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M D. Asmus

Michael D. Tokach

Jim L. Nelssen

See next page for additional authors

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The effects of immunocastration and dried distillers grains with solubles withdrawal on growth performance, carcass characteristics, fatty acid analysis, and iodine value of pork fat depots

Authors

M D. Asmus, Michael D. Tokach, Jim L. Nelssen, Robert D. Goodband, Joel M. DeRouchey, and Steven S. Dritz

The Effects of Immunocastration and Dried Distillers Grains with Solubles Withdrawal on Growth Performance, Carcass Characteristics, Fatty Acid Analysis, and Iodine Value of Pork Fat Depots¹

M. D. Asmus, M. D. Tokach, S. S. Dritz², J. L. Nelssen, R. D Goodband, and J. M. DeRouchey

Summary

A total of 1,360 pigs (PIC 337 × 1050, initially 53.0 lb) were used in a 125-d study to determine the effects of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration (IC; Improvest, Pfizer Animal Health, Kalamazoo, MI) on growth performance and carcass fat quality of growing-finishing pigs. Pens of pigs were randomly allotted by initial weight and gender (barrows or IC) to 1 of 3 dietary treatments with 8 replications per treatment for a total of 48 pens with 27 to 29 pigs per pen. Treatments were arranged in a 2 × 3 factorial with the main effects of gender (barrow or IC) and diet (0% DDGS throughout, 30% DDGS throughout, or 30% DDGS through d 75 then withdrawn to 0% to d 125). Boars were injected with Improvest on d 39 and 74 of the study. Dietary treatments were corn-soybean meal-based diets and fed in 5 phases. No gender × diet interactions ($P > 0.18$) were observed except for a tendency for F/G ($P < 0.07$) during the second phase (d 25 to 53), when 1 of the 2 barrow groups fed 30% DDGS had an increase in ADFI resulting in poorer F/G. For the entire period before the second Improvest injection (d 0 to 74), barrows tended ($P < 0.08$) to have increased ADG (1.98 vs. 1.95 lb) and increased ($P < 0.001$) ADFI (4.32 vs. 3.91 lb) but were less efficient ($P < 0.001$) than boars (2.19 vs. 2.01). During the same time period, pigs fed 30% DDGS had reduced ($P < 0.002$) ADG and poorer feed efficiency.

For the period after the second Improvest injection until the first marketing event (d 74 to 107; 33 d after the second dose), IC pigs had increased ($P < 0.01$) ADG (2.29 vs. 2.10 lb), similar ADFI (6.92 vs. 6.81 lb), and were more efficient ($P < 0.001$; 3.02 vs. 3.25) than barrows. From d 0 to 107, IC pigs had improved ($P < 0.03$) ADG (2.05 vs. 2.01 lb), F/G (2.34 vs. 2.52), and lower ADFI (4.80 vs. 5.06 lb) than barrows. The inclusion of 30% DDGS regardless of withdrawal or gender did not influence ADG or ADFI but did worsen ($P < 0.001$) feed efficiency.

For the period after the second Improvest injection to the end of the trial (d 74 to 125; 51 d after the second dose), IC pigs had increased ($P < 0.01$) ADG (2.29 vs. 2.10),

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² Department of Diagnostic Medicine/Pathobiology, College of Veterinary Medicine, Kansas State University.

ADFI (7.09 vs. 6.82), and were more efficient (3.09 vs. 3.25) than barrows. Overall (d 0 to 125), IC pigs had improved ($P < 0.003$) ADG (2.07 vs 2.02) and F/G (2.44 vs. 2.58) and lower ADFI (5.05 vs. 5.22) than barrows. The inclusion of 30% DDGS regardless of withdrawal or gender again did not influence ADG or ADFI but worsened ($P < 0.001$) feed efficiency.

Carcass yield was lower ($P < 0.001$) for IC pigs than barrows regardless of dietary DDGS or withdrawal strategy. Pigs fed 30% DDGS throughout had decreased ($P < 0.001$) carcass yield; however, withdrawing DDGS from the diet on d 74 was effective at fully recovering the yield loss, returning values similar to that of pigs fed the control diet throughout. Carcass fat iodine values (IV) were consistently higher ($P < 0.001$) regardless of fat depot or harvest time when 30% DDGS were included in the diet. The withdrawal strategy was successful at lowering ($P < 0.003$) IV when compared to feeding DDGS throughout; however, it was not successful ($P < 0.001$) at fully lowering IV to values similar to pigs fed the control diet throughout. Iodine value of the jowl ($P < 0.07$), loin ($P < 0.02$), and clear plate ($P < 0.003$) tended to be or were greater for IC pigs than barrows on d 107, but differences in IV between IC and barrows disappeared by d 125. Similar to previous studies, withdrawing DDGS from the diet before harvest can improve carcass fat quality (IV) and recover yield loss, but F/G was still poorer regardless of withdrawal strategy.

Overall, immunocastrates had reduced carcass yields, but they also had reduced ADFI and improved ADG, which led to improved feed efficiency. Although the use of Improvest can increase IV of fat depots when pigs are harvested at a shorter interval after the second injection, extending the feeding duration after the second injection returns IV to values similar to barrows. Another interesting observation is the magnitude of changes in fatty acid profile or IV between the different fat depots in relationship to rations, genders, and days after second injection with the immunocastrated barrows exhibiting larger changes than the contemporary physically castrated barrows.

Key words: DDGS, Improvest, finishing pig, withdrawal

Introduction

By-products such as dried distillers grains with solubles (DDGS) are often used as alternatives to corn and soybean meal in swine diets. Although these ingredients are used with the intent of lowering feed costs, they have been shown to negatively affect performance and carcass characteristics. One main area of concern is the reduction in carcass yield with pigs fed high-fiber diets as well as the negative effect of DDGS on fat quality. Soft carcass fat with a high iodine value (more unsaturated fat) has consistently been observed in pigs fed high levels of DDGS; however, removing DDGS as the source of unsaturated fat from the diet prior to harvest lowers carcass fat IV.

Improvest (Pfizer Animal Health, Kalamazoo, MI), an immunocastration technology, allows pigs to perform as boars until the second immunization injection. After the second immunization, IC pigs rapidly increase feed intake and growth rate. Our hypothesis was that pigs administered Improvest would deposit less fat prior to the second dose with a greater portion of their total fat deposition occurring late in the finishing stage; thus, we speculated that feeding high levels of unsaturated fat prior to

the second dose would have less overall impact on IV with these pigs when less unsaturated fat is fed during the phase after the second dose.

Previous research has shown that reducing the level of DDGS in the diet before harvest has been successful in improving carcass yield and improving fat quality; however, no studies are available to determine the impact of the DDGS withdrawal strategy in combination with immunocastration. The objective of this trial was to determine the effects of withdrawing DDGS from the diets of barrows and immunocastrates prior to market on growth performance and carcass fat quality of growing-finishing pigs.

Procedures

The Kansas State University Institutional Animal Care and Use Committee approved the protocol used in this experiment. The study was conducted at a commercial research-finishing barn in southwestern Minnesota. The barns were naturally ventilated and double-curtain-sided. Pens had completely slatted flooring and deep pits for manure storage. Each pen was equipped with a 5-hole stainless steel dry self-feeder and a cup waterer for ad libitum access to feed and water. Daily feed additions to each pen were accomplished through a robotic feeding system (FeedPro; Feedlogic Corp., Willmar, MN) that delivered and recorded diets as specified. The equipment provided pigs with ad libitum access to feed and water.

A total of 1,360 pigs (PIC 1050 $\times$ 337, initially 53.0 lb) were used in a 125-d study. All pigs used in the study were individually tagged and tattooed at birth in sequential order; to minimize maternal effects, even numbers of pigs were used from each sow. To create gender differences, all odd-numbered pigs were left intact and even-numbered pigs were surgically castrated at 2 d of age per standard farm procedures. At weaning (~19 d of age), all pigs were transported to the commercial wean-to-finish barn and double-stocked in pens by gender (the other half of the barn was stocked with gilts). When pigs reached ~50 lb, all gilts were removed and pens were split by gender (barrow and boar) to single-stocking density. Pens of pigs (~28 barrows per pen or ~28 boars per pen) were randomly allotted by initial weight to 1 of 6 dietary treatments with 8 replications per treatment. Treatments were arranged in a 2 $\times$ 3 factorial with the main effects of gender (barrow vs. immunocastrate) and dietary DDGS duration (0% throughout, 30% throughout, or 30% from d 0 to 74 and no DDGS from d 74 to market). Dietary treatments were corn-soybean meal-based and fed in 5 phases (Tables 1 and 2). All diets were fed in meal form. On d 39 (~110 d of age), all boar pigs were administered a 2-ml primer dose of Improvest (Pfizer Animal Health, Kalamazoo, MI) in the high lateral aspect of the neck by a Pfizer Animal Health certified injection team (PAH), who also administered the second 2-ml dose on d 74 (~145 d of age). A PAH quality assurance check was performed on d 88 to ensure all pigs received both doses and did not exhibit any signs of typical boar behavior. Any pig thought to be a “suspect pig” (21 total) was re-dosed with an additional 2 ml of Improvest in the high lateral aspect of the neck, and the individual pig ID was recorded.

Pens of pigs were weighed and feed disappearance was recorded at d 0, 25, 53, 74, 87, 107, and 125 to determine ADG, ADFI, and F/G. On d 107 (180 d of age), all pigs were weighed individually and the 9 heaviest pigs per pen were selected (topped) and tattooed by pen to be transported to Natural Food Holdings (Sioux Center, IA). At

that time, an additional 4 median weight pigs in each pen (4 pigs per pen, 32 pigs per treatment) were also identified to gain representative fat samples over time. These pigs were individually tattooed with a unique number (1 through 192), and 2 pigs per pen (16 per treatment) were transported with the 9 topped pigs to Natural Food Holdings for harvest. During harvest, the 2 selected median weight pigs were sequenced with a unique number corresponding to the tattoo given at the farm to allow for further tracking. The day after harvest, the left side of each carcass was transported by refrigerated truck to the University of Illinois Meat Sciences Laboratory (Urbana, IL) for full carcass breakdown. Standard carcass criteria of HCW and percentage carcass yield were collected on all pigs harvested. The other 2 median-weight pigs remained in their respective pens and were harvested on d 125, then transported to the University of Illinois Meat Sciences Laboratory for carcass processing. Fat samples were collected for both harvest dates from 4 fat depots (jowl, 10th rib, clear plate, and belly) at the University of Illinois Meat Sciences Laboratory. These fat samples were then transported frozen to the K-State Analytical Lab (Manhattan, KS) for full fatty acid analyses. Percentage yield was calculated by dividing HCW at the plant by live weight at 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 gender and DDGS during withdrawal, as well as interactive effects, 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

No gender $\times$ diet interactions ($P > 0.18$) occurred with the exception of a tendency in F/G ($P < 0.07$) during the second phase (d 25 to 53), in which 1 of the 2 barrow groups fed 30% DDGS had an increase in ADFI resulting in poorer F/G. The other interaction tendency ($P < 0.07$) was for carcass yield on d 107, where there was a greater reduction in carcass yield for IC pigs compared with barrows when fed DDGS throughout than when fed the control diet throughout or when DDGS was withdrawn from the diet on d 74. Barrows had greater ($P < 0.01$) ADG (1.92 vs. 1.85) than boars from d 0 to 25 (Tables 3 and 4), which resulted in a tendency for barrows to have greater ($P < 0.08$) ADG than boars prior to the second Improvest immunization (d 74; Tables 5 and 6). Boars had decreased ($P < 0.001$) ADFI and improved ($P < 0.001$) F/G for all periods prior to the second immunization. Immediately after the second immunization (d 74 to 87), IC pigs continued to have lower ($P < 0.001$) ADFI, but grew faster ($P < 0.03$) than barrows, resulting in improved ($P < 0.001$) F/G. After this 2-wk period, feed intake increased rapidly in IC pigs such that they had greater ($P < 0.001$) ADFI for the last two phases of the trial (d 87 to 107 and d 107 to 125) than barrows. The higher feed intake allowed IC pigs to have much greater ($P < 0.001$) ADG during the last two phases than barrows. Feed efficiency also improved ($P < 0.01$) from d 87 to 107 for IC pigs but was similar to barrows from d 107 to 125.

For the period after the second Improvest injection until the first marketing event (d 74 to 107; 33 d after the second dose), IC pigs had increased ($P < 0.01$) ADG and were more efficient ($P < 0.01$; 3.02 vs. 3.25) than barrows. From d 0 to 107, IC pigs had improved ($P < 0.03$) ADG (2.05 vs. 2.01 lb), F/G (2.34 vs. 2.52), and lower ($P < 0.001$) ADFI (4.80 vs. 5.06 lb) than barrows. The inclusion of 30% DDGS regardless of

withdrawal or gender did not influence ADG or ADFI but did worsen ($P < 0.001$) feed efficiency.

For the period after the second Improvest injection to the end of the trial (d 74 to 125; 51 d after the second dose), IC pigs had increased ($P < 0.01$) ADG (2.29 vs. 2.10) and ADFI (7.09 vs. 6.82) and were more efficient ($P < 0.01$; 3.09 vs. 3.25) than barrows. Overall (d 0 to 125), IC pigs had improved ($P < 0.003$) ADG (2.07 vs. 2.02) and F/G (2.44 vs. 2.58) and lower ADFI (5.05 vs. 5.22) than barrows. The inclusion of 30% DDGS regardless of withdrawal or gender again did not influence ADG or ADFI but worsened ($P < 0.001$) feed efficiency.

Regardless of gender, pigs fed 30% DDGS had decreased ($P < 0.02$) ADG compared with pigs fed the control diet without DDGS from d 0 to 25, d 25 to 53, and for the entire period prior to the second Improvest immunization (d 74). Withdrawing DDGS from the diet on d 74 did not influence pig performance from d 74 to 107 but resulted in lower ($P < 0.001$) ADFI and improved ($P < 0.001$) F/G from d 107 to 125. The inclusion of 30% DDGS did not influence ($P > 0.12$) overall ADG or ADFI but worsened ($P = 0.001$) F/G regardless of withdrawal strategy.

Carcass yield was lower ($P < 0.001$) for IC pigs than barrows regardless of diet type or withdrawal strategy. Pigs fed the 30% DDGS diet throughout had decreased ($P < 0.001$) carcass yield; however, withdrawing DDGS from the diet on d 74 was effective at fully recovering the yield loss, returning yield to levels similar to that of the pigs fed the corn-soybean meal diet throughout. Final HCW were not influenced ($P > 0.11$) by treatment. Carcass fat IV were greater when 30% DDGS were included in the diet. The withdrawal strategy was successful at lowering the IV compared with pigs fed DDGS throughout; however, as observed in previous studies, it was not successful at fully lowering IV to values similar to pigs fed the control diet throughout.

Fatty Acid Analysis on d 107

All fat depots responded similarly to treatment, so results will be discussed together (Tables 7, 8, 11, 12, 15, 16, 19, and 20). Including 30% DDGS reduced ($P < 0.001$) SFA and MUFA proportions regardless of fat depot. Of the predominant SFA ($P < 0.02$), myristic (14:0), palmitic (16:0), and stearic (18:0) acid concentrations were reduced ($P < 0.01$) as well as MUFA concentrations of palmitoleic (16:1), oleic (18:1c9), and vaccenic (18:1n7) acids. Total *trans* and PUFA, however, were increased ($P < 0.04$) due to increases in linoleic (18:2n6), α -linoleic (18:3n3), eicosadienoic (20:2), and arachidonic (20:4n-6) acid concentrations, resulting in overall increases ($P < 0.001$) in UFA:SFA and PUFA:SFA ratios as well as IV. Withdrawing DDGS from the diet on d 74 reduced ($P < 0.03$) SFA concentrations through reductions in 16:0 and 18:0 and tended to reduce MUFA by reducing 18:1c9. Total *trans* and PUFA concentration increased ($P < 0.05$) by 18:2n6, 18:3n3, and 20:2 concentration, which resulted in overall increases ($P < 0.02$) in UFA:SFA, PUFA:SFA, and IV. The IC pigs had reduced ($P < 0.04$) MUFA proportions as a result of reductions in 18:1c9 and 20:1 concentrations. The IC pigs also had lower ($P < 0.02$) 14:0 concentrations but no difference in overall SFA; however, total PUFA was increased ($P < 0.01$) through increases ($P < 0.04$) in 18:2n6, 18:3n3, 20:2, and 20:4n6, causing an overall increase ($P < 0.02$) in PUFA:SFA ratio. Iodine values were increased ($P < 0.02$) in loin and clear

plate samples and tended to increase ($P < 0.07$) in jowl samples for IC pigs compared with barrows, but no difference was detected in IV for belly fat samples.

Fatty Acid Analyses on d 125

From d 107 to d 125 fatty acid profiles of immunocastrates changed dramatically through reductions in PUFA, mainly 18:2n6, 18:3n3, 20:2, and 20:4n6 (Tables 9, 10, 13, 14, 17, 18, 21, and 22). These reductions in unsaturated fatty acid concentration resulted in improved IV, resulting in values that were not statistically different, and in some cases numerically better than that of barrows. Despite increases ($P < 0.05$) in 17:0, including 30% DDGS in the diet reduced ($P < 0.001$) SFA and MUFA proportions through reductions ($P < 0.01$) in SFA concentrations of 14:0 and 16:0 and MUFA concentrations ($P < 0.01$) of 16:1, 18:1c9, and 18:1n7. Total *trans* and PUFA were increased ($P < 0.003$) by increases ($P < 0.004$) in 18:2n6, 18:3n3, 20:2, and 20:4n6, which resulted in overall increases ($P < 0.001$) in UFA:SFA, PUFA:SFA, and IV when 30% DDGS were included in the diet. Withdrawing DDGS from the diet on d 74 reduced ($P < 0.002$) SFA and MUFA proportions through reductions ($P < 0.001$) in SFA concentrations of 16:0 and 18:0 (except in jowl fat samples) and MUFA concentrations ($P < 0.05$) of 16:1, 18:1c9, and 18:n7; however, PUFA was increased ($P < 0.001$) through increases ($P < 0.04$) in 18:2n6, 18:3n3, and 20:2, which resulted in overall increases ($P < 0.04$) in UFA:SFA, PUFA:SFA, and IV. The IC pigs tended ($P < 0.10$) to have reduced MUFA proportions as a result of reductions ($P < 0.09$) in 18:1c9 and 18:1n7 concentrations, but no differences were detected in UFA:SFA, PUFA:SFA, or IV between IC pigs and barrows.

The change in fatty acid profile and IV between fat stores and by days post-second injection of Improvest are shown in Tables 23 and 24 and Figure 1. The IV of jowl fat is considerably greater than the IV of backfat, belly fat, or clear plate regardless of gender or dietary regimen. Increasing feeding duration from 33 to 51 d post-second injection reduced IV for backfat and belly fat for IC pigs but did not influence IV of jowl or clear plate fat. These results would be expected, because more of the fat in the late finishing period is being deposited in the belly and backfat. The data also demonstrate the difference in conclusion depending on which fat source is being measured. For jowl fat, IV was greater for IC pigs than barrows regardless of diet and did not decrease with days on feed. For backfat and belly fat, increasing days on feed from d 107 to d 125 reduced IV, with IC pigs having a much greater reduction in IV than barrows.

Withdrawing DDGS from the diet prior to harvest, regardless of gender, can regain yield loss and improve IV; however, regardless of withdrawal strategy, feed efficiency was poorer when feeding DDGS. Immunocastrates had reduced carcass yields regardless of diet type compared with barrows, but they also had reduced ADFI and improved ADG, which resulted in improved F/G. Although Improvest can increase IV of fat depots when pigs are harvested at 5 wk post-second injection, extending the length of feeding duration prior to harvest after the second injection returns IV values to levels similar to those of barrows.

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

Item	DDGS, %: ²	Phase 1		Phase 2	
		0	30	0	30
Ingredient, %					
Corn		67.85	45.25	72.90	50.20
Soybean meal (46.5% CP)		29.45	22.40	24.70	17.55
DDGS		---	30.00	---	30.00
Monocalcium P (21% P)		0.60	---	0.45	---
Limestone		0.90	1.20	0.90	1.20
Salt		0.35	0.35	0.35	0.35
Vitamin premix		0.09	0.09	0.09	0.09
L-threonine		0.09	0.04	0.08	0.03
DL-methionine		0.12	0.01	0.07	---
L-lysine sulfate		0.51	0.64	0.45	0.58
Phytase ³		0.01	0.01	0.01	0.01
Total		100.0	100.0	100.0	100.0
Calculated analysis					
Standardized ileal digestible (SID) amino acids, %					
Lysine		1.14	1.14	1.00	1.00
Isoleucine:lysine		61	63	62	64
Leucine:lysine		130	157	139	169
Methionine:lysine		32	29	30	30
Met & Cys:lysine		56	56	56	60
Threonine:lysine		62	62	63	63
Tryptophan:lysine		18	18	18	18
Valine:lysine		66	72	68	76
SID lysine:ME, g/Mcal		3.41	3.39	2.98	2.98
ME, kcal/lb		1,518	1,524	1,521	1,525
Total lysine, %		1.26	1.33	1.11	1.18
CP, %		19.9	22.9	18.1	21.0
Ca, %		0.57	0.55	0.53	0.54
Crude fiber, %		2.6	4.1	2.6	4.0
P, %		0.52	0.50	0.47	0.48
Available P, %		0.30	0.32	0.27	0.32

¹ Phase 1 diets were fed from approximately 50 to 100 lb; Phase 2 diets were fed from 100 to 150 lb.

² DDGS: dried distillers grains with solubles.

³ Optiphos 2000 (Enzyvia LLC, Sheridan, IN) provided per pound of diet: 454.0 phytase units (FTU)/lb and 0.11% available P released.

Table 2. Phase 3, 4, and 5 diet composition (as-fed basis)¹

Table 2. Phase 3, 4, and 5 diet composition (as fed basis)							
Item	DDGS, %: ²	Phase 3		Phase 4		Phase 5	
		0	30	0	30	0	30
Ingredient, %							
Corn		75.75	53.00	80.10	57.15	85.30	62.25
Soybean meal (46.5% CP)		22.00	14.75	17.80	10.70	12.75	5.65
DDGS		---	30.00	---	30.00	---	30.00
Monocalcium P (21% P)		0.35	---	0.30	---	0.30	---
Limestone		0.90	1.20	0.85	1.20	0.85	1.20
Salt		0.35	0.35	0.35	0.35	0.35	0.35
Vitamin premix		0.09	0.09	0.09	0.09	0.09	0.09
L-threonine		0.07	0.02	0.06	0.02	0.03	---
DL-methionine		0.04	---	0.03	---	---	---
L-lysine sulfate		0.42	0.55	0.37	0.50	0.31	0.44
Phytase ³		0.01	0.01	0.01	0.01	0.01	0.01
Total		100.0	100.0	100.0	100.0	100.0	100.0
Calculated analysis							
Standardized ileal digestible (SID) amino acids, %							
Lysine		0.92	0.92	0.80	0.80	0.65	0.65
Isoleucine:lysine		63	65	64	67	67	71
Leucine:lysine		146	178	157	194	177	223
Methionine:lysine		29	31	30	34	31	39
Met & Cys:lysine		56	63	59	68	63	78
Threonine:lysine		64	64	66	66	66	69
Tryptophan:lysine		18	18	18	18	18	18
Valine:lysine		70	78	73	82	79	90
SID lysine:ME, g/Mcal		2.74	2.74	2.38	2.38	1.93	1.93
ME, kcal/lb		1,523	1,525	1,525	1,526	1,525	1,526
Total lysine, %		1.03	1.09	0.90	0.96	0.73	0.80
CP, %		17.0	20.0	15.4	18.4	13.4	16.4
Ca, %		0.50	0.53	0.46	0.52	0.45	0.50
Crude fiber, %		2.5	3.9	2.5	3.9	2.4	3.8
P, %		0.44	0.46	0.41	0.45	0.39	0.43
Available P, %		0.24	0.31	0.23	0.31	0.22	0.30

¹Phase 3 diets were fed from approximately 150 to 200 lb, Phase 4 diets were fed from 200 to 230 lb, and Phase 5 diets were fed from 230 to 280 lb.

²DDGS: dried distillers grains with solubles.

³Optiphos 2000 (Enzyvia LLC, Sheridan, IN) provided per pound of diet: 454.0 phytase units (FTU)/lb and 0.11% available P released.

Table 3. Effect of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on growth performance¹

Gender:	Barrow			Improvest			SEM
		30%	30%		30%	30%	
d 0 to 74:	Corn-soy	DDGS	DDGS	Corn-soy	DDGS	DDGS	
d 74 to 125:	Corn-soy	Corn-soy	30% DDGS	Corn-soy	Corn-soy	30% DDGS	
d 0 to 25							
ADG, lb	1.99	1.89	1.88	1.92	1.80	1.84	0.03
ADFI, lb	3.47	3.38	3.33	3.23	3.14	3.19	0.07
F/G	1.75	1.79	1.77	1.68	1.75	1.74	0.03
d 25 to 53 ²							
ADG, lb	1.79	1.72	1.73	1.79	1.73	1.74	0.03
ADFI, lb	4.05	4.27	3.99	3.59	3.66	3.69	0.09
F/G	2.26	2.49	2.31	2.01	2.12	2.13	0.04
d 53 to 74 ³							
ADG, lb	2.36	2.37	2.38	2.37	2.34	2.31	0.04
ADFI, lb	5.80	5.73	5.83	5.23	5.16	5.11	0.09
F/G	2.46	2.42	2.45	2.21	2.21	2.22	0.03
d 74 to 87							
ADG, lb	2.15	2.14	2.20	2.26	2.26	2.19	0.04
ADFI, lb	6.59	6.63	6.65	5.87	6.09	5.91	0.11
F/G	3.07	3.10	3.03	2.60	2.70	2.70	0.04
d 87 to 107							
ADG, lb	2.00	2.03	2.12	2.25	2.34	2.41	0.07
ADFI, lb	6.66	7.05	7.10	7.34	7.57	7.81	0.17
F/G	3.36	3.49	3.35	3.27	3.24	3.25	0.07
d 107 to 125							
ADG, lb	2.06	2.14	2.11	2.28	2.33	2.28	0.07
ADFI, lb	6.70	6.68	7.15	7.29	7.53	8.08	0.13
F/G	3.28	3.12	3.39	3.20	3.25	3.55	0.07

¹ A total of 1,360 pigs (PIC 337 × 1050, initially 53.0 lb) were used in a 125-d study.

² First Improvest injection was given on d 39.

³ Second Improvest injection was given on d 74.

Table 4. Main effects of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on growth performance¹

	Probability, <i>P</i> <				
	Interaction ²	Gender ³	Diet ⁴	DDGS before ⁵	DDGS withdrawal ⁶
d 0 to 25					
ADG, lb	0.66	0.01	0.001	0.001	
ADFI, lb	0.71	0.001	0.35	0.15	
F/G	0.85	0.04	0.14	0.05	
d 25 to 53					
ADG, lb	0.95	0.78	0.08	0.03	
ADFI, lb	0.22	0.001	0.20	0.27	
F/G	0.07	0.001	0.001	0.001	
d 53 to 74					
ADG, lb	0.61	0.42	0.86	0.64	
ADFI, lb	0.63	0.001	0.73	0.46	
F/G	0.73	0.001	0.65	0.75	
d 74 to 87					
ADG, lb	0.22	0.03	0.98		0.93
ADFI, lb	0.64	0.001	0.51		0.49
F/G	0.24	0.001	0.26		0.35
d 87 to 107					
ADG, lb	0.88	0.001	0.13		0.26
ADFI, lb	0.84	0.001	0.04		0.41
F/G	0.44	0.01	0.64		0.38
d 107 to 125					
ADG, lb	0.93	0.001	0.62		0.54
ADFI, lb	0.39	0.001	0.001		0.001
F/G	0.18	0.20	0.001		0.001

¹ A total of 1,360 pigs (PIC 337 × 1050, initially 53.0 lb.) were used in a 125-d study.

² Interaction gender × diet.

³ Main effect of gender (Treatments 1, 2, and 3 – (barrows) vs. 4, 5, and 6 – (Immunocastrates)).

⁴ Main effect of diet type (corn-soy or 30% DDGS).

⁵ Effect of DDGS before 2nd injection (Treatments 1 and 4 vs. 2, 3, 5, and 6).

⁶ Effect of withdrawing DDGS after 2nd injection (Treatments 2 and 5 vs. 3 and 6).

Table 5. Effect of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on overall growth performance and weights¹

	Gender:		Barrow		Improvast		SEM
	Day 0 to 74:	Corn-soy	30% DDGS	30% DDGS	Corn-soy	30% DDGS	
			30% DDGS	30% DDGS	Corn-soy	30% DDGS	
	Day 74 to 125:	Corn-soy	Corn-soy	DDGS	Corn-soy	Corn-soy	DDGS
Weight, lb							
d 0		53.3	53.4	53.4	52.9	53.0	52.8
d 25 ²		103.0	100.7	100.4	101.0	98.1	98.9
d 53		153.3	149.0	148.9	151.3	147.4	147.8
d 74 ³		203.1	198.8	198.8	201.3	196.7	197.0
d 87		231.0	226.6	227.5	230.9	226.1	225.8
d 107		257.5	254.4	254.9	263.8	259.1	259.8
d 125		294.7	294.1	293.1	305.0	301.4	301.3
d 0 to 74							
ADG, lb		2.02	1.96	1.96	2.00	1.92	1.93
ADFI, lb		4.33	4.37	4.27	3.92	3.89	3.92
F/G		2.15	2.23	2.18	1.96	2.03	2.03
d 74 to 107							
ADG, lb		2.06	2.08	2.15	2.25	2.31	2.32
ADFI, lb		6.63	6.88	6.92	6.74	6.97	7.04
F/G		3.23	3.32	3.22	3.00	3.02	3.04
d 74 to 125							
ADG, lb		2.06	2.09	2.14	2.26	2.31	2.31
ADFI, lb		6.65	6.83	6.97	6.88	7.10	7.29
F/G		3.23	3.27	3.26	3.04	3.08	3.16
d 0 to 107							
ADG, lb		2.03	1.99	2.02	2.07	2.04	2.04
ADFI, lb		5.02	5.12	5.06	4.76	4.80	4.84
F/G		2.47	2.57	2.51	2.30	2.36	2.37
d 0 to 125							
ADG, lb		2.03	2.01	2.03	2.09	2.06	2.07
ADFI, lb		5.16	5.26	5.24	4.98	5.04	5.12
F/G		2.54	2.62	2.59	2.38	2.45	2.48
HCW, lb							
d 107		208.4	205.9	204.9	209.1	208.0	204.4
d 125		213.5	212.6	210.1	216.4	213.9	211.8
Yield, %							
d 107		76.6	76.4	75.9	74.8	74.8	73.6
d 125		76.3	76.2	75.8	74.9	74.8	74.0

¹ A total of 1,360 pigs (PIC 337 × 1050, initially 53.0 lb.) were used in a 125-d study.

² First Improvest injection was given on d 39.

³ Second Improvest injection was given on d 74.

Table 6. Main effects of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on overall growth performance and weights¹

	Probability, $P <$				
	Interaction ²	Gender ³	Diet ⁴	DDGS before ⁵	DDGS withdrawal ⁶
Weight, lb					
d 0	1.00	0.64	1.00	0.96	
d 25 ²	0.95	0.17	0.26	0.10	
d 53	0.98	0.36	0.08	0.03	
d 74 ³	1.00	0.29	0.07	0.02	
d 87	0.93	0.67	0.08		0.90
d 107	0.96	0.04	0.37		0.85
d 125	0.89	0.002	0.70		0.87
d 0 to 74					
ADG, lb	0.92	0.08	0.002	0.001	
ADFI, lb	0.60	0.001	0.77	0.74	
F/G	0.39	0.001	0.005	0.002	
d 74 to 107					
ADG, lb	0.78	<0.001	0.24		0.35
ADFI, lb	0.99	0.35	0.10		0.72
F/G	0.44	<0.001	0.41		0.34
d 74 to 125					
ADG, lb	0.81	0.001	0.24		0.55
ADFI, lb	0.93	0.01	0.01		0.15
F/G	0.43	0.001	0.21		0.34
d 0 to 107					
ADG, lb	0.91	0.03	0.22	0.13	0.41
ADFI, lb	0.80	<0.001	0.58	0.30	0.88
F/G	0.37	<0.001	0.01	0.001	0.26
d 0 to 125					
ADG, lb	0.89	0.003	0.37	0.21	0.53
ADFI, lb	0.76	0.003	0.26	0.12	0.59
F/G	0.33	0.001	0.01	0.001	0.97
HCW, lb					
d 107	0.83	0.66	0.15	0.11	0.28
d 125	0.94	0.30	0.23	0.16	0.32
Yield, %					
d 107	0.07	0.001	0.001		0.001
d 125	0.41	0.001	0.001		0.001

¹ A total of 1,360 pigs (PIC 337 × 1050, initially 53.0 lb.) were used in a 125-d study.

² Interaction gender × diet type.

³ Main effect of gender (Treatments 1, 2, and 3 – (barrows) vs. 4, 5, and 6 – (Immunocastrates)).

⁴ Main effect of diet type (corn-soy or 30% DDGS).

⁵ Effect of DDGS before 2nd injection (Treatments 1 and 4 vs. 2, 3, 5, and 6).

⁶ Effect of withdrawing DDGS after 2nd injection (Treatments 2 and 5 vs. 3 and 6).

Table 7. Effect of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on jowl fatty acid analysis for pigs harvested at d 107^{1,2,3}

	Gender:	Barrow			Improvest			SEM
	Day 0 to 74:	Corn-soy	DDGS	DDGS	Corn-soy	DDGS	DDGS	
	Day 74 to 125:	Corn-soy	Corn-soy	DDGS	Corn-soy	Corn-soy	DDGS	
Myristic acid (C14:0), %		1.34	1.30	1.25	1.28	1.22	1.20	0.03
Palmitic acid (C16:0), %		23.16	21.74	21.17	22.02	21.64	21.05	0.30
Palmitoleic acid (C16:1), %		2.47	2.36	2.15	2.40	2.12	2.12	0.11
Margaric acid (C17:0), %		0.59	0.66	0.72	0.62	0.62	0.67	0.04
Stearic acid (C18:0), %		11.72	10.21	9.95	11.53	11.52	10.23	0.36
Oleic acid (C18:1 <i>cis</i> -9), %		39.59	37.36	36.20	38.05	35.76	35.31	0.47
Vaccenic acid (C18:1n-7), %		3.82	3.62	3.35	3.77	3.36	3.32	0.10
Linoleic acid (C18:2n-6), %		12.80	17.73	19.99	15.53	18.85	20.77	0.63
α -Linoleic acid (C18:3n-3), %		0.58	0.69	0.73	0.71	0.72	0.74	0.03
Arachidic acid (C20:0), %		0.24	0.22	0.24	0.21	0.23	0.21	0.01
Gadoleic acid (C20:1), %		0.88	0.85	0.83	0.80	0.80	0.84	0.02
Eicosadienoic acid (C20:2), %		0.75	0.97	1.07	0.84	1.00	1.13	0.04
Arachidonic acid (C20:4n-6), %		0.27	0.31	0.31	0.34	0.36	0.36	0.01
Other fatty acids, %		1.79	1.98	2.04	1.90	1.81	2.06	0.06
Total SFA, %		37.31	34.39	33.59	35.93	35.49	33.64	0.58
Total MUFA, %		46.88	44.31	42.64	45.12	42.14	41.72	0.62
Total PUFA, %		14.68	20.01	22.44	17.73	21.20	23.38	0.70
Total <i>trans</i> fatty acids, %		0.90	1.07	1.13	1.03	1.00	1.12	0.03
UFA:SFA ratio		1.66	1.88	1.95	1.76	1.80	1.96	0.05
PUFA:SFA ratio		0.40	0.58	0.67	0.50	0.61	0.71	0.03
Iodine value, g/100g		64.8	71.5	74.1	68.4	71.5	74.8	0.92

¹ All values are on a DM basis.

² First Improvest injection was given on d 39; second Improvest injection was given on d 74.

³ Pigs selected for fat analyses represented the median for each pen (2 pigs/pen).

Table 8. Main effects of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on jowl fatty acid analysis for pigs harvested at d 107¹

	Probability, $P <$				
	Interaction ²	Gender ³	Diet ⁴	DDGS ⁵	Withdrawal ⁶
Myristic acid (C14:0), %	0.89	0.01	0.01	0.005	0.17
Palmitic acid (C16:0), %	0.15	0.07	<0.001	<0.001	0.06
Palmitoleic acid (C16:1), %	0.62	0.21	0.03	0.01	0.32
Margaric acid (C17:0), %	0.49	0.47	0.05	0.05	0.13
Stearic acid (C18:0), %	0.11	0.12	<0.001	<0.001	0.03
Oleic acid (C18:1 <i>cis</i> -9), %	0.70	0.001	<0.001	<0.001	0.09
Vaccenic acid (C18:1n-7), %	0.47	0.17	<0.001	<0.001	0.14
Linoleic acid (C18:2n-6), %	0.26	0.004	<0.001	<0.001	0.002
α -Linoleic acid (C18:3n-3), %	0.08	0.01	0.005	0.002	0.24
Arachidic acid (C20:0), %	0.09	0.10	0.99	0.99	0.91
Gadoleic acid (C20:1), %	0.09	0.02	0.76	0.60	0.60
Eicosadienoic acid (C20:2), %	0.75	0.04	<0.001	<0.001	0.002
Arachidonic acid (C20:4n-6), %	0.67	<0.001	0.01	0.002	0.71
Other fatty acids, %	0.06	0.76	0.003	0.02	0.01
Total SFA, % ⁷	0.11	0.87	<0.001	<0.001	0.03
Total MUFA, % ⁸	0.59	0.003	<0.001	<0.001	0.10
Total PUFA, % ⁹	0.27	0.004	<0.001	<0.001	0.002
Total <i>trans</i> fatty acids, % ¹⁰	0.02	0.49	<0.001	<0.001	0.02
UFA:SFA ratio ¹¹	0.21	0.78	<0.001	<0.001	0.02
PUFA:SFA ratio ¹²	0.32	0.02	<0.001	<0.001	0.001
Iodine value, g/100g ¹³	0.12	0.07	<0.001	<0.001	0.003

¹ All values are on a DM basis.² Interaction gender $\times$ diet type.³ Main effect of gender (Treatments 1, 2, and 3 – (barrows) vs. 4, 5, and 6 – (Immunocastrates)).⁴ Main effect of diet type (corn-soy or 30% DDGS).⁵ Effect of DDGS before d 74 (Treatments 1 and 4 vs. 2, 3, 5, and 6).⁶ Effect of DDGS withdrawal after d 74 (Treatments 2 and 5 vs. 3 and 6).⁷ 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.⁸ Total MUFA = ([C14:1] + [C16:1] + [C18:1*cis*-9] + [C18:1n-7] + [C20:1] + [C24:1]); brackets indicate concentration.⁹ Total PUFA = ([C18:2n-6] + [C18:3n-3] + [C18:3n-6] + [C20:2] + [C20:4n-6]); brackets indicate concentration.¹⁰ Total *trans* fatty acids = ([C18:1*trans*] + [C18:2*trans*] + [C18:3*trans*]); brackets indicate concentration.¹¹ UFA:SFA = (total MUFA + total PUFA)/total SFA.¹² PUFA:SFA = total PUFA/total SFA.¹³ Calculated as IV value (IV) = [C16:1] $\times$ 0.95 + [C18:1] $\times$ 0.86 + [C18:2] $\times$ 1.732 + [C18:3] $\times$ 2.616 + [C20:1] $\times$ 0.785 + [C22:1] $\times$ 0.723; brackets indicate concentration.

Table 9. Effect of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on jowl fatty acid analysis for pigs harvested at d 125^{1,2,3}

	Gender:	Barrow			Improvest			SEM
	Day 0 to 74:	Corn-soy	DDGS	DDGS	Corn-soy	DDGS	DDGS	
	Day 74 to 125:	Corn-soy	Corn-soy	DDGS	Corn-soy	Corn-soy	DDGS	
Myristic acid (C14:0), %		1.33	1.25	1.22	1.35	1.20	1.22	0.03
Palmitic acid (C16:0), %		22.60	20.95	20.50	22.44	20.99	20.71	0.26
Palmitoleic acid (C16:1), %		2.53	2.46	2.17	2.56	2.31	2.03	0.10
Margaric acid (C17:0), %		0.60	0.63	0.66	0.59	0.65	0.60	0.03
Stearic acid (C18:0), %		10.82	9.64	9.01	10.83	10.04	9.84	0.25
Oleic acid (C18:1 <i>cis</i> -9), %		40.44	38.36	37.26	38.94	37.94	35.78	0.37
Vaccenic acid (C18:1n-7), %		3.84	3.66	3.34	3.78	3.52	3.13	0.08
Linoleic acid (C18:2n-6), %		13.43	18.24	20.84	15.02	18.51	21.85	0.41
α -Linoleic acid (C18:3n-3), %		0.61	0.70	0.73	0.67	0.71	0.75	0.02
Arachidic acid (C20:0), %		0.21	0.22	0.21	0.21	0.21	0.21	0.01
Gadoleic acid (C20:1), %		0.90	0.82	0.84	0.85	0.84	0.80	0.02
Eicosadienoic acid (C20:2), %		0.79	0.98	1.13	0.83	1.03	1.15	0.03
Arachidonic acid (C20:4n-6), %		0.26	0.30	0.30	0.27	0.31	0.31	0.01
Other fatty acids, %		1.64	1.79	1.79	1.67	1.74	1.62	0.04
Total SFA, %		35.81	32.91	31.81	35.66	33.33	32.81	0.43
Total MUFA, %		47.76	45.37	43.67	46.20	44.68	41.81	0.45
Total PUFA, %		15.31	20.50	23.26	17.00	20.80	24.31	0.46
Total <i>trans</i> fatty acids, %		0.90	1.06	1.06	0.98	1.03	1.02	0.03
UFA:SFA ratio		1.77	2.01	2.11	1.78	1.97	2.03	0.04
PUFA:SFA ratio		0.43	0.63	0.73	0.48	0.63	0.74	0.02
Iodine value, g/100g		66.6	73.3	76.4	68.2	73.1	76.4	0.65

¹ All values are on a DM basis.

² First Improvest injection was given on d 39; second Improvest injection was given on d 74.

³ Pigs selected for fat analyses represented the median for each pen (2 pigs/pen).

Table 10. Main effects of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on jowl fatty acid analysis for pigs harvested at d 125¹

	Probability, $P <$				
	Interaction ²	Gender ³	Diet ⁴	DDGS ⁵	Withdrawal ⁶
Myristic acid (C14:0), %	0.54	0.75	0.001	0.001	0.78
Palmitic acid (C16:0), %	0.77	0.88	0.001	0.001	0.17
Palmitoleic acid (C16:1), %	0.60	0.30	0.001	0.001	0.01
Margaric acid (C17:0), %	0.45	0.54	0.36	0.16	0.80
Stearic acid (C18:0), %	0.27	0.05	0.001	0.001	0.11
Oleic acid (C18:1 <i>cis</i> -9), %	0.26	0.001	0.001	0.001	0.001
Vaccenic acid (C18:1n-7), %	0.62	0.04	0.001	0.001	0.001
Linoleic acid (C18:2n-6), %	0.28	0.01	0.001	0.001	0.001
α -Linoleic acid (C18:3n-3), %	0.25	0.07	0.001	0.001	0.04
Arachidic acid (C20:0), %	0.88	0.91	0.74	0.50	0.70
Gadoleic acid (C20:1), %	0.21	0.23	0.04	0.01	0.68
Eicosadienoic acid (C20:2), %	0.80	0.13	0.001	0.001	0.001
Arachidonic acid (C20:4n-6), %	0.87	0.54	0.002	0.001	0.84
Other fatty acids, %	0.12	0.09	0.06	0.05	0.16
Total SFA, % ⁷	0.43	0.24	0.001	0.001	0.07
Total MUFA, % ⁸	0.41	0.001	0.001	0.001	0.001
Total PUFA, % ⁹	0.31	0.01	0.001	0.001	0.001
Total <i>trans</i> fatty acids, % ¹⁰	0.03	0.95	0.001	0.001	0.94
UFA:SFA ratio ¹¹	0.42	0.25	0.001	0.001	0.04
PUFA:SFA ratio ¹²	0.39	0.21	0.001	0.001	0.001
Iodine value, g/100g ¹³	0.35	0.37	0.001	0.001	0.001

¹ All values are on a DM basis.

² Interaction gender $\times$ diet type.

³ Main effect of gender (Treatments 1, 2, and 3 – (barrows) vs. 4, 5, and 6 – (Immunocastrates)).

⁴ Main effect of diet type (corn-soy or 30% DDGS).

⁵ Effect of DDGS before d 74 (Treatments 1 and 4 vs. 2, 3, 5, and 6).

⁶ Effect of DDGS withdrawal after d 74 (Treatments 2 and 5 vs. 3 and 6).

⁷ 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.

⁸ Total MUFA = ([C14:1] + [C16:1] + [C18:1*cis*-9] + [C18:1n-7] + [C20:1] + [C24:1]); brackets indicate concentration.

⁹ Total PUFA = ([C18:2n-6] + [C18:3n-3] + [C18:3n-6] + [C20:2] + [C20:4n-6]); brackets indicate concentration.

¹⁰ Total *trans* fatty acids = ([C18:1*trans*] + [C18:2*trans*] + [C18:3*trans*]); brackets indicate concentration.

¹¹ UFA:SFA = (total MUFA + total PUFA)/total SFA.

¹² PUFA:SFA = total PUFA/total SFA.

¹³ Calculated as IV value (IV) = [C16:1] $\times$ 0.95 + [C18:1] $\times$ 0.86 + [C18:2] $\times$ 1.732 + [C18:3] $\times$ 2.616 + [C20:1] $\times$ 0.785 + [C22:1] $\times$ 0.723; brackets indicate concentration.

Table 11. Effect of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on backfat fatty acid analysis for pigs harvested at d 107^{1,2,3}

	Gender:	Barrow			Improvest			SEM
	Day 0 to 74:	Corn-soy	DDGS	DDGS	Corn-soy	DDGS	DDGS	
	Day 74 to 125:	Corn-soy	Corn-soy	DDGS	Corn-soy	Corn-soy	DDGS	
Myristic acid (C14:0), %		1.36	1.34	1.29	1.34	1.25	1.22	0.03
Palmitic acid (C16:0), %		25.41	24.30	23.22	24.53	23.80	22.95	0.34
Palmitoleic acid (C16:1), %		2.09	1.95	1.79	2.07	1.82	1.76	0.09
Margaric acid (C17:0), %		0.65	0.66	0.75	0.65	0.64	0.67	0.04
Stearic acid (C18:0), %		14.80	13.57	12.32	14.48	14.03	12.33	0.34
Oleic acid (C18:1 <i>cis</i> -9), %		35.83	34.43	32.84	34.66	33.35	32.52	0.42
Vaccenic acid (C18:1n-7), %		3.11	2.93	2.71	3.07	2.82	2.69	0.06
Linoleic acid (C18:2n-6), %		12.77	16.45	20.46	15.01	17.93	21.27	0.62
α -Linoleic acid (C18:3n-3), %		0.54	0.61	0.68	0.64	0.66	0.69	0.02
Arachidic acid (C20:0), %		0.30	0.28	0.29	0.27	0.29	0.28	0.01
Gadoleic acid (C20:1), %		0.80	0.78	0.72	0.72	0.72	0.73	0.02
Eicosadienoic acid (C20:2), %		0.66	0.82	0.95	0.71	0.85	0.99	0.03
Arachidonic acid (C20:4n-6), %		0.23	0.25	0.27	0.28	0.29	0.28	0.01
Other fatty acids, %		1.50	1.63	1.70	1.58	1.55	1.62	0.04
Total SFA, %		42.77	40.38	38.12	41.54	40.26	37.70	0.59
Total MUFA, %		41.92	40.18	38.14	40.58	38.79	37.77	0.52
Total PUFA, %		14.38	18.35	22.60	16.85	19.95	23.48	0.68
Total <i>trans</i> fatty acids, %		0.80	0.93	1.01	0.92	0.92	0.97	0.03
UFA:SFA ratio		1.32	1.45	1.60	1.39	1.47	1.64	0.04
PUFA:SFA ratio		0.34	0.46	0.60	0.41	0.50	0.63	0.02
Iodine value, g/100g		60.1	65.3	70.8	63.2	66.8	71.8	0.96

¹ All values are on a DM basis.² First Improvest injection was given on d 39; second Improvest injection was given on d 74.³ Pigs selected for fat analyses represented the median for each pen (2 pigs/pen).

Table 12. Main effects of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on backfat fatty acid analysis for pigs harvested at d 107¹

	Probability, $P <$				
	Interaction ²	Gender ³	Diet ⁴	DDGS ⁵	Withdrawal ⁶
Myristic acid (C14:0), %	0.50	0.02	0.01	0.01	0.25
Palmitic acid (C16:0), %	0.67	0.05	0.001	0.001	0.01
Palmitoleic acid (C16:1), %	0.80	0.42	0.01	0.003	0.24
Margaric acid (C17:0), %	0.52	0.33	0.19	0.38	0.11
Stearic acid (C18:0), %	0.53	0.86	0.001	0.001	0.001
Oleic acid (C18:1 <i>cis</i> -9), %	0.57	0.02	0.001	0.001	0.01
Vaccenic acid (C18:1n-7), %	0.75	0.28	0.001	0.001	0.01
Linoleic acid (C18:2n-6), %	0.53	0.005	0.001	0.001	0.001
α -Linoleic acid (C18:3n-3), %	0.24	0.01	0.002	0.002	0.05
Arachidic acid (C20:0), %	0.24	0.14	0.99	0.97	0.92
Gadoleic acid (C20:1), %	0.17	0.01	0.28	0.30	0.23
Eicosadienoic acid (C20:2), %	0.97	0.16	0.001	0.001	0.001
Arachidonic acid (C20:4n-6), %	0.41	0.001	0.20	0.07	0.82
Other fatty acids, %	0.11	0.41	0.03	0.04	0.10
Total SFA, % ⁷	0.64	0.23	0.001	0.001	0.001
Total MUFA, % ⁸	0.56	0.02	0.001	0.001	0.01
Total PUFA, % ⁹	0.52	0.01	0.001	0.001	0.001
Total <i>trans</i> fatty acids, % ¹⁰	0.02	0.30	0.001	0.001	0.03
UFA:SFA ratio ¹¹	0.79	0.21	0.001	0.001	0.001
PUFA:SFA ratio ¹²	0.73	0.02	0.001	0.001	0.001
Iodine value, g/100g ¹³	0.54	0.02	0.001	0.001	0.001

¹ All values are on a DM basis.

² Interaction gender $\times$ diet type.

³ Main effect of gender (Treatments 1, 2, and 3 – (barrows) vs. 4, 5, and 6 – (Immunocastrates)).

⁴ Main effect of diet type (corn-soy or 30% DDGS)..

⁵ Effect of DDGS before d 74 (Treatments 1 and 4 vs. 2, 3, 5, and 6).

⁶ Effect of DDGS withdrawal after d 74 (Treatments 2 and 5 vs. 3 and 6).

⁷ 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.

⁸ Total MUFA = ([C14:1] + [C16:1] + [C18:1*cis*-9] + [C18:1n-7] + [C20:1] + [C24:1]); brackets indicate concentration.

⁹ Total PUFA = ([C18:2n-6] + [C18:3n-3] + [C18:3n-6] + [C20:2] + [C20:4n-6]); brackets indicate concentration.

¹⁰ Total *trans* fatty acids = ([C18:1*trans*] + [C18:2*trans*] + [C18:3*trans*]); brackets indicate concentration.

¹¹ UFA:SFA = (total MUFA + total PUFA)/total SFA.

¹² PUFA:SFA = total PUFA/total SFA.

¹³ Calculated as IV value (IV) = [C16:1] $\times$ 0.95 + [C18:1] $\times$ 0.86 + [C18:2] $\times$ 1.732 + [C18:3] $\times$ 2.616 + [C20:1] $\times$ 0.785 + [C22:1] $\times$ 0.723; brackets indicate concentration.

Table 13. Effect of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on backfat fatty acid analysis for pigs harvested at d 125^{1,2,3}

	Gender:	Barrow			Improvest			SEM
	Day 0 to 74:	Corn-soy	DDGS	DDGS	Corn-soy	DDGS	DDGS	
	Day 74 to 125:	Corn-soy	Corn-soy	DDGS	Corn-soy	Corn-soy	DDGS	
Myristic acid (C14:0), %		1.35	1.33	1.27	1.38	1.29	1.28	0.03
Palmitic acid (C16:0), %		25.60	24.51	23.19	25.86	24.80	23.52	0.26
Palmitoleic acid (C16:1), %		2.10	2.05	1.73	2.03	1.95	1.68	0.09
Margaric acid (C17:0), %		0.53	0.57	0.65	0.52	0.58	0.60	0.03
Stearic acid (C18:0), %		14.97	13.99	12.48	15.52	14.49	13.27	0.30
Oleic acid (C18:1 <i>cis</i> -9), %		37.29	35.48	33.54	35.92	36.31	32.60	0.40
Vaccenic acid (C18:1n-7), %		3.08	2.94	2.64	2.94	2.91	2.53	0.06
Linoleic acid (C18:2n-6), %		11.27	14.97	20.15	12.08	13.73	20.28	0.49
α -Linoleic acid (C18:3n-3), %		0.48	0.53	0.64	0.49	0.49	0.63	0.02
Arachidic acid (C20:0), %		0.30	0.31	0.28	0.30	0.30	0.27	0.01
Gadoleic acid (C20:1), %		0.83	0.79	0.76	0.82	0.82	0.72	0.03
Eicosadienoic acid (C20:2), %		0.62	0.77	0.96	0.62	0.72	0.94	0.02
Arachidonic acid (C20:4n-6), %		0.20	0.23	0.24	0.20	0.22	0.25	0.01
Other fatty acids, %		1.37	1.51	1.48	1.31	1.39	1.45	0.04
Total SFA, %		43.01	40.96	38.11	43.82	41.69	39.19	0.46
Total MUFA, %		43.38	41.34	38.73	41.77	42.06	37.59	0.47
Total PUFA, %		12.75	16.72	22.18	13.56	15.33	22.28	0.53
Total <i>trans</i> fatty acids, %		0.71	0.84	0.89	0.74	0.74	0.89	0.03
UFA:SFA ratio		1.31	1.42	1.61	1.27	1.38	1.54	0.03
PUFA:SFA ratio		0.30	0.41	0.59	0.31	0.37	0.57	0.02
Iodine value, g/100g		58.6	63.6	70.4	58.7	61.8	69.7	0.73

¹ All values are on a DM basis.² First Improvest injection was given on d 39; second Improvest injection was given on d 74.³ Pigs selected for fat analyses represented the median for each pen (2 pigs/pen).

Table 14. Main effects of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on backfat fatty acid analysis for pigs harvested at d 125¹

	Probability, $P <$				
	Interaction ²	Gender ³	Diet ⁴	DDGS ⁵	Withdrawal ⁶
Myristic acid (C14:0), %	0.50	0.93	0.02	0.01	0.26
Palmitic acid (C16:0), %	0.99	0.18	0.001	0.001	0.001
Palmitoleic acid (C16:1), %	0.95	0.30	0.001	0.01	0.001
Margaric acid (C17:0), %	0.62	0.51	0.02	0.01	0.16
Stearic acid (C18:0), %	0.87	0.02	0.001	0.001	0.001
Oleic acid (C18:1 <i>cis</i> -9), %	0.02	0.13	0.001	0.001	0.001
Vaccenic acid (C18:1n-7), %	0.67	0.06	0.001	0.001	0.001
Linoleic acid (C18:2n-6), %	0.11	0.81	0.001	0.001	0.001
α -Linoleic acid (C18:3n-3), %	0.27	0.41	0.001	0.001	0.001
Arachidic acid (C20:0), %	0.68	0.50	0.01	0.30	0.01
Gadoleic acid (C20:1), %	0.43	0.66	0.004	0.02	0.02
Eicosadienoic acid (C20:2), %	0.58	0.20	0.001	0.001	0.001
Arachidonic acid (C20:4n-6), %	0.80	0.73	0.001	0.001	0.10
Other fatty acids, %	0.58	0.05	0.01	0.002	0.73
Total SFA, % ⁷	0.92	0.02	0.001	0.001	0.001
Total MUFA, % ⁸	0.04	0.08	0.001	0.001	0.001
Total PUFA, % ⁹	0.11	0.71	0.001	0.001	0.001
Total <i>trans</i> fatty acids, % ¹⁰	0.07	0.27	0.001	0.001	0.001
UFA:SFA ratio ¹¹	0.85	0.03	0.001	0.001	0.001
PUFA:SFA ratio ¹²	0.30	0.35	0.001	0.001	0.001
Iodine value, g/100g ¹³	0.46	0.17	0.001	0.001	0.001

¹ All values are on a DM basis.² Interaction gender $\times$ diet type.³ Main effect of gender (Treatments 1, 2, and 3 – (barrows) vs. 4, 5, and 6 – (Immunocastrates)).⁴ Main effect of diet type (corn-soy or 30% DDGS).⁵ Effect of DDGS before d 74 (Treatments 1 and 4 vs. 2, 3, 5, and 6).⁶ Effect of DDGS withdrawal after d 74 (Treatments 2 and 5 vs. 3 and 6).⁷ 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.⁸ Total MUFA = ([C14:1] + [C16:1] + [C18:1cis-9] + [C18:1n-7] + [C20:1] + [C24:1]); brackets indicate concentration.⁹ Total PUFA = ([C18:2n-6] + [C18:3n-3] + [C18:3n-6] + [C20:2] + [C20:4n-6]); brackets indicate concentration.¹⁰ Total *trans* fatty acids = ([C18:1trans] + [C18:2trans] + [C18:3trans]); brackets indicate concentration.¹¹ UFA:SFA = (total MUFA + total PUFA)/total SFA.¹² PUFA:SFA = total PUFA/total SFA.¹³ Calculated as IV value (IV) = [C16:1] $\times$ 0.95 + [C18:1] $\times$ 0.86 + [C18:2] $\times$ 1.732 + [C18:3] $\times$ 2.616 + [C20:1] $\times$ 0.785 + [C22:1] $\times$ 0.723; brackets indicate concentration.

Table 15. Effect of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on belly fatty acid analysis for pigs harvested at d 107¹²³

	Gender:	Barrow			Improvest			SEM
	Day 0 to 74:	Corn-soy	DDGS	DDGS	Corn-soy	DDGS	DDGS	
	Day 74 to 125:	Corn-soy	Corn-soy	DDGS	Corn-soy	Corn-soy	DDGS	
Myristic acid (C14:0), %		1.39	1.36	1.31	1.36	1.28	1.22	0.03
Palmitic acid (C16:0), %		24.44	23.28	22.54	23.74	23.29	22.27	0.33
Palmitoleic acid (C16:1), %		2.59	2.38	2.26	2.54	2.15	2.11	0.12
Margaric acid (C17:0), %		0.54	0.58	0.62	0.55	0.53	0.57	0.03
Stearic acid (C18:0), %		12.35	11.40	10.84	12.64	12.76	11.11	0.46
Oleic acid (C18:1 <i>cis</i> -9), %		39.28	37.44	36.17	37.98	36.36	35.58	0.50
Vaccenic acid (C18:1n-7), %		3.78	3.50	3.35	3.73	3.35	3.22	0.11
Linoleic acid (C18:2n-6), %		11.64	15.64	18.35	13.25	15.97	19.32	0.43
α -Linoleic acid (C18:3n-3), %		0.52	0.59	0.65	0.59	0.60	0.65	0.02
Arachidic acid (C20:0), %		0.25	0.24	0.25	0.23	0.26	0.24	0.01
Gadoleic acid (C20:1), %		0.83	0.82	0.78	0.76	0.77	0.77	0.02
Eicosadienoic acid (C20:2), %		0.66	0.85	0.93	0.73	0.83	1.00	0.03
Arachidonic acid (C20:4n-6), %		0.23	0.26	0.27	0.29	0.30	0.30	0.01
Other fatty acids, %		1.54	1.65	1.66	1.62	1.53	1.62	0.05
Total SFA, %		39.19	37.12	35.82	38.78	38.38	35.67	0.70
Total MUFA, %		46.56	44.22	42.63	45.11	42.71	41.76	0.66
Total PUFA, %		13.25	17.57	20.42	15.08	17.91	21.50	0.47
Total <i>trans</i> fatty acids, %		0.79	0.91	0.94	0.87	0.86	0.94	0.03
UFA:SFA ratio		1.54	1.67	1.77	1.57	1.60	1.79	0.05
PUFA:SFA ratio		0.34	0.48	0.57	0.39	0.47	0.61	0.02
Iodine value, g/100g		62.2	67.4	70.9	64.0	66.6	71.8	0.82

¹ All values are on a DM basis.

² First Improvest injection was given on d 39; second Improvest injection was given on d 74.

³ Pigs selected for fat analyses represented the median for each pen (2 pigs/pen).

Table 16. Main effects of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on belly fatty acid analysis for pigs harvested at d 107¹

	Probability, $P <$				
	Interaction ²	Gender ³	Diet ⁴	DDGS ⁵	Withdrawal ⁶
Myristic acid (C14:0), %	0.57	0.01	0.002	0.002	0.08
Palmitic acid (C16:0), %	0.55	0.23	0.001	0.001	0.01
Palmitoleic acid (C16:1), %	0.74	0.13	0.005	0.001	0.48
Margaric acid (C17:0), %	0.56	0.21	0.23	0.23	0.22
Stearic acid (C18:0), %	0.40	0.09	0.01	0.02	0.02
Oleic acid (C18:1 <i>cis</i> -9), %	0.77	0.02	0.001	0.001	0.04
Vaccenic acid (C18:1n-7), %	0.87	0.21	0.001	0.001	0.18
Linoleic acid (C18:2n-6), %	0.33	0.01	0.001	0.001	0.001
α -Linoleic acid (C18:3n-3), %	0.18	0.04	0.001	0.001	0.003
Arachidic acid (C20:0), %	0.23	0.75	0.41	0.21	0.65
Gadoleic acid (C20:1), %	0.42	0.03	0.67	0.82	0.39
Eicosadienoic acid (C20:2), %	0.19	0.09	0.001	0.001	0.001
Arachidonic acid (C20:4n-6), %	0.34	0.001	0.07	0.02	0.69
Other fatty acids, %	0.13	0.55	0.40	0.40	0.28
Total SFA, % ⁷	0.44	0.69	0.001	0.001	0.01
Total MUFA, % ⁸	0.86	0.02	0.001	0.001	0.06
Total PUFA, % ⁹	0.29	0.01	0.001	0.001	0.001
Total <i>trans</i> fatty acids, % ¹⁰	0.04	0.67	0.001	0.001	0.02
UFA:SFA ratio ¹¹	0.54	0.84	0.001	0.001	0.005
PUFA:SFA ratio ¹²	0.31	0.09	0.001	0.001	0.001
Iodine Value, g/100g ¹³	0.29	0.34	0.001	0.001	0.001

¹ All values are on a DM basis.² Interaction gender $\times$ diet type.³ Main effect of gender (Treatments 1, 2, and 3 – (barrows) vs. 4, 5, and 6 – (Immunocastrates)).⁴ Main effect of diet type (corn-soy or 30% DDGS).⁵ Effect of DDGS before d 74 (Treatments 1 and 4 vs. 2, 3, 5, and 6).⁶ Effect of DDGS withdrawal after d 74 (Treatments 2 and 5 vs. 3 and 6).⁷ 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.⁸ Total MUFA = ([C14:1] + [C16:1] + [C18:1cis-9] + [C18:1n-7] + [C20:1] + [C24:1]); brackets indicate concentration.⁹ Total PUFA = ([C18:2n-6] + [C18:3n-3] + [C18:3n-6] + [C20:2] + [C20:4n-6]); brackets indicate concentration.¹⁰ Total *trans* fatty acids = ([C18:1trans] + [C18:2trans] + [C18:3trans]); brackets indicate concentration.¹¹ UFA:SFA = (total MUFA + total PUFA)/total SFA.¹² PUFA:SFA = total PUFA/total SFA.¹³ Calculated as IV value (IV) = [C16:1] $\times$ 0.95 + [C18:1] $\times$ 0.86 + [C18:2] $\times$ 1.732 + [C18:3] $\times$ 2.616 + [C20:1] $\times$ 0.785 + [C22:1] $\times$ 0.723; brackets indicate concentration.

Table 17. Effect of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on belly fatty acid analysis for pigs harvested at d 125^{1,2,3}

	Gender:	Barrow			Improvest			SEM
	Day 0 to 74:	Corn-soy	DDGS	DDGS	Corn-soy	DDGS	DDGS	
	Day 74 to 125:	Corn-soy	Corn-soy	DDGS	Corn-soy	Corn-soy	DDGS	
Myristic acid (C14:0), %		1.38	1.32	1.28	1.42	1.30	1.28	0.03
Palmitic acid (C16:0), %		24.64	23.35	21.99	24.67	23.79	22.49	0.30
Palmitoleic acid (C16:1), %		2.46	2.40	2.20	2.56	2.31	2.10	0.10
Margaric acid (C17:0), %		0.52	0.56	0.59	0.52	0.57	0.54	0.03
Stearic acid (C18:0), %		12.80	11.85	10.13	12.88	12.54	11.38	0.38
Oleic acid (C18:1 <i>cis</i> -9), %		39.70	37.95	37.19	38.56	38.25	36.02	0.48
Vaccenic acid (C18:1n-7), %		3.72	3.54	3.38	3.71	3.49	3.20	0.09
Linoleic acid (C18:2n-6), %		10.83	14.72	18.63	11.67	13.55	18.59	0.52
α -Linoleic acid (C18:3n-3), %		0.47	0.54	0.63	0.51	0.51	0.60	0.02
Arachidic acid (C20:0), %		0.26	0.26	0.26	0.25	0.28	0.26	0.01
Gadoleic acid (C20:1), %		0.86	0.80	0.82	0.81	0.83	0.75	0.02
Eicosadienoic acid (C20:2), %		0.63	0.79	0.99	0.64	0.76	0.95	0.03
Arachidonic acid (C20:4n-6), %		0.22	0.26	0.27	0.24	0.25	0.27	0.01
Other fatty acids, %		1.52	1.66	1.65	1.57	1.58	1.53	0.05
Total SFA, %		39.85	37.60	34.48	40.01	38.72	36.18	0.62
Total MUFA, %		46.83	44.77	43.66	45.73	44.97	42.15	0.59
Total PUFA, %		12.36	16.56	20.77	13.29	15.29	20.62	0.58
Total <i>trans</i> fatty acids, %		0.77	0.88	0.93	0.81	0.81	0.88	0.03
UFA:SFA ratio		1.49	1.64	1.88	1.49	1.56	1.75	0.04
PUFA:SFA ratio		0.31	0.44	0.61	0.34	0.40	0.58	0.02
Iodine value, g/100g		61.0	66.2	72.2	61.6	64.2	70.8	0.87

¹ All values are on a DM basis.² First Improvest injection was given on d 39; second Improvest injection was given on d 74.³ Pigs selected for fat analyses represented the median for each pen (2 pigs/pen).

Table 18. Main effects of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on belly fatty acid analysis for pigs harvested at d 125¹

	Probability, $P <$				
	Interaction ²	Gender ³	Diet ⁴	DDGS ⁵	Withdrawal ⁶
Myristic acid (C14:0), %	0.58	0.89	0.001	0.001	0.33
Palmitic acid (C16:0), %	0.71	0.20	0.001	0.001	0.001
Palmitoleic acid (C16:1), %	0.61	0.74	0.005	0.01	0.06
Margaric acid (C17:0), %	0.46	0.48	0.14	0.05	0.88
Stearic acid (C18:0), %	0.31	0.03	0.001	0.001	0.001
Oleic acid (C18:1 <i>cis</i> -9), %	0.22	0.09	0.001	0.001	0.003
Vaccenic acid (C18:1n-7), %	0.66	0.32	0.001	0.001	0.02
Linoleic acid (C18:2n-6), %	0.17	0.78	0.001	0.001	0.001
α -Linoleic acid (C18:3n-3), %	0.22	0.63	0.001	0.001	0.001
Arachidic acid (C20:0), %	0.64	0.90	0.20	0.20	0.21
Gadoleic acid (C20:1), %	0.15	0.14	0.19	0.13	0.30
Eicosadienoic acid (C20:2), %	0.54	0.40	0.001	0.001	0.001
Arachidonic acid (C20:4n-6), %	0.43	0.81	0.003	0.002	0.10
Other fatty acids, %	0.19	0.20	0.31	0.17	0.54
Total SFA, % ⁷	0.45	0.05	0.001	0.001	0.001
Total MUFA, % ⁸	0.33	0.10	0.001	0.001	0.002
Total PUFA, % ⁹	0.18	0.73	0.001	0.001	0.001
Total <i>trans</i> fatty acids, % ¹⁰	0.14	0.29	0.002	0.003	0.06
UFA:SFA ratio ¹¹	0.34	0.06	0.001	0.001	0.001
PUFA:SFA ratio ¹²	0.21	0.34	0.001	0.001	0.001
Iodine value, g/100g ¹³	0.28	0.20	0.001	0.001	0.001

¹ All values are on a DM basis.² Interaction gender $\times$ diet type.³ Main effect of gender (Treatments 1, 2, and 3 – (barrows) vs. 4, 5, and 6 – (Immunocastrates)).⁴ Main effect of diet type (corn-soy or 30% DDGS).⁵ Effect of DDGS before d 74 (Treatments 1 and 4 vs. 2, 3, 5, and 6).⁶ Effect of DDGS withdrawal after d 74 (Treatments 2 and 5 vs. 3 and 6).⁷ 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.⁸ Total MUFA = ([C14:1] + [C16:1] + [C18:1cis-9] + [C18:1n-7] + [C20:1] + [C24:1]); brackets indicate concentration.⁹ Total PUFA = ([C18:2n-6] + [C18:3n-3] + [C18:3n-6] + [C20:2] + [C20:4n-6]); brackets indicate concentration.¹⁰ Total *trans* fatty acids = ([C18:1trans] + [C18:2trans] + [C18:3trans]); brackets indicate concentration.¹¹ UFA:SFA = (total MUFA + total PUFA)/total SFA.¹² PUFA:SFA = total PUFA/total SFA.¹³ Calculated as IV value (IV) = [C16:1] $\times$ 0.95 + [C18:1] $\times$ 0.86 + [C18:2] $\times$ 1.732 + [C18:3] $\times$ 2.616 + [C20:1] $\times$ 0.785 + [C22:1] $\times$ 0.723; brackets indicate concentration.

Table 19. Effect of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on clear plate fatty acid analysis for pigs harvested at d 107^{1,2,3}

	Gender:	Barrow			Improvest			SEM
	Day 0 to 74:	Corn-soy	DDGS	DDGS	Corn-soy	DDGS	DDGS	
	Day 74 to 125:	Corn-soy	Corn-soy	DDGS	Corn-soy	Corn-soy	DDGS	
Myristic acid (C14:0), %		1.36	1.32	1.27	1.31	1.23	1.17	0.03
Palmitic acid (C16:0), %		25.25	23.89	23.04	24.16	23.52	22.26	0.28
Palmitoleic acid (C16:1), %		1.97	1.85	1.75	1.94	1.64	1.60	0.09
Margaric acid (C17:0), %		0.65	0.70	0.74	0.66	0.67	0.70	0.04
Stearic acid (C18:0), %		14.95	13.41	12.43	14.52	14.21	12.30	0.37
Oleic acid (C18:1 <i>cis</i> -9), %		36.01	34.29	33.54	35.36	33.47	32.76	0.40
Vaccenic acid (C18:1n-7), %		3.01	2.84	2.72	3.03	2.68	2.62	0.07
Linoleic acid (C18:2n-6), %		12.78	17.24	19.91	14.90	18.18	21.81	0.50
α -Linoleic acid (C18:3n-3), %		0.56	0.64	0.68	0.64	0.67	0.73	0.02
Arachidic acid (C20:0), %		0.27	0.27	0.27	0.24	0.26	0.26	0.01
Gadoleic acid (C20:1), %		0.81	0.78	0.75	0.71	0.74	0.76	0.02
Eicosadienoic acid (C20:2), %		0.68	0.87	0.95	0.73	0.88	1.07	0.03
Arachidonic acid (C20:4n-6), %		0.22	0.25	0.26	0.28	0.30	0.30	0.01
Other fatty acids, %		1.50	1.65	1.70	1.52	1.54	1.67	0.05
Total SFA, %		42.71	39.83	37.98	41.13	40.14	36.93	0.56
Total MUFA, %		41.89	39.82	38.83	41.11	38.60	37.81	0.50
Total PUFA, %		14.43	19.25	22.04	16.74	20.26	24.17	0.54
Total <i>trans</i> fatty acids, %		0.82	0.97	1.01	0.90	0.94	1.04	0.03
UFA:SFA ratio		1.32	1.49	1.61	1.42	1.48	1.69	0.04
PUFA:SFA ratio		0.34	0.48	0.58	0.41	0.51	0.66	0.02
Iodine value, g/100g		60.2	66.5	70.4	63.4	67.1	72.9	0.82

¹ All values are on a DM basis.

² First Improvest injection was given on d 39; second Improvest injection was given on d 74.

³ Pigs selected for fat analyses represented the median for each pen (2 pigs/pen).

Table 20. Main effects of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on clear plate fatty acid analysis for pigs harvested at d 107¹

	Probability, $P <$				
	Interaction ²	Gender ³	Diet ⁴	DDGS ⁵	Withdrawal ⁶
Myristic acid (C14:0), %	0.69	0.003	0.003	0.003	0.10
Palmitic acid (C16:0), %	0.47	0.003	0.001	0.001	0.001
Palmitoleic acid (C16:1), %	0.64	0.09	0.01	0.003	0.46
Margaric acid (C17:0), %	0.85	0.53	0.27	0.18	0.38
Stearic acid (C18:0), %	0.25	0.80	0.001	0.001	0.001
Oleic acid (C18:1 <i>cis</i> -9), %	0.98	0.03	0.001	0.001	0.08
Vaccenic acid (C18:1n-7), %	0.40	0.15	0.001	0.001	0.18
Linoleic acid (C18:2n-6), %	0.47	0.001	0.001	0.001	0.001
α -Linoleic acid (C18:3n-3), %	0.40	0.001	0.001	0.001	0.03
Arachidic acid (C20:0), %	0.54	0.04	0.72	0.42	0.98
Gadoleic acid (C20:1), %	0.11	0.04	0.89	0.73	0.74
Eicosadienoic acid (C20:2), %	0.18	0.02	0.001	0.001	0.001
Arachidonic acid (C20:4n-6), %	0.49	0.001	0.02	0.004	0.93
Other fatty acids, %	0.42	0.35	0.01	0.005	0.10
Total SFA, % ⁷	0.24	0.11	0.001	0.001	0.001
Total MUFA, % ⁸	0.91	0.02	0.001	0.001	0.09
Total PUFA, % ⁹	0.46	0.001	0.001	0.001	0.001
Total <i>trans</i> fatty acids, % ¹⁰	0.22	0.26	0.001	0.001	0.03
UFA:SFA ratio ¹¹	0.33	0.08	0.001	0.001	0.001
PUFA:SFA ratio ¹²	0.39	0.001	0.001	0.001	0.001
Iodine value, g/100g ¹³	0.26	0.003	0.001	0.001	0.001

¹ All values are on a DM basis.

² Interaction gender $\times$ diet type.

³ Main effect of gender (Treatments 1, 2, and 3 – (barrows) vs. 4, 5, and 6 – (Immunocastrates)).

⁴ Main effect of diet type (corn-soy or 30% DDGS).

⁵ Effect of DDGS before d 74 (Treatments 1 and 4 vs. 2, 3, 5, and 6).

⁶ Effect of DDGS withdrawal after d 74 (Treatments 2 and 5 vs. 3 and 6).

⁷ 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.

⁸ Total MUFA = ([C14:1] + [C16:1] + [C18:1*cis*-9] + [C18:1n-7] + [C20:1] + [C24:1]); brackets indicate concentration.

⁹ Total PUFA = ([C18:2n-6] + [C18:3n-3] + [C18:3n-6] + [C20:2] + [C20:4n-6]); brackets indicate concentration.

¹⁰ Total *trans* fatty acids = ([C18:1*trans*] + [C18:2*trans*] + [C18:3*trans*]); brackets indicate concentration.

¹¹ UFA:SFA = (total MUFA + total PUFA)/total SFA.

¹² PUFA:SFA = total PUFA/total SFA.

¹³ Calculated as IV value (IV) = [C16:1] $\times$ 0.95 + [C18:1] $\times$ 0.86 + [C18:2] $\times$ 1.732 + [C18:3] $\times$ 2.616 + [C20:1] $\times$ 0.785 + [C22:1] $\times$ 0.723; brackets indicate concentration.

Table 21. Effect of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on clear plate fatty acid analysis for pigs harvested at d 125^{1,2,3}

	Gender:	Barrow			Improvast			SEM
	Day 0 to 74:	Corn-soy	DDGS	DDGS	Corn-soy	DDGS	DDGS	
	Day 74 to 125:	Corn-soy	Corn-soy	DDGS	Corn-soy	Corn-soy	DDGS	
Myristic acid (C14:0), %		1.32	1.26	1.21	1.34	1.22	1.19	0.03
Palmitic acid (C16:0), %		25.03	23.72	22.41	25.02	23.71	22.50	0.27
Palmitoleic acid (C16:1), %		1.95	1.88	1.63	1.95	1.78	1.47	0.08
Margaric acid (C17:0), %		0.62	0.66	0.72	0.62	0.69	0.67	0.04
Stearic acid (C18:0), %		14.99	13.70	12.15	14.92	14.00	13.04	0.34
Oleic acid (C18:1 <i>cis</i> -9), %		36.48	34.57	33.28	35.07	34.96	31.54	0.44
Vaccenic acid (C18:1n-7), %		2.99	2.88	2.63	2.95	2.81	2.42	0.06
Linoleic acid (C18:2n-6), %		12.73	17.08	21.46	14.14	16.60	22.70	0.57
α -Linoleic acid (C18:3n-3), %		0.55	0.61	0.69	0.60	0.60	0.72	0.02
Arachidic acid (C20:0), %		0.25	0.25	0.25	0.25	0.25	0.24	0.01
Gadoleic acid (C20:1), %		0.79	0.77	0.75	0.75	0.77	0.72	0.02
Eicosadienoic acid (C20:2), %		0.67	0.84	1.02	0.70	0.84	1.03	0.03
Arachidonic acid (C20:4n-6), %		0.21	0.24	0.25	0.23	0.24	0.27	0.01
Other fatty acids, %		1.44	1.56	1.56	1.48	1.55	1.49	0.04
Total SFA, %		42.43	39.83	36.95	42.37	40.08	37.88	0.51
Total MUFA, %		42.26	40.16	38.34	40.78	40.39	36.21	0.53
Total PUFA, %		14.33	18.98	23.61	15.84	18.46	24.91	0.62
Total <i>trans</i> fatty acids, %		0.81	0.93	0.97	0.87	0.89	0.98	0.03
UFA:SFA ratio		1.34	1.49	1.68	1.34	1.47	1.62	0.03
PUFA:SFA ratio		0.34	0.48	0.64	0.37	0.46	0.66	0.02
Iodine value, g/100g		60.4	66.4	72.6	61.7	65.6	72.9	0.85

¹ All values are on a DM basis.

² First Improvest injection was given on d 39; second Improvest injection was given on d 74.

³ Pigs selected for fat analyses represented the median for each pen (2 pigs/pen).

Table 22. Main effects of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on clear plate fatty acid analysis for pigs harvested at d 125¹

	Probability, $P <$				
	Interaction ²	Gender ³	Diet ⁴	DDGS ⁵	Withdrawal ⁶
Myristic acid (C14:0), %	0.41	0.61	0.001	0.001	0.16
Palmitic acid (C16:0), %	0.97	0.92	0.001	0.001	0.001
Palmitoleic acid (C16:1), %	0.57	0.19	0.001	0.001	0.001
Margaric acid (C17:0), %	0.46	0.73	0.11	0.04	0.53
Stearic acid (C18:0), %	0.34	0.17	0.001	0.001	0.001
Oleic acid (C18:1 <i>cis</i> -9), %	0.03	0.01	0.001	0.001	0.001
Vaccenic acid (C18:1n-7), %	0.34	0.04	0.001	0.001	0.001
Linoleic acid (C18:2n-6), %	0.18	0.12	0.001	0.001	0.001
α -Linoleic acid (C18:3n-3), %	0.25	0.14	0.001	0.001	0.001
Arachidic acid (C20:0), %	0.92	0.82	0.88	0.76	0.69
Gadoleic acid (C20:1), %	0.67	0.23	0.26	0.41	0.16
Eicosadienoic acid (C20:2), %	0.82	0.53	0.001	0.001	0.001
Arachidonic acid (C20:4n-6), %	0.61	0.20	0.004	0.004	0.07
Other fatty acids, %	0.37	0.67	0.08	0.03	0.48
Total SFA, % ⁷	0.61	0.36	0.001	0.001	0.001
Total MUFA, % ⁸	0.07	0.01	0.001	0.001	0.001
Total PUFA, % ⁹	0.19	0.12	0.001	0.001	0.001
Total <i>trans</i> fatty acids, % ¹⁰	0.18	0.62	0.001	0.001	0.02
UFA:SFA ratio ¹¹	0.61	0.34	0.001	0.001	0.001
PUFA:SFA ratio ¹²	0.38	0.46	0.001	0.001	0.001
Iodine Value, g/100g ¹³	0.46	0.64	0.001	0.001	0.001

¹ All values are on a DM basis.² Interaction gender $\times$ diet type.³ Main effect of gender (Treatments 1, 2, and 3 – (barrows) vs. 4, 5, and 6 – (Immunocastrates)).⁴ Main effect of diet type (corn-soy or 30% DDGS).⁵ Effect of DDGS before d 74 (Treatments 1 and 4 vs. 2, 3, 5, and 6).⁶ Effect of DDGS withdrawal after d 74 (Treatments 2 and 5 vs. 3 and 6).⁷ 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.⁸ Total MUFA = ([C14:1] + [C16:1] + [C18:1cis-9] + [C18:1n-7] + [C20:1] + [C24:1]); brackets indicate concentration.⁹ Total PUFA = ([C18:2n-6] + [C18:3n-3] + [C18:3n-6] + [C20:2] + [C20:4n-6]); brackets indicate concentration.¹⁰ Total *trans* fatty acids = ([C18:1trans] + [C18:2trans] + [C18:3trans]); brackets indicate concentration.¹¹ UFA:SFA = (total MUFA + total PUFA)/total SFA.¹² PUFA:SFA = total PUFA/total SFA.¹³ Calculated as IV value (IV) = [C16:1] $\times$ 0.95 + [C18:1] $\times$ 0.86 + [C18:2] $\times$ 1.732 + [C18:3] $\times$ 2.616 + [C20:1] $\times$ 0.785 + [C22:1] $\times$ 0.723; brackets indicate concentration.

Table 23. Effects of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on fatty acid concentrations for pigs harvested at d 107^{1,2}

	Jowl			Belly			Backfat			Clear plate		
	Gender ³	DDGS ⁴	Withdraw ⁵	Gender	DDGS	Withdraw	Gender	DDGS	Withdraw	Gender	DDGS	Withdraw
Myristic acid (C14:0)	↓	↓	~	↓	↓	↓*	↓	↓	~	↓	↓	↓*
Palmitic acid (C16:0)	↓*	↓	↓*	~	↓	↓	↓	↓	↓	↓	↓	↓
Palmitoleic acid (C16:1)	~	↓	~	~	↓	~	~	↓	~	↓*	↓	~
Margaric acid (C17:0)	~	↑	~	~	~	~	~	~	~	~	~	~
Stearic acid (C18:0)	~	↓	↓	↑*	↓	↓	~	↓	↓	~	↓	↓
Oleic acid (C18:1 <i>cis</i> -9)	↓	↓	↓*	↓	↓	↓	↓	↓	↓	↓	↓	↓*
Vaccenic acid (C18:1n-7)	~	↓	~	~	↓	~	~	↓	↓	~	↓	~
Linoleic acid (C18:2n-6)	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
α-Linoleic acid (C18:3n-3)	↑	↑	~	↑	↑	↑	↑	↑	↑	↑	↑	↑
Arachidic acid (C20:0)	↓*	~	~	~	~	~	~	~	~	↓	~	~
Gadoleic acid (C20:1)	↓	~	~	↓	~	~	↓	~	~	↓	~	~
Eicosadienoic acid (C20:2)	↑	↑	↑	↑*	↑	↑	~	↑	↑	↑	↑	↑
Arachidonic acid (C20:4n-6)	↑	↑	~	↑	↑	~	↑*	↑*	~	↑	↑	~
Other fatty acids	~	↑	↑	~	~	~	~	↑	↑*	~	↑	↑*
Total SFA ⁶	~	↓	↓	~	↓	↓	~	↓	↓	~	↓	↓
Total MUFA ⁷	↓	↓	↓*	↓	↓	↓*	↓	↓	↓	↓	↓	↓*
Total PUFA ⁸	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
Total <i>trans</i> fatty acids ⁹	~	↑	↑	~	↑	↑	~	↑	↑	~	↑	↑
UFA:SFA ratio ¹⁰	~	↑	↑	~	↑	↑	~	↑	↑	↑*	↑	↑
PUFA:SFA ratio ¹¹	↑	↑	↑	↑*	↑	↑	↑	↑	↑	↑	↑	↑
Iodine value, g/100g ¹²	↑*	↑	↑	~	↑	↑	↑	↑	↑	↑	↑	↑

¹ Symbols (↓↑) mean significant differences ($P < 0.05$); symbols with (*) mean trend ($P < 0.10$); ~ means no difference ($P > 0.10$).

² First Improvest injection was given on d 39; second Improvest injection was given on d 74.

³ Effect of gender (Immunocastrate vs. Barrow); ↑ means value was higher for IC pigs; ↓ means value was lower for IC pigs.

⁴ Effect of DDGS for first 74 d; ↑ means value was higher for pigs fed DDGS; ↓ means value was lower for pigs fed DDGS.

⁵ Effect of DDGS during withdrawal; ↑ means value was higher for pigs fed DDGS throughout; ↓ means value was lower for pigs fed DDGS throughout.

⁶ 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.

⁷ Total MUFA = ([C14:1] + [C16:1] + [C18:1*cis*-9] + [C18:1n-7] + [C20:1] + [C24:1]); brackets indicate concentration.

⁸ Total PUFA = ([C18:2n-6] + [C18:3n-3] + [C18:3n-6] + [C20:2] + [C20:4n-6]); brackets indicate concentration.

⁹ Total *trans* fatty acids = ([C18:1*trans*] + [C18:2*trans*] + [C18:3*trans*]); brackets indicate concentration.

¹⁰ UFA:SFA = (total MUFA + total PUFA)/total SFA.

¹¹ PUFA:SFA = total PUFA/total SFA.

¹² Calculated as iodine 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 24. Effects of dried distillers grains with solubles (DDGS) withdrawal post-immunocastration on fatty acid concentrations for pigs harvested at d 125^{1,2}

	Jowl			Belly			Backfat			Clear plate		
	Gender ³	DDGS ⁴	Withdraw ⁵	Gender	DDGS	Withdraw	Gender	DDGS	Withdraw	Gender	DDGS	Withdraw
Myristic acid (C14:0)	~	↓	~	~	↓	~	~	↓	~	~	↓	~
Palmitic acid (C16:0)	~	↓	~	~	↓	↓	~	↓	↓	~	↓	↓
Palmitoleic acid (C16:1)	~	↓	↓	~	↓	↓*	~	↓	↓	~	↓	↓
Margaric acid (C17:0)	~	~	~	~	↑	~	~	↑	~	~	↑	~
Stearic acid (C18:0)	↑	↓	~	↑	↓	↓	↑	↓	↓	~	↓	↓
Oleic acid (C18:1 <i>cis</i> -9)	↓	↓	↓	↓*	↓	↓	~	↓	↓	↓	↓	↓
Vaccenic acid (C18:1n-7)	↓	↓	↓	~	↓	↓	↓*	↓	↓	↓	↓	↓
Linoleic acid (C18:2n-6)	↑	↑	↑	~	↑	↑	~	↑	↑	~	↑	↑
α -Linoleic acid (C18:3n-3)	↑*	↑	↑	~	↑	↑	~	↑	↑	~	↑	↑
Arachidic acid (C20:0)	~	~	~	~	~	~	~	~	↓	~	~	~
Gadoleic acid (C20:1)	~	↓	~	~	~	~	~	↓	↓	~	~	~
Eicosadienoic acid (C20:2)	~	↑	↑	~	↑	↑	~	↑	↑	~	↑	↑
Arachidonic acid (C20:4n-6)	~	↑	~	~	↑	↑*	~	↑	↑*	~	↑	↑*
Other fatty acids	↓*	↑	~	~	~	~	↓	↑	~	~	↑	~
Total SFA ⁶	~	↓	↓*	↑	↓	↓	↑	↓	↓	~	↓	↓
Total MUFA ⁷	↓	↓	↓	↓*	↓	↓	↓*	↓	↓	↓	↓	↓
Total PUFA ⁸	↑	↑	↑	~	↑	↑	~	↑	↑	~	↑	↑
Total <i>trans</i> fatty acids ⁹	~	↑	~	~	↑	↑*	~	↑	↑	~	↑	↑
UFA:SFA ratio ¹⁰	~	↑	↑	↓*	↑	↑	↓	↑	↑	~	↑	↑
PUFA:SFA ratio ¹¹	~	↑	↑	~	↑	↑	~	↑	↑	~	↑	↑
Iodine value, g/100g ¹²	~	↑	↑	~	↑	↑	~	↑	↑	~	↑	↑

¹ Symbols (↑↓) mean significant differences ($P < 0.05$); symbols with (*) mean trend ($P < 0.10$); ~ means no difference ($P > 0.10$).

² First Improvest injection was given on d 39; second Improvest injection was given on d 74.

³ Effect of gender (Immunocastrate vs. Barrow); ↑ means value was higher for IC pigs; ↓ means value was lower for IC pigs.

⁴ Effect of DDGS for first 74 d; ↑ means value was higher for pigs fed DDGS; ↓ means value was lower for pigs fed DDGS.

⁵ Effect of DDGS during withdrawal; ↑ means value was higher for pigs fed DDGS throughout; ↓ means value was lower for pigs fed DDGS throughout.

⁶ 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.

⁷ Total MUFA = ([C14:1] + [C16:1] + [C18:1cis-9] + [C18:1n-7] + [C20:1] + [C24:1]); brackets indicate concentration.

⁸ Total PUFA = ([C18:2n-6] + [C18:3n-3] + [C18:3n-6] + [C20:2] + [C20:4n-6]); brackets indicate concentration.

⁹ Total *trans* fatty acids = ([C18:1trans] + [C18:2trans] + [C18:3trans]); brackets indicate concentration.

¹⁰ UFA:SFA = (total MUFA + total PUFA)/total SFA.

¹¹ PUFA:SFA = total PUFA/total SFA.

¹² Calculated as iodine 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.

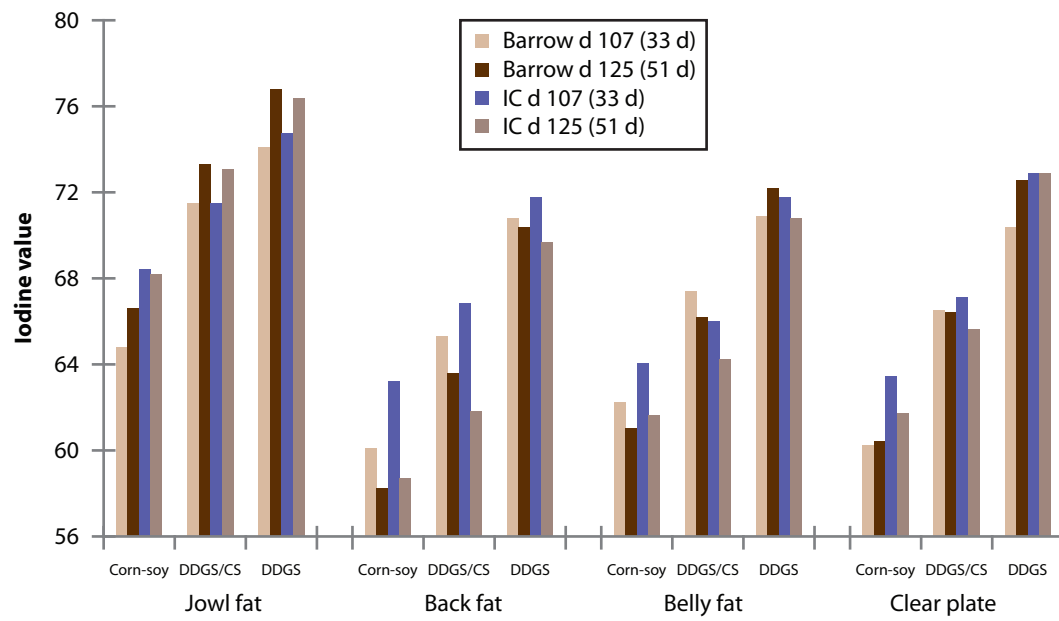


Figure 1. Differences in fat depot iodine values and changes between genders and time post-second injection.