The Interactive Effects of High-Fiber Diets and Ractopamine HCl on Finishing Pig Growth Performance, Carcass Characteristics, Carcass Fat Quality, and Intestinal Weights[1]

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Summary

In previous research, feeding pigs high amounts of dried distillers grains with solubles (DDGS) and wheat middlings (midds) has been shown to reduce carcass yield and negatively affect iodine value (IV). The influence of Ractopamine HCl (RAC; Paylean, Elanco Animal Health, Greenfield, IN) on this response is not known; therefore, a total of 575 finishing pigs (PIC 327 × 1050, initially 123 lb) were used in two consecutive 73-d trials to determine the effects of DDGS and midds (high fiber) withdrawal 24 d before harvest in diets with or without RAC on finishing pig growth performance, carcass characteristics, and fat quality. From d 0 to 49, pigs were allotted to 1 of 2 dietary treatments in a completely randomized design based on initial pen weight. The dietary treatments included a corn-soybean meal–based control diet or diets with 30% DDGS and 19% wheat midds. Twelve pens of pigs were fed the corn-soybean meal control diet, and 24 pens were fed the high-fiber diet. During this 49 d period, pigs fed the corn-soybean meal diets had improved ($P < 0.0001$) ADG and F/G compared with those fed the high-fiber diets.

On d 49, pens of pigs were re-allotted to 1 of 6 dietary treatments; pigs remained on the corn-soybean meal diets, switched from the high-fiber diet to corn-soybean meal (withdrawal diet), or were maintained on the high-fiber diet. These 3 regimens were fed with or without 9 g/ton RAC.

No fiber withdrawal regimen × RAC interactions were observed ($P > 0.10$). Pigs maintained on the corn-soybean meal diet or switched to the withdrawal diet had greater ($P < 0.02$) ADG and better F/G than those that remained on the high-fiber diet throughout the study.

Overall (d 0 to 73), pigs fed the corn-soybean meal diet throughout had greater ($P < 0.03$) ADG and better F/G than those fed the high-fiber withdrawal regimen and the high-fiber diets throughout. Pigs fed the withdrawal diet had greater ($P < 0.03$) ADG and ADFI but F/G similar to those fed high-fiber diets throughout. Pigs fed RAC had increased ($P < 0.0002$) ADG, final BW, and improved F/G regardless of dietary regimen.

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For carcass characteristics, pigs fed the corn-soybean meal diet throughout had greater ($P < 0.001$) carcass yield compared with the pigs fed the high-fiber diet throughout, with those fed the withdrawal diets being intermediate. Pigs fed RAC had greater ($P < 0.001$) carcass yield than those not fed RAC. Iodine values of jowl, backfat, belly, and leaf fat were lowest ($P < 0.001$) for pigs fed the corn soybean meal diets, highest ($P < 0.01$) for those fed high-fiber diets throughout (due to DDGS and midds), and intermediate for pigs fed the high-fiber withdrawal diet. Feeding RAC increased ($P < 0.04$) IV of backfat, but did not influence IV of other fat depots. We observed no differences in intestine and organ weights between pigs that were fed corn-soybean meal diets for the duration of the study and pigs that were switched to the corn-soybean meal from high fiber at d 49; however, pigs that remained on the high-fiber diets throughout the study had increased ($P < 0.05$) full cecum and large intestine weights compared with the pigs that were switched from high-fiber diets to the corn-soybean meal diets at d 49.

Feeding the high-fiber diets containing DDGS and midds throughout the study decreased growth performance and carcass yield and increased IV compared with those fed a corn-soybean meal diet. Withdrawing the high-fiber diet and switching to a corn-soybean meal diet for the last 24 d before harvest partially or completely mitigated these negative effects. Feeding RAC for the last 24 d before market, regardless of dietary regimen, improved growth performance and increased carcass yield.

Key words: corn, DDGS, fiber, finishing pig, Ractopamine HCl, wheat middlings

Introduction

By-product ingredients such as dried distillers grains with solubles (DDGS) and wheat middlings are common feed ingredients used in diet formulation. A major concern with feeding a high amount of DDGS is soft carcass fat (high iodine value) and both DDGS and midds have been shown to reduce carcass yield. Complete withdrawal of DDGS and wheat midds before marketing has been successful in lowering the iodine value (IV) and improving carcass yield.[3]

A feed additive that improves carcass yield is Ractopamine HCl (RAC; Paylean, Elanco Animal Health, Greenfield, IN). It is frequently added to finishing swine diets the last 3 wk before marketing to increase weight gain and improve F/G. The supplement also has positive effects on carcass yield, so in addition to feeding a withdrawal diet before marketing, feeding RAC may also reverse or mitigate the negative effects of high-fiber diets on carcass yield. The objective of this study was to determine the effects of RAC on growth performance, carcass characteristics, carcass fat quality, and intestinal weights of pigs withdrawn from the high-fiber diets before market vs. pigs fed corn-soybean meal based diets or high-fiber diets containing DDGS and midds.

Procedures

The protocols for these studies were approved by the Kansas State University Institutional Animal Care and Use Committee.

[3] Asmus et al., Swine Day 2011, Report of Progress 1056, pp. 202.

These studies were conducted at the K-State Swine Teaching and Research Center in Manhattan, KS. The facility was a totally enclosed, environmentally regulated, mechanically ventilated barn containing 36 pens (8 ft × 10 ft). The pens had adjustable gates facing the alleyway that allowed for 10 ft^2/pig. Each pen was equipped with a cup waterer and a single-sided, dry self-feeder (Farmweld, Teutopolis, IL) with 2 eating spaces located in the fence line. Pens were located over a completely slatted concrete floor with a 4-ft pit underneath for manure storage. The facility was also equipped with a computerized feeding system (FeedPro; Feedlogic Corp., Willmar, MN) that delivered and recorded diets as specified. The equipment provided pigs with ad libitum access to food and water.

Wheat midds and DDGS samples were collected at the time of feed manufacture, and a composite sample was analyzed at Ward Laboratories (Kearney, NE; Table 1). Fatty acid analyses were conducted on the DDGS and midds used in the study at the K-State Analytical Lab (Manhattan, KS; Table 2). Feed samples were also collected from each feeder during each phase and combined for a single composite sample by treatment for each phase to measure bulk density (Table 3). Bulk density of a material represents the mass per unit volume (lb/bushel).

A total of 575 pigs (PIC 327 × 1050, initially 123 lb) were used in two consecutive studies (73 and 72 d, respectively). Initially, pens of pigs (4 barrows and 4 gilts per pen) were randomly allotted by initial weight to 1 of 2 dietary treatments in a completely randomized design based on initial pen weight. The dietary treatments included a corn-soybean meal–based control diet or diets with 30% DDGS and 19% midds (Table 3). Twelve pens of pigs were fed the corn-soybean meal control diet, and 24 pens were fed the high-fiber diet. On d 49, pigs were re-allotted to 1 of 6 treatments. Pens of pigs previously fed the corn-soybean meal–based diets remained on corn-soybean meal diets with or without the addition of RAC (Tables 4 and 5). Half of the high fiber–fed pigs were switched to corn-soybean meal–based diets, which served as the high-fiber withdrawal treatment, again with or without RAC. Finally, half of the high-fiber diet–fed pigs remained on a high-fiber diet with or without RAC. There were 12 replications per treatment.

Pigs and feeders were weighed approximately every 3 wk to calculate ADG, ADFI, and F/G. In the first trial, before marketing, all pigs were weighed individually to allow for calculation of carcass yield. The second heaviest barrow in each pen (1 pig per pen, 6 pigs per treatment) was identified to be harvested at the K-State Meats Lab. Hot carcass weights were measured immediately after evisceration. Following evisceration, the entire pluck (heart, lungs, liver, kidneys, spleen, stomach, cecum, large intestine and small intestine) was weighed, then the individual organs were weighed. After full organ weights were recorded, the large intestine, stomach, and cecum were physically stripped, flushed with water, and weighed again. After carcasses had chilled, 10^{th}-rib backfat and loin eye area measurements were taken. Because there were differences in HCW, it was used as a covariate for backfat and loin depth. In the second trial, all pigs were transported approximately 2 h to Farmland Foods (Crete, NE). Pigs harvested at the commercial packing plant were individually tattooed to allow for carcass data collection at the packing plant and data retrieval by pen. Hot carcass weights were measured immediately after evisceration, and belly and jowl fat samples were collected from each

carcass and analyzed for their fatty acid content. Percentage yield was calculated by dividing HCW at the plant by live weight at the farm before transport to the plant.

Data were analyzed as a completely randomized design using the PROC MIXED procedure of SAS (SAS Institute, Inc., Cary, NC) with pen as the experimental unit. The main effects of diet type, high-fiber diet withdrawal time, and RAC usage and their interactions were tested. Differences between treatments were determined by using least squares means. Results were considered significant at $P \leq 0.05$ and considered a trend at $P \leq 0.10$.

Results and Discussion

As expected, adding 30% DDGS and 19% midds decreased diet bulk density (Table 3).

No interactions were found ($P > 0.10$) between fiber withdrawal regimen and RAC for any response criteria. From d 0 to 49, pigs fed the corn-soybean meal–based diet had increased ($P < 0.001$) ADG and improved F/G compared with pigs fed the high-fiber diet (Table 6).

From d 49 to 73, pigs maintained on the corn-soybean meal diet or those switched to the corn-soybean meal diet on d 49 had similar ADG and F/G, and both were improved ($P < 0.03$) compared with pigs maintained on high fiber throughout. Pigs fed RAC had increased ($P < 0.0001$) ADG and improved F/G compared with those not fed RAC. Pigs that remained on high fiber had decreased ($P = 0.0002$) final BW compared with those maintained on the corn-soybean meal diets throughout or switched from high fiber to the corn-soybean meal diet (fiber withdrawal).

Pigs fed high-fiber diets throughout had decreased ($P < 0.001$) carcass yield and carcass weight compared with pigs fed corn-soybean meal diets for the entire study, whereas pigs that were switched from high-fiber diets to corn-soybean meal diets on d 49 were intermediate ($P = 0.01$). Pigs fed RAC had increased ($P < 0.001$) carcass yield and carcass weight compared with pigs that were not fed RAC. No differences ($P > 0.15$) were observed in 10th-rib fat depth or loin eye area among the different dietary fiber regimens; however, RAC tended to decrease ($P < 0.10$) backfat.

No differences were observed in intestine and organ weights between pigs that were fed corn-soybean meal diets for the duration of the study and pigs switched to the corn-soybean meal from high fiber at d 49 (Table 7); however, pigs that remained on the high-fiber diets throughout the study had increased ($P < 0.05$) full cecum and large intestine weights compared with the pigs switched from high-fiber diets to the corn-soybean meal diets at d 49. These results correspond to previous data in which high-fiber diets increased intestine weights.[3] Pigs fed RAC had decreased ($P = 0.01$) rinsed stomach weight and tended to have decreased ($P = 0.07$) full stomach weight compared with pigs that were not fed RAC. Kidney fat decreased ($P = 0.02$) in pigs that were fed the high-fiber diets throughout.

Pigs fed high fiber throughout had increased ($P = 0.02$) linoleic (C18:2n-6) and eicosadienoic (C20:2) concentrations in backfat, belly, leaf, and jowl fat (Tables 8 through 11). Iodine value was lowest ($P < 0.001$) in all 4 fat depots for pigs fed the corn-soybean

meal diet throughout and highest ($P < 0.01$) for those fed high fiber throughout, with those on the fiber withdrawal regimen being intermediate. Added RAC had no effect ($P > 0.12$) on jowl, leaf, or belly fat IV but increased ($P < 0.05$) IV in backfat.

Pigs fed RAC the last 24 d before harvest had improved ADG, ADFI, and F/G as well as carcass yield, regardless of fiber withdrawal regimen. Feeding high-fiber diets throughout the study decreased growth performance, increased full intestine weight, decreased carcass yield, and increased carcass fat IV compared with those fed a corn-soybean meal diet. Withdrawing the high-fiber diet and switching to a corn-soybean meal diet for the last 24 d before harvest restored carcass yield to values similar to pigs fed corn-soybean meal–based diets but only partially mitigated the negative effects on carcass fat IV.

Table 1. Chemical analysis of dried distillers grains with solubles (DDGS) and wheat middlings (as-fed basis)[1]

Nutrient,%	DDGS	Wheat middlings
DM	92.2	90.8
CP	29.2	17.5
Fat (oil)	9.3	4.3
Crude fiber	7.7	8.4
ADF	12.1	13.3
NDF	28.7	34.9
Ash	6.5	5.6

[1] Values represent the mean of a composite sample among the 2 trials.

Table 2. Fatty acid analysis of dietary ingredients[1]

	Exp. 1		Exp. 2	
Item	DDGS[2]	Wheat midds	DDGS	Wheat midds
Myristic acid (C14:0), %	0.05	0.11	0.06	0.10
Palmitic acid (C16:0), %	13.71	15.62	13.64	15.42
Palmitoleic acid (C16:1), %	0.17	0.21	0.16	0.19
Margaric acid (C17:0), %	0.15	0.28	0.14	0.29
Stearic acid (C18:0), %	2.16	1.02	2.08	1.14
Oleic acid (C18:1 cis-9), %	25.22	16.62	24.75	16.33
Vaccenic acid (C18:1n-7), %	1.23	1.53	1.22	1.40
Linoleic acid (C18:2n-6), %	54.06	56.74	54.59	56.87
α-Linoleic acid (C18:3n-3), %	1.53	4.20	1.58	4.26
Arachidic acid (C20:0), %	0.43	0.26	0.42	0.24
Gadoleic acid (C20:1), %	0.25	0.70	0.24	0.71
Eicosadienoic acid (C20:2), %	0.08	0.14	0.09	0.14
Arachidonic acid (C20:4n-6), %	0.04	0.06	0.04	0.06
Other fatty acids, %	0.87	2.58	1.00	2.79
Total SFA, %[3]	16.50	17.29	16.33	17.19
Total MUFA, %[4]	27.11	19.25	26.55	18.83
Total PUFA, %[5]	55.71	61.13	56.30	61.33
Total trans fatty acids, %[6]	0.08	0.00	0.10	0.06
UFA:SFA ratio[7]	5.02	4.65	5.07	4.66
PUFA:SFA ratio[8]	3.38	3.54	3.45	3.57
Iodine value, g/100g[9]	119.68	124.29	120.30	124.43

[1] Values represent the mean of 4 samples collected during each trial.
[2] DDGS: dried distillers grains with solubles.
[3] Total SFA = ([C8:0] + [C10:0] + [C12:0] + [C14:0] + [C16:0] + [C17:0] + [C18:0] +[C20:0] + [C22:0] + [C24:0]); brackets indicate concentration.
[4] Total MUFA = ([C14:1] + [C16:1] + [C18:1 cis-9] + [C18:1n-7] + [C20:1] + [C24:1]); brackets indicate concentration.
[5] Total PUFA = ([C18:2n-6] + [C18:3n-3] + [C18:3n-6] + [C20:2] + [C20:4n-6]); brackets indicate concentration.
[6] Total *trans* fatty acids = ([C18:1 trans] + [C18:2 trans] + [C18:3 trans]); brackets indicate concentration.
[7] UFA:SFA = (total MUFA + total PUFA)/total SFA.
[8] PUFA:SFA = total PUFA/total SFA.
[9] Calculated as IV value (IV) = [C16:1] × 0.95 + [C18:1] × 0.86 + [C18:2] × 1.732 + [C18:3] × 2.616 + [C20:1] × 0.785; brackets indicate concentration.

Table 3. Bulk density of experimental diets (as-fed basis)[1]

		Treatments	
	DDGS,%:[2]	None	30
Bulk density, lb/bu[3]	Wheat midds,%:	None	19
Phase 1		56.22	43.02
Phase 2		53.42	40.87
Phase 3		57.72	42.78
Phase 4		56.64	44.71

[1] Diet samples collected from each feeder during each phase.
[2] DDGS: dried distillers grains with solubles.
[3] Phase 1 was d 0 to 7; Phase 2 was d 7 to 28; Phase 3 was d 28 to 49; Phase 4 was d 49 to 73.

Table 4. Phase 1 and 2 diets (as-fed basis)[1]

	Phase 1		Phase 2	
Item	Corn-soy	High fiber	Corn-soy	High fiber
Ingredient, %				
Corn	79.0	40.0	82.7	43.6
Soybean meal, 46.5% CP	18.9	8.7	15.3	5.2
DDGS[2]	---	30.0	---	30.0
Wheat middlings	---	19.0	---	19.0
Monocalcium P, 21% P	0.35	---	0.25	---
Limestone	1.00	1.28	0.98	1.29
Salt	0.35	0.35	0.35	0.35
Vitamin premix	0.13	0.13	0.10	0.10
Trace mineral premix	0.13	0.13	0.10	0.10
L-lysine HCl	0.15	0.29	0.14	0.28
DL-methionine	---	---	---	---
L-threonine	0.01	---	---	---
Phytase 600[3]	0.13	0.13	0.13	0.13
Total	100.00	100.00	100.00	100.00
Calculated analysis				
Standard ileal digestible (SID) amino acids, %				
Lysine, %	0.79	0.79	0.69	0.69
Isoleucine:lysine	70	74	72	76
Methionine:lysine	30	37	32	41
Met & Cys:lysine	62	77	66	83
Threonine:lysine	63	69	64	72
Tryptophan:lysine	19	19	19	19
Valine:lysine	81	94	85	99
Total lysine, %	0.89	0.94	0.78	0.83
ME, kcal/lb	1,516	1,486	1,520	1,487
SID lysine:ME ratio, g/Mcal	2.36	2.41	2.06	2.10
CP, %	15.6	18.9	14.3	17.6
Crude fiber, %	2.5	4.9	2.4	4.8
NDF	9.3	19.0	9.3	19.0
ADF	3.2	6.6	3.1	6.5
Ca, %	0.53	0.56	0.49	0.55
P, %	0.42	0.56	0.39	0.55
Available P, %	0.13	0.27	0.11	0.26

[1] Phase 1 was d 0 to 28; Phase 2 was d 28 to 49.
[2] DDGS: dried distillers grains with solubles.
[3] Phyzyme 600 (Danisco Animal Nutrition, St. Louis, MO) provided 340.5 phytase units (FTU)/lb, with a release of 0.12% available P.

Table 5. Phase 3 diets (as-fed basis)[1]

	Phase 3			
	Corn-soy		High fiber	
Item RAC:[2]	-	+	-	+
Ingredient, %				
Corn	85.0	75.3	45.7	35.9
Soybean meal, 46.5% CP	13.2	22.7	3.1	12.7
DDGS[3]	---	---	30.0	30.0
Wheat middlings	---	---	19.0	19.0
Monocalcium P, 21% P	0.20	0.15	---	---
Limestone	0.93	0.90	1.40	1.40
Salt	0.35	0.35	0.35	0.35
Vitamin premix	0.08	0.08	0.08	0.08
Trace mineral premix	0.08	0.08	0.08	0.08
L-lysine HCl	0.13	0.17	0.27	0.31
DL-methionine	---	0.02	---	---
L-threonine	0.01	0.06	---	---
Paylean, 9 g/lb[4]	---	0.05	---	0.05
Phytase 600[5]	0.125	0.125	0.125	0.125
Total	100	100	100.00	100.00
Calculated analysis				
Standard ileal digestible (SID) amino acids, %				
Lysine, %	0.63	0.90	0.63	0.90
Isoleucine:lysine	73	69	78	72
Methionine:lysine	33	30	43	35
Met & Cys:lysine	69	60	88	72
Threonine:lysine	67	67	74	67
Tryptophan:lysine	19	19	19	19
Valine:lysine	87	79	1	89
Total lysine, %	0.72	1.01	0.77	1.06
ME, kcal/lb	1,522	1,521	1,486	1,484
SID lysine:ME ratio, g/Mcal	1.88	2.68	1.92	2.75
CP, %	13.5	17.2	16.7	20.4
Crude fiber, %	2.4	2.5	4.8	4.9
NDF	9.3	9.3	19.0	18.9
ADF	3.1	3.3	6.4	6.7
Ca, %	0.46	0.47	0.59	0.62
P, %	0.37	0.40	0.54	0.58
Available P, %	0.10	0.10	0.26	0.27

[1] Phase 3 was d 49 to 73.
[2] Ractopamine HCl (RAC; Paylean, Elanco Animal Health, Greenfield, IN)
[3] DDGS: dried distillers grains with solubles.
[4] Paylean, 9 g/lb, was added at a rate of 1 lb/ton.
[5] Phyzyme 600 (Danisco Animal Nutrition, St. Louis, MO.) provided 340.5 phytase units (FTU)/lb, with a release of 0.12% available P.

Table 6. Effects of high fiber with or without ractopamine HCl (RAC[1]) on growth performance and carcass characteristics[2]

Treatment:	A	B	C	D	E	F						
d 0 to 49:	Corn-soy	Corn-soy	High fiber	High fiber	High fiber	High fiber		d 0 to 49	d 49 to 73			
d 49 to 73:	Corn-soy	Corn-soy	Corn-soy	Corn-soy	High fiber	High fiber		Corn-soy vs. high fiber[3]	Corn-soy vs. high-fiber withdrawal[4]	Corn-soy vs. high fiber[5]	High-fiber withdrawal vs. high fiber[6]	Paylean vs. no paylean[7]
Item RAC:	-	+	-	+	-	+	SEM					
d 0 to 49												
ADG, lb	2.24	2.22	2.11	2.11	2.10	2.11	0.08	<0.001	-	-	-	-
ADFI, lb	6.14	6.05	5.99	6.10	5.92	5.90	0.10	0.13	-	-	-	-
F/G	2.75	2.73	2.85	2.89	2.83	2.80	0.07	0.001	-	-	-	-
d 49 to 73												
ADG, lb	2.00	2.40	2.03	2.46	1.89	2.19	0.20	0.32	0.46	0.02	0.002	<0.001
ADFI, lb	6.94	6.70	7.29	7.16	6.98	6.85	0.30	0.02	0.002	0.44	0.02	0.11
F/G	3.56	2.80	3.61	2.93	3.72	3.17	0.18	0.01	0.22	0.001	0.01	<0.001
Overall												
ADG, lb	2.16	2.27	2.08	2.22	2.03	2.13	0.12	0.001	0.03	<0.001	0.01	<0.001
ADFI, lb	6.40	6.26	6.41	6.44	6.26	6.21	0.16	0.951	0.23	0.279	0.03	0.42
F/G	2.98	2.76	3.08	2.90	3.09	2.92	0.10	<0.001	<0.001	<0.001	0.64	<0.001
BW, lb												
d 0	122.7	122.7	123.0	123.0	123.3	123.3	6.24	0.73	0.84	0.70	0.85	0.99
d 49	232.2	231.5	226.9	226.6	226.2	226.6	3.29	0.01	0.03	0.02	0.89	0.91
d 73	279.3	287.5	275.7	284.9	270.8	278.1	3.91	0.01	0.23	0.001	0.03	0.001

continued

Table 6. Effects of high fiber with or without ractopamine HCl (RAC[1]) on growth performance and carcass characteristics[2]

Treatment:	A	B	C	D	E	F						
d 0 to 49:	Corn-soy	Corn-soy	High fiber	High fiber	High fiber	High fiber		d 0 to 49	d 49 to 73			
d 49 to 73:	Corn-soy	Corn-soy	Corn-soy	Corn-soy	High fiber	High fiber						
Item RAC:	-	+	-	+	-	+	SEM	Corn-soy vs. high fiber[3]	Corn-soy vs. high-fiber withdrawal[4]	Corn-soy vs. high fiber[5]	High-fiber withdrawal vs. high fiber[6]	Paylean vs. no paylean[7]
Carcass traits												
HCW, lb[8]	203.2	215.3	201.3	210.5	195.0	201.4	2.76	0.001	0.22	<0.001	0.01	<0.001
Yield, %[8]	74.22	75.13	73.73	74.58	72.77	73.61	0.19	< 0.001	0.01	< 0.001	< 0.001	< 0.001
Avg BF[9]	1.11	1.02	1.04	0.94	0.94	0.97	0.06	0.04	0.13	0.05	0.49	0.21
LEA[9]	7.68	8.05	7.99	8.61	7.96	7.90	0.34	0.36	0.15	0.84	0.24	0.23

[1] Paylean; Elanco Animal Health (Greenfield, IN).
[2] A total of 575 pigs (PIC 327 ×1050, initially 123 lb BW) were used in a 73-d growth trial with 8 pigs per pen and 12 replications per treatment. No fiber withdrawal × RAC interactions were observed.
[3] Treatments A, B vs. C, D, E, F.
[4] Treatments A, B vs. C, D.
[5] Treatments A, B vs. E, F.
[6] Treatments C, D vs. E, F.
[7] Treatments A, C, E vs. B, D, F.
[8] Values represent 278 observations from pigs that were shipped approximately 2 h to Farmland Foods (Crete, NE).
[9] Values represent 36 barrows (6 observations per treatment) selected for harvest at the Kansas State University Meats Lab (Manhattan, KS).

Table 7. Effects of high fiber with or without Ractopamine HCl (RAC[1]) on intestine and organ weights[2]

Treatment:	A	B	C	D	E	F						
d 0 to 49:	Corn-soy	Corn-soy	High fiber	High fiber	High fiber	High fiber		d 0 to 49	d 49 to 73			
d 49 to 73:	Corn-soy	Corn-soy	Corn-soy	Corn-soy	High fiber	High fiber						
Item RAC:	-	+	-	+	-	+	SEM	Corn-soy vs. high fiber[3]	Corn-soy vs. high-fiber withdrawal[4]	Corn-soy vs. high fiber[5]	High-fiber withdrawal vs. high fiber[6]	Paylean vs. no paylean[7]
Whole intestine	17.99	19.13	18.19	19.13	20.39	19.64	1.00	0.38	0.92	0.16	0.18	0.59
Stomach												
Full	2.30	2.51	2.84	1.98	2.68	2.20	0.24	0.92	0.97	0.89	0.92	0.07
Rinsed	1.58	1.54	1.66	1.48	1.71	1.55	0.05	0.34	0.80	0.16	0.25	0.01
Cecum												
Full	1.39	1.52	1.73	1.60	1.72	2.02	0.20	0.08	0.30	0.05	0.33	0.56
Rinsed	0.72	0.76	0.78	0.75	0.66	0.68	0.04	0.58	0.45	0.09	0.02	0.72
Large intestine												
Full	9.64	9.48	9.33	10.22	11.92	11.82	0.65	0.03	0.74	0.001	0.003	0.70
Rinsed	4.42	4.19	4.33	4.41	4.17	4.38	0.20	0.93	0.76	0.87	0.64	0.89
Small intestine												
Full	7.43	7.92	7.65	7.42	8.01	6.82	0.48	0.63	0.77	0.58	0.80	0.42
Heart	1.00	0.95	1.00	0.93	0.93	1.00	0.04	0.66	0.70	0.70	1.00	0.59
Liver	4.52	4.33	4.59	4.70	4.67	4.64	0.15	0.09	0.15	0.14	0.96	0.77
Kidneys	1.03	1.03	1.03	1.00	1.00	1.13	0.04	0.77	0.74	0.41	0.25	0.38
Kidney Fat	3.97	3.83	3.56	3.21	3.07	2.85	0.37	0.03	0.17	0.02	0.25	0.43

[1] Paylean; Elanco Animal Health (Greenfield, IN).
[2] A total of 575 pigs (PIC 327 ×1050, initially 123 lb BW) were used in a 73-d growth trial with 8 pigs per pen and 12 replications per treatment. Values represent 36 barrows (6 observations per treatment) selected for harvest at the Kansas State University Meats Lab (Manhattan, KS). No fiber withdrawal × RAC interactions were observed.
[3] Treatments A, B vs. C, D, E, F.
[4] Treatments A, B vs. C, D.
[5] Treatments A, B vs. E, F.
[6] Treatments C, D vs. E, F.
[7] Treatments A, C, E vs. B, D, F.

Table 8. Effects of high fiber with or without Ractopamine HCl (RAC[1]) on fatty acid analysis of jowl fat samples[2]

Treatment:	A	B	C	D	E	F						
d 0 to 49:	Corn-soy	Corn-soy	High fiber	High fiber	High fiber	High fiber		d 0 to 49	d 49 to 73			
d 49 to 73:	Corn-soy	Corn-soy	Corn-soy	Corn-soy	High fiber	High fiber		Corn-soy vs. high fiber[3]	Corn-soy vs. high-fiber withdrawal[4]	Corn-soy vs. high fiber[5]	High-fiber withdrawal vs. high fiber[6]	Paylean vs. no paylean[7]
Item RAC:	-	+	-	+	-	+	SEM					
Myristic acid (C14:0), %	1.37	1.34	1.40	1.31	1.30	1.33	0.04	0.53	0.98	0.29	0.32	0.32
Palmitic acid (C16:0), %	23.10	23.24	22.21	21.81	21.31	21.23	0.32	<.001	0.001	0.001	0.02	0.64
Palmitoleic acid (C16:1), %	3.55	3.70	3.48	3.17	3.26	3.10	0.13	0.001	0.02	0.001	0.23	0.28
Stearic acid (C18:0), %	9.20	9.28	8.87	8.97	8.49	8.63	0.25	0.02	0.19	0.01	0.14	0.59
Oleic acid (C18:1 cis-9), %	48.50	48.59	45.24	45.67	44.02	42.74	0.79	<.001	0.001	0.001	0.01	0.67
Vaccenic acid (C18:1n-7), %	0.23	0.18	0.20	0.24	0.20	0.20	0.04	0.88	0.65	0.84	0.52	0.93
Linoleic acid (C18:2n-6), %	10.31	9.64	14.24	14.54	16.56	17.63	0.67	<.001	0.001	0.001	0.001	0.65
α-Linoleic acid (C18:3n-3), %	0.46	0.52	0.61	0.60	0.70	0.76	0.03	<.001	0.001	0.001	0.001	0.11
Arachidic acid (C20:0), %	0.21	0.21	0.17	0.20	0.21	0.24	0.02	0.92	0.32	0.39	0.07	0.16
Gadoleic acid (C20:1), %	1.03	0.97	0.87	1.02	0.91	0.97	0.06	0.24	0.34	0.29	0.93	0.30
Eicosadienoic acid (C20:2), %	0.53	0.49	0.66	0.77	0.77	0.84	0.04	<.001	.0001	0.001	0.02	0.13
Arachidonic acid (C20:4n-6), %	0.20	0.22	0.25	0.22	0.26	0.29	0.02	0.004	0.14	0.001	0.03	0.59
Other fatty acids, %	1.33	1.64	1.81	1.48	2.01	2.05	0.23	0.07	0.47	0.02	0.09	0.97
Iodine value, g/100g[8]	65.14	64.28	69.31	70.04	72.35	73.15	0.86	<.001	0.001	0.001	0.001	0.74

[1] Paylean; Elanco Animal Health (Greenfield, IN).
[2] Values represent 36 barrows (6 per treatment) selected for harvest at the Kansas State University Meats Lab (Manhattan, KS). All values are on a DM basis. No fiber withdrawal × RAC interactions were observed.
[3] Treatments A, B vs. C, D, E, F.
[4] Treatments A, B vs. C, D.
[5] Treatments A, B vs. E, F.
[6] Treatments C, D vs. E, F.
[7] Treatments A, C, E vs. B, D, F.
[8] Calculated as IV value (IV) = [C16:1] × 0.95 + [C18:1] × 0.86 + [C18:2] × 1.732 + [C18:3] × 2.616 + [C20:1] × 0.785 + [C22:1] × 0.723; brackets indicate concentration.

Table 9. Effects of high fiber with or without Ractopamine HCl (RAC[1]) on fatty acid analysis of backfat samples[2]

Treatment:	A	B	C	D	E	F		d 0 to 49	d 49 to 73			
d 0 to 49:	Corn-soy	Corn-soy	High fiber	High fiber	High fiber	High fiber						
d 49 to 73:	Corn-soy	Corn-soy	Corn-soy	Corn-soy	High fiber	High fiber		Corn-soy vs. high fiber[3]	Corn-soy vs. high-fiber withdrawal[4]	Corn-soy vs. high fiber[5]	High-fiber withdrawal vs. high fiber[6]	Paylean vs. no paylean[7]
Item RAC:	-	+	-	+	-	+	SEM					
Myristic acid (C14:0), %	1.37	1.35	1.39	1.27	1.34	1.22	0.06	0.27	0.57	0.18	0.43	0.10
Palmitic acid (C16:0), %	23.87	23.28	22.62	21.99	22.07	20.93	0.59	0.003	0.04	0.001	0.18	0.11
Palmitoleic acid (C16:1), %	2.87	3.03	2.68	2.49	2.45	2.34	0.12	0.001	0.005	0.001	0.13	0.65
Stearic acid (C18:0), %	10.86	9.92	10.15	9.64	10.10	9.04	0.60	0.21	0.41	0.17	0.59	0.09
Oleic acid (C18:1 cis-9), %	45.84	45.64	41.10	42.36	39.02	39.31	0.79	<.001	0.001	0.001	0.003	0.49
Vaccenic acid (C18:1n-7), %	0.21	0.21	0.28	0.04	0.13	0.14	0.06	0.20	0.35	0.19	0.72	0.09
Linoleic acid (C18:2n-6), %	11.23	12.56	17.11	17.92	20.25	22.07	0.82	<.001	0.001	0.001	0.001	0.05
α-Linoleic acid (C18:3n-3), %	0.53	0.63	0.72	0.76	0.77	0.85	0.04	<.001	0.001	0.001	0.09	0.02
Arachidic acid (C20:0), %	0.25	0.23	0.27	0.15	0.25	0.24	0.05	0.83	0.55	0.82	0.40	0.20
Gadoleic acid (C20:1), %	0.92	0.87	0.79	0.91	0.79	0.80	0.05	0.07	0.29	0.04	0.28	0.46
Eicosadienoic acid (C20:2), %	0.50	0.56	0.69	0.75	0.79	0.86	0.04	<.001	0.001	0.001	0.02	0.09
Arachidonic acid (C20:4n-6), %	0.21	0.34	0.36	0.28	0.34	0.37	0.05	0.14	0.35	0.10	0.46	0.48
Other fatty acids, %	1.34	1.38	1.86	1.45	1.70	1.84	0.18	0.04	0.12	0.03	0.54	0.61
Iodine value, g/100g[8]	63.87	66.39	70.27	72.56	73.70	77.22	1.59	<.001	0.001	0.001	0.01	0.04

[1] Paylean; Elanco Animal Health (Greenfield, IN).

[2] Values represent 36 barrows (6 per treatment) selected for harvest at the Kansas State University Meats Lab (Manhattan, KS). All values are on a DM basis. No fiber withdrawal × RAC interactions were observed.

[3] Treatments A, B vs. C, D, E, F.

[4] Treatments A, B vs. C, D.

[5] Treatments A, B vs. E, F.

[6] Treatments C, D vs. E, F.

[7] Treatments A, C, E vs. B, D, F.

[8] Calculated as IV value (IV) = [C16:1] × 0.95 + [C18:1] × 0.86 + [C18:2] × 1.732 + [C18:3] × 2.616 + [C20:1] × 0.785 + [C22:1] × 0.723; brackets indicate concentration.

Table 10. Effects of high fiber with or without Ractopamine HCl (RAC[1]) on fatty acid analysis of belly fat samples[2]

Treatment:	A	B	C	D	E	F						
d 0 to 49:	Corn-soy	Corn-soy	High fiber	High fiber	High fiber	High fiber		d 0 to 49	d 49 to 73			
d 49 to 73:	Corn-soy	Corn-soy	Corn-soy	Corn-soy	High fiber	High fiber						
Item RAC:	-	+	-	+	-	+	SEM	Corn-soy vs. high fiber[3]	Corn-soy vs. high-fiber withdrawal[4]	Corn-soy vs. high fiber[5]	High-fiber withdrawal vs. high fiber[6]	Paylean vs. no paylean[7]
Myristic acid (C14:0), %	1.52	1.46	1.51	1.41	1.41	1.39	0.06	0.24	0.64	0.12	0.27	0.18
Palmitic acid (C16:0), %	25.60	25.21	24.71	24.25	22.63	22.09	0.62	0.001	0.15	0.001	0.002	0.37
Palmitoleic acid (C16:1), %	3.34	3.34	3.03	2.67	3.12	2.91	0.22	0.04	0.03	0.15	0.47	0.30
Stearic acid (C18:0), %	12.36	11.80	11.75	12.59	9.67	9.75	1.17	0.27	0.94	0.05	0.04	0.90
Oleic acid (C18:1 cis-9), %	45.08	44.11	41.55	40.08	41.54	39.75	1.58	0.01	0.02	0.02	0.91	0.28
Vaccenic acid (C18:1n-7), %	0.26	0.24	0.20	0.19	0.20	0.19	0.03	0.03	0.06	0.06	0.95	0.57
Linoleic acid (C18:2n-6), %	8.41	10.27	13.54	14.42	16.96	19.30	0.64	0.001	0.001	0.001	0.001	0.003
α-Linoleic acid (C18:3n-3), %	0.43	0.53	0.58	0.67	0.71	0.77	0.03	0.001	0.001	0.001	0.001	0.001
Arachidic acid (C20:0), %	0.25	0.23	0.23	0.32	0.25	0.22	0.02	0.40	0.12	0.89	0.09	0.39
Gadoleic acid (C20:1), %	0.81	0.79	0.73	0.84	0.78	0.76	0.06	0.59	0.76	0.54	0.76	0.66
Eicosadienoic acid (C20:2), %	0.38	0.44	0.51	0.62	0.68	0.75	0.04	0.001	0.001	0.001	0.001	0.01
Arachidonic acid (C20:4n-6), %	0.18	0.22	0.23	0.24	0.27	0.31	0.01	0.001	0.03	0.001	0.001	0.01
Other fatty acids, %	1.40	1.37	1.43	1.71	1.78	1.84	0.12	0.01	0.13	0.001	0.06	0.32
Iodine value, g/100g[8]	58.48	61.11	64.32	64.55	70.72	73.14	1.65	0.001	0.01	0.001	0.001	0.20

[1] Paylean; Elanco Animal Health (Greenfield, IN).
[2] Values represent 36 barrows (6 per treatment) selected for harvest at the Kansas State University Meats Lab (Manhattan, KS). All values are on a DM basis. No fiber withdrawal × RAC interactions were observed.
[3] Treatments A, B vs. C, D, E, F.
[4] Treatments A, B vs. C, D.
[5] Treatments A, B vs. E, F.
[6] Treatments C, D vs. E, F.
[7] Treatments A, C, E vs. B, D, F.
[8] Calculated as IV value (IV) = [C16:1] × 0.95 + [C18:1] × 0.86 + [C18:2] × 1.732 + [C18:3] × 2.616 + [C20:1] × 0.785 + [C22:1] × 0.723; brackets indicate concentration.

Table 11. Effects of high fiber with or without Ractopamine HCl (RAC[1]) on fatty acid analysis of leaf fat samples[2]

Treatment:	A	B	C	D	E	F		d 0 to 49	d 49 to 73			
d 0 to 49:	Corn-soy	Corn-soy	High fiber	High fiber	High fiber	High fiber						
d 49 to 73:	Corn-soy	Corn-soy	Corn-soy	Corn-soy	High fiber	High fiber		Corn-soy vs. high fiber[3]	Corn-soy vs. high-fiber withdrawal[4]	Corn-soy vs. high fiber[5]	High-fiber withdrawal vs. high fiber[6]	Paylean vs. no paylean[7]
Item RAC:	-	+	-	+	-	+	SEM					
Myristic acid (C14:0), %	1.45	1.41	1.60	1.45	1.39	1.45	0.07	0.45	0.14	0.85	0.11	0.43
Palmitic acid (C16:0), %	27.96	27.83	27.96	26.70	25.25	24.62	0.51	0.001	0.23	0.001	0.001	0.09
Palmitoleic acid (C16:1), %	2.32	2.25	2.12	2.07	2.00	1.90	0.13	0.02	0.13	0.01	0.24	0.48
Stearic acid (C18:0), %	18.01	18.18	17.37	16.90	15.72	14.29	0.69	0.001	0.13	0.001	0.003	0.27
Oleic acid (C18:1 cis-9), %	38.77	38.66	34.95	36.41	33.51	33.59	1.00	0.001	0.003	0.001	0.03	0.52
Vaccenic acid (C18:1n-7), %	0.18	0.17	0.16	0.18	0.16	0.15	0.01	0.31	0.74	0.17	0.28	0.86
Linoleic acid (C18:2n-6), %	8.46	8.53	12.57	12.83	18.02	19.80	0.79	0.001	0.001	0.001	0.001	0.24
α-Linoleic acid (C18:3n-3), %	0.35	0.40	0.49	0.48	0.64	0.73	0.03	0.001	0.002	0.001	0.001	0.11
Arachidic acid (C20:0), %	0.26	0.29	0.27	0.28	0.35	0.26	0.04	0.68	0.93	0.44	0.39	0.50
Gadoleic acid (C20:1), %	0.67	0.69	0.63	0.72	0.60	0.64	0.05	0.42	0.89	0.22	0.28	0.24
Eicosadienoic acid (C20:2), %	0.37	0.36	0.42	0.50	0.54	0.65	0.02	0.001	0.001	0.001	0.001	0.002
Arachidonic acid (C20:4n-6), %	0.11	0.15	0.16	0.14	0.24	0.27	0.02	0.001	0.30	0.001	0.001	0.41
Other fatty acids, %	1.09	1.07	1.30	1.34	1.59	1.66	0.13	0.001	0.06	0.001	0.02	0.75
Iodine value, g/100g[8]	51.80	51.89	55.74	57.48	64.20	67.52	1.44	0.001	0.001	0.001	0.001	0.12

[1] Paylean; Elanco Animal Health (Greenfield, IN).
[2] Values represent 36 barrows (6 per treatment) selected for harvest at the Kansas State University Meats Lab (Manhattan, KS). All values are on a DM basis. No fiber withdrawal × RAC interactions were observed.
[3] Treatments A, B vs. C, D, E, F.
[4] Treatments A, B vs. C, D.
[5] Treatments A, B vs. E, F.
[6] Treatments C, D vs. E, F.
[7] Treatments A, C, E vs. B, D, F.
[8] Calculated as IV value (IV) = [C16:1] × 0.95 + [C18:1] × 0.86 + [C18:2] × 1.732 + [C18:3] × 2.616 + [C20:1] × 0.785 + [C22:1] × 0.723; brackets indicate concentration.