisted of providing a control diet or a feed flavor diet with inclusion of Krave AP at 0.05% of diet (Adisseo, Alpharetta, GA) from d 110 of gestation until weaning.

[3]Nursery treatment consisted of providing a control diet or a feed flavor diet with the inclusion of Delistart #NA 21 at 0.05% of diet (Adisseo, Alpharetta, GA) in phases 1, 2, and 3.

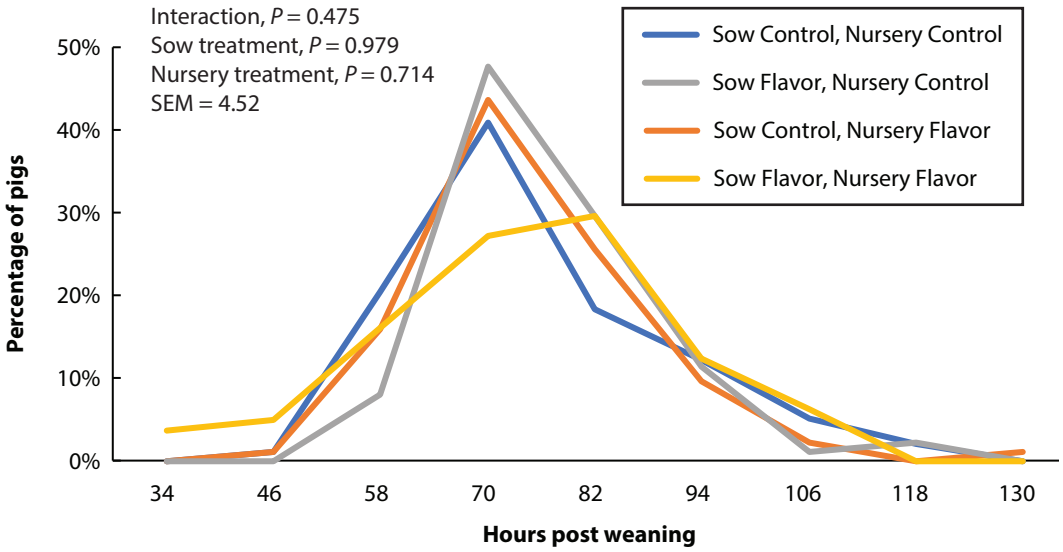

Figure 1. Percentage of pigs defined as eater by time after weaning as influenced by sow or nursery treatment. Fecal swabs were taken starting ~10 hours post weaning and continued every 12 hours after to define eaters vs. non-eaters until all pigs were defined as eaters. Iron oxide was used as an indigestible marker and a red tint on the fecal swab was defined as an eater. The percentage of pigs by treatment defined as eaters at each fecal swabbing time-point was determined.

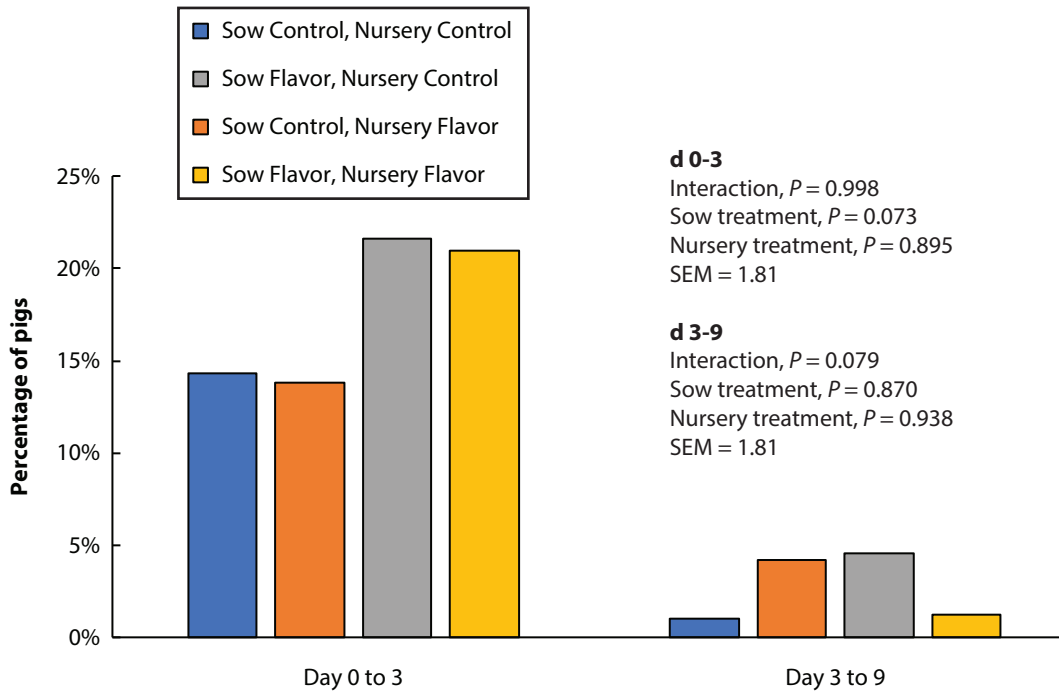

Figure 2. Percentage of pigs that lost weight from d 0–3 and d 3–9 by treatment. Pigs were weighed on d 0, 3, and 9 to determine the percentage of pigs that lost weight from d 0–3 and from d 3–9.