Effects of Switching Diet Formulations on Finishing Pig Performance[1]

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Summary

A total of 1,239 finishing pigs (initially 43 lb) were used in a 41-d trial to determine the effects on ADG, ADFI, and F/G of switching every 2 wk from a corn-soybean meal-based diet to a diet containing alternative ingredients. Pens of pigs were weighed and allotted randomly to 1 of 4 dietary treatments. Dietary treatments were: (1) feeding a corn-soybean meal-based diet; (2) feeding an alternative ingredient-based diet; (3) feeding both diets in succession by feeding 2 wk of the corn-soybean meal-based diet followed by 2 wk of the diet with alternative ingredients, then feeding the corn-soybean meal-based diet again for 2 wk (Switch 1); or (4) feeding both diets in succession by feeding 2 wk of the diet with alternative ingredients followed by 2 wk of the corn-soybean meal-based diet, then feeding the diet with alternative ingredients again for 2 wk (Switch 2). Nutrient specifications of the corn-soybean meal-based diet and alternative ingredient-based diet were similar within phase, and diets were fed in 2 phases (Phase 1: 4 wk, and Phase 2: 2 wk). Pigs were weighed and feed intake was recorded by pen on d 0, 13, 27, and 41 to determine ADG, ADFI, and F/G.

Although performance among pigs fed the different dietary treatments was variable throughout the testing periods, dietary treatment did not affect ($P \geq 0.07$) overall ADG or ADFI. This resulted in pigs being of similar ($P = 0.41$) off-test weight, regardless of the diet (corn-soybean meal-based or alternative ingredient-based diets) or diet sequence (Switch 1 or Switch 2). Therefore, in this study with diets formulated to similar nutrient specifications but having different ingredients, pigs had comparable performance regardless of whether a corn-soybean meal-based diet or an alternative ingredient-based diet was fed continuously or whether pigs were fed these same 2 diets alternated every 2 wk.

Key words: alternative ingredients, diet formulation, diet switching

Introduction

Swine diets are formulated with available ingredients to optimize profitability through reduced cost or improved performance. Historically, swine diets in the Midwestern United States have been based on corn and soybean meal; however, with large amounts of corn by-products available, more alternative ingredients are being used to lower diet cost. Some examples of alternative ingredients used in swine diets are dried distillers grains with solubles (DDGS), and hominy feed. The pricing of these alternative ingredients is sometimes more volatile than that of corn and soybean meal. Thus, as prices fluctuate, so do the optimum diet formulation and inclusion percentages. As ingredi-

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ents are substituted, pig diet formulations often shift abruptly, even though nutrient specifications remain consistent. Nonnutritive characteristics of ingredients, such as palatability or odor, may affect feed intake and growth performance with changes in diet formulation. Sudden and frequent formulation changes may exacerbate the effects. Little work has been done to determine what effects abrupt changes in diet formulations may have on finishing-pig performance. Objectives of this trial were to determine the effects on finishing-pig performance of switching diet formulation extremes between a corn-soybean meal-based diet and a diet containing alternative ingredients (DDGS and hominy feed).

Procedures

The Kansas State University Institutional Animal Care and Use Committee approved procedures used in this study. The study was conducted at a commercial research facility in northeastern Kansas. The barn was double-curtain-sided and naturally ventilated, with deep pits for manure storage. All 44 pens used for the trial were 10 × 18 ft with totally slatted flooring and equipped with a single-sided dry, 3-hole, stainless-steel feeder (AP-3WFS-QA; Automated Production Systems, Assumption, IL) and a double-nipple swinging waterer (Trojan Plastic Waterswing, Trojan Specialty Products, Dodge City, KS), allowing pigs ad libitum access to feed and water. The barn was equipped with an automated feeding system (FeedPro; Feedlogic Corp., Willmar, MN), which recorded feed delivery to individual pens.

A total of 1,239 finishing pigs (initially 43 lb) were used in a 41-d trial to determine the effects on pig performance of switching diet formulations. Pigs were stocked with 27 to 29 barrows or gilts in single-sex pens. Pigs were sourced from farms having 1 of 2 genetic backgrounds (maternal or terminal). Pigs were penned by source, and sources were distributed across the dietary treatments. There were 12 pens per corn-soybean meal-based diet and alternative-ingredient diet only treatments and 10 pens per treatment with switching diets (Switch 1 and Switch 2).

On d 0, pens of pigs were weighed and allotted to 1 of 4 dietary treatments. Dietary treatments were: (1) feeding a corn-soybean meal-based diet; (2) feeding an alternative ingredient-based diet; (3) feeding both diets in succession by feeding 2 wk of the corn-soybean meal-based diet followed by 2 wk of the alternative ingredient-based diet, and then 2 wk of the corn-soybean meal-based diet (Switch 1); or (4) feeding both diets in succession by feeding 2 wk of the alternative ingredient-based diet followed by 2 wk of the corn-soybean meal-based diet, followed by 2 wk of the alternative ingredient-based diet (Switch 2). Diets were fed in 2 phases (Table 1). Phase 1 diets were fed during the first 4 wk of the trial, and Phase 2 diets were fed during the last 2 wk of the trial. Pigs were weighed by pen on d 0, 13, 27, and 41. Feed intake data were recorded on weigh days, and from these data, ADG, ADFI, and F/G were calculated.

Data were analyzed as a completely randomized design using the GLIMMIX procedure of SAS (SAS Institute Inc., Cary, NC), with pen as the experimental unit. In addition to dietary treatment, the effects of gender (barrow or gilt), source, and all interactions were included as fixed effects in the model. Differences between treatments were determined by using least squares means ($P < 0.05$).

Results and Discussion

Dietary treatment did not affect ($P \geq 0.09$) ADG, ADFI, or F/G from d 0 to 13 (Table 2). From d 13 to 27, pigs continuously fed the alternative ingredient-based diet or switched on d 13 to the alternative ingredient-based diet (Switch 1) had improved ($P \leq 0.007$) ADG compared to pigs fed the corn-soybean meal-based diet or switched to the corn-soybean meal-based diet on d 13 (Switch 2). This improved ADG was a result of pigs continuously fed the alternative ingredient-based diet or switched on d 13 to the alternative ingredient-based diet (Switch 1) having increased ($P \leq 0.001$) ADFI from d 13 to 27, compared to pigs fed the corn-soybean meal-based diet, and pigs on the Switch 2 treatment had intermediate ADFI. From d 27 to 41, dietary treatment tended ($P = 0.06$) to affect ADG and ADFI, with pigs fed the corn-soybean meal-based diet or switched to the corn-soybean meal-based diet on d 27 having numerically increased ADG and ADFI compared with pigs fed the alternative ingredient-based diet during that period (alternative ingredient-based diet treatment and Switch 2).

There was a 2-way interaction ($P = 0.03$) between diet and gender for d 27 to 41 F/G. Gilts fed the Switch 1 diet sequence had poorer (2.47 ± 0.042 vs. 2.34 ± 0.042; $P = 0.04$) F/G than barrows fed the Switch 1 diet sequence. Within other diet treatments, barrows and gilts had similar ($P \geq 0.10$) F/G.

These variable growth rate and performance differences across the trial periods resulted in no overall difference ($P \geq 0.07$) in ADG or ADFI or off-test weight among dietary treatments. Differences within phases suggest that characteristics of the diets caused differences in performance. These results indicate that overall pig performance was similar, regardless of whether corn-soybean meal-based diets or alternative ingredient-based diets were fed continuously or pigs were fed these diets in an alternating manner, as long as diets were formulated to similar nutrient specifications. Therefore, on this commercial farm, as ingredient availability or costs change, there appear to be no negative effects on performance if pigs must be switched between corn-soybean meal-based diets and alternative ingredient-based diets.

Table 1. Phase 1 and 2 diet composition (as-fed basis)[1,2]

Item	Phase 1		Phase 2	
	Corn-soybean meal-based	Alternative ingredient-based	Corn-soybean meal-based	Alternative ingredient-based
Ingredient, %				
Corn	75.73	38.95	78.20	41.20
Soybean meal (46.5% CP)	21.75	11.95	19.60	9.75
Corn hominy feed	---	32.50	---	32.50
DDGS	---	15.00	---	15.00
Monocalcium phosphate (21% P)	0.55	---	0.33	---
Limestone	0.70	0.58	0.65	0.58
Salt	0.35	0.28	0.35	0.28
Vitamin premix with phytase	0.15	0.12	0.15	0.12
Phytase	0.05	0.03	0.05	---
Trace mineral premix	0.15	0.12	0.15	0.12
Copper sulfate	0.05	0.05	0.05	0.05
L-lysine HCl	0.37	0.40	0.35	0.37
DL-methionine	0.06	---	0.04	---
L-threonine	0.09	0.05	0.09	0.04
Total	100.00	100.00	100.00	100.00
Calculated analysis				
SID[3] amino acids, %				
Lysine	1.03	1.02	0.96	0.95
Isoleucine:lysine	59	62	59	63
Leucine:lysine	136	155	141	161
Methionine:lysine	30	30	29	31
Met & Cys:lysine	55	58	55	60
Threonine:lysine	60	60	61	61
Tryptophan:lysine	16	16	16	16
Valine:lysine	67	76	68	77
SID Lysine:ME ratio, g/Mcal	3.08	3.08	2.86	2.87
ME, kcal/lb	1,519	1,501	1,523	1,502
Total lysine, %	1.14	1.17	1.07	1.08
CP, %	17.00	19.22	16.18	18.37
Ca, %	0.52	0.54	0.46	0.53
P, %	0.48	0.53	0.42	0.52
Available P, %	0.29	0.30	0.24	0.28

[1] Phase 1 diets were fed during the first 4 wk of the trial and formulated for a weight range of 50 to 80 lb. Phase 2 diets were fed during the last 2 wk of the trial and formulated for a weight range of 80 to 110 lb.

[2] Treatment diets were corn-soybean meal-based diets or alternative ingredient-based diets containing 47.5% alternative ingredients.

[3] Standardized ileal digestible.

Table 2. Effects of diet formulation treatment on performance of commercial finishing pigs[1,2]

Item	Corn-soybean meal-based diet	Alternative ingredient-based diet	Switch 1[3]	Switch 2[4]	SEM[5]	Probability, $P <$
Pens, no.	12	12	10	10	---	---
d 0 to 13						
ADG, lb	1.55	1.52	1.57	1.55	0.025	0.56
ADFI, lb	3.24	3.12	3.27	3.08	0.064	0.13
F/G	2.09	2.05	2.09	1.99	0.032	0.09
d 13 to 27						
ADG, lb	1.73[a]	1.85[b]	1.84[b]	1.73[a]	0.027	0.002
ADFI, lb	3.81[a]	4.11[bc]	4.20[c]	3.96[ab]	0.059	<0.001
F/G	2.21	2.22	2.28	2.28	0.028	0.10
d 27 to 41						
ADG, lb	2.10	1.99	2.11	2.09	0.034	0.06
ADFI, lb	4.98	4.77	5.07	4.87	0.080	0.06
F/G[6]	2.37	2.39	2.40	2.34	0.029	0.44
d 0 to 41						
ADG, lb	1.80	1.79	1.85	1.79	0.023	0.30
ADFI, lb	4.03	4.02	4.20	3.99	0.059	0.07
F/G	2.24	2.24	2.27	2.22	0.019	0.35
Weight, lb						
d 0	43.2	43.2	43.3	43.1	0.60	0.99
d 13	63.4	63.0	63.7	63.2	0.81	0.94
d 27	87.7	88.9	89.5	87.6	1.04	0.49
d 41	117.0	116.8	119.4	117.0	1.27	0.41

[abc] Results without a common superscript letter differ ($P < 0.05$).

[1] A total of 1,239 pigs with 27 to 29 pigs per pen were used in a 41-day trial. Pigs were weighed on d 0, 13, 27, and 41.

[2] Treatments were: (1) feeding a corn-soybean meal-based diet; (2) feeding an alternative ingredient-based diet; (3) feeding both diets by switching every 2 wk, with pigs starting on the corn-soybean meal-based diet (Switch 1); or (4) feeding both diets by switching every 2 wk, with pigs starting on the alternative ingredient-based diet (Switch 2).

[3] Pigs assigned to the Switch 1 treatment were fed the corn-soybean meal-based diet from d 0 to 13 and 27 to 41 and the alternative ingredient-based diet from d 13 to 27.

[4] Pigs assigned to the Switch 2 treatment were fed the alternative ingredient-based diet from d 0 to 13 and 27 to 41 and the corn-soybean meal-based diet from d 13 to 27.

[5] SEM among treatment groups differed because of unbalanced design. The highest SEM among the treatment groups is reported.

[6] The diet × gender interaction ($P = 0.03$) for F/G from d 27 to 41 resulted from gilts fed the Switch 1 diet sequence having poorer (2.47 ± 0.042 vs. 2.34 ± 0.042; $P = 0.04$) F/G than barrows fed the Switch 1 diet sequence, while within diet treatments, barrows and gilts had similar ($P \geq 0.10$) F/G.