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J J. Engel

J W. Smith II

Robert D. Goodband

See next page for additional authors

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Abstract

Eighty-four crossbred gilts were used to exan1ine the effects of increasing dietary additions of poultry fat (PF) or choice white grease (CWG) on finishing pig growth performance, standard carcass characteristics, and longissimus muscle quality. Increasing CWG or PF improved feed efficiency. Increasing CWG tended to increase then decrease longissimus muscle visual color compared with longissimus muscles from those animals fed PF. Pigs fed CWG had firmer, less exudative, and more purplish-red (measured by a Minolta chronometer) longissimus muscles compared with pigs fed PF. Feeding CWG or PF did not affect standard carcass traits and had minimal effects on longissimus muscle quality.; Swine Day, Manhattan, KS, November 20, 1997

Keywords

Swine day, 1997; Kansas Agricultural Experiment Station contribution; no. 98-142-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 795; Swine; Finishing pigs; Choice white grease; Poultry fat; Performance; Longissimus muscle quality

Authors

J J. Engel, J W. Smith II, Robert D. Goodband, John A. Unruh, Michael D. Tokach, and Jim L. Nelssen

EFFECTS OF POULTRY FAT AND CHOICE WHITE GREASE ON FINISHING PIG GROWTH PERFORMANCE, GENERAL CARCASS CHARACTERISTICS, AND PORK LONGISSIMUS MUSCLE QUALITY [1]

J. J. Engel, J. W. Smith, II, R. D. Goodband, J. A. Unruh, M. D. Tokach, and J. L. Nelssen

Summary

Eighty-four crossbred gilts were used to examine the effects of increasing dietary additions of poultry fat (PF) or choice white grease (CWG) on finishing pig growth performance, standard carcass characteristics, and longissimus muscle quality. Increasing CWG or PF improved feed efficiency. Increasing CWG tended to increase then decrease longissimus muscle visual color compared with longissimus muscles from those animals fed PF. Pigs fed CWG had firmer, less exudative, and more purplish-red (measured by a Minolta chronometer) longissimus muscles compared with pigs fed PF. Feeding CWG or PF did not affect standard carcass traits and had minimal effects on longissimus muscle quality.

(Key Words: Finishing Pigs, Choice White Grease, Poultry Fat, Performance, Longissimus Muscle Quality.)

Introduction

Much research has been conducted to investigate the effects of dietary fat additions on finishing pig growth performance and carcass characteristics. Research from Kansas State University indicated that increasing CWG to as much as 6% of the diet did not affect growth performance or standard carcass characteristics of finishing pigs. However, the effects of alternative energy sources on the growth performance, standard carcass characteristics, and longissimus muscle quality of finishing pigs has not been examined. We know that differences in saturated and unsaturated fat depositions in pork carcasses can result from the source of dietary fat added to the finishing pig diet. Adding unsaturated poultry fat (PF) to finishing pig diets at high levels might have an influence on pork quality.

Therefore, the objective of this study was to compare the effects of dietary additions of increasing PF or CWG on finishing pig growth performance, standard carcass traits, and longissimus muscle quality.

Procedures

Eighty four crossbred gilts, PIC L326 × C15 at an initial weight of 133 lb were used in this experiment. Choice white grease and PF were added at 2, 4, or 6% to a corn-soybean meal-based control diet (Table 1). Pigs were blocked by ancestry and allotted to one of seven dietary treatments.

The experimental control diet contained 0% added fat and was formulated to .75% lysine, .55% Ca, .50% P, and 2.26 g lysine/Mcal ME. This lysine-calorie ratio was maintained in all of the diets containing PF or CWG additions. The lysine levels in the diets with the added fat varied from .75 to .81%. The corn-soybean meal-based experimental diets were fed in a meal form. The pigs were housed with two pigs per pen in an environmentally controlled finishing barn with 4 ft × 4 ft slatted pens. Each treatment included two pigs per pen and six replicate pens. The pens provided ad libitum access to

[1]The authors thank the U.S. Poultry & Egg Association, Tucker, GA for partial financial support.

Table 1. Basal Diet Composition[a]

Item	%
Corn	83.33
Soybean meal, 46.5%	14.07
Monocalcium phosphate	1.01
Limestone	.83
Salt	.35
L-Lysine HCl	.15
Vitamin premix	.15
Trace mineral premix	.10
Ethoxyquin	.01
Choice white grease[b]	—
Poultry fat[b]	—
Total	100.00

[a]Diets were formulated to 2.26 g lysine/Mcal ME, .60% Ca, and .50% P. Dietary lysine levels ranged from .75 to .81%.
[b]Choice white grease and poultry fat were added at 2, 4, or 6% to provide the experimental diets.

feed and water. Pigs and feeders were weighed every 14 days to calculate ADG, ADFI, and F/G.

Individual fat sources were analyzed for their fatty acid profiles (Table 2). These profiles indicated that the percentages of palmitic fatty acids were very similar between the two fat sources. Palmitic and linoleic acid levels were almost double in PF as compared to CWG. Stearic acid levels were nearly double in CWG. Oleic acid levels were slightly higher in CWG than in PF.

Table 2. Fatty Acid Profiles of Choice White Grease and Poultry Fat

Fatty Acid, %	PF	CWG
Palmitic (16:0)	22.2	23.3
Palmitoleic (16:1)	8.4	3.5
Stearic (18:0)	5.1	11.0
Oleic (18:1)	42.3	47.1
Linoleic (18:2)	19.3	11.0

Both fat sources were analyzed using several key quality indicators (Table 3). These indicators included total fatty acid percentage; free fatty acid percentage; moisture, impurities, and unsaponifiables; and peroxide values. CWG tended to have a higher peroxide value. Nonetheless, this analysis revealed that both fat sources were of high quality.

Table 3. Fat Quality Indicators of Choice White Grease and Poultry Fat

Item	PF	CWG
Total fatty acids, %	98.7	97.9
Free fatty acids, %	3.2	3.2
M.I.U., %	1.3	.8
Peroxide value	.2	7.3

Pigs were slaughtered at the Kansas State University Meats Laboratory when the mean weight of pigs in a pen reached 240 lb. At 24 hours postmortem, standard carcass measurements were taken. The carcasses were then ribbed at the tenth rib and allowed to bloom for 30 minutes. At this time, the longissimus muscle was evaluated by a three-person panel for visual quality characteristics including visual marbling, visual color, and visual firmness and wetness. Longissimus muscle color was evaluated on a 1 to 5 scale with 1 representing a muscle that was pale-pinkish-gray and 5 being a muscle that was dark-purplish red in color. Longissimus muscle visual firmness and wetness were evaluated on a 1 to 5 scale, with 1 being very soft and watery and 5 being very firm and dry. Visual marbling was evaluated on a 1 to 5 scale with 1 being practically devoid and 5 being moderately abundant or greater.

Following the visual evaluations, the longissimus muscle and the subcutaneous fat surrounding the longissimus muscle were evaluated with a Minolta chronometer to obtain CIE L* a* b* values. The L* a* b* values then were used to calculate saturation index, hue angle, and A:B ratio. Minolta L* values represent the lightness of a sample. Longissimus muscles with a higher L* value would have a lighter color, whereas those with a lower L* value would appear darker. Minolta a* values are chromatic coordinates representing a change from a green to a red color. A higher a* value represents a sample with more red color. Minolta b* values are also chromatic coordinates, representing a change in color from blue to yellow. The higher the b* value, the more yellow the color of the sample. Saturation indexes, hue angles, and A:B ratios can be calculated from Minolta L* a* b* values. Saturation index tells the chroma, or the total color of the sample. The greater the value of the saturation index, the more intensely colored the sample is. Saturation index also can be referred to as the vividness of a sample. The hue angle represents the change from a red toward an orange color. The higher the hue angle, the less red the sample. The A:B ratio indicates a change in redness. The higher the value, the redder the color.

Longissimus muscle samples were removed, and drip loss after 24 and 48 hours of suspension was evaluated. This evaluation was conducted by suspending the sample on a fish hook inside a sealed Tupperware container. The weight loss of each sample then was collected and reported as a percent of the original weight.

The data from this experiment were analyzed with the GLM procedure of SAS. The experimental design was a two by three factorial arrangement. The statistical model included linear and quadratic effects of increasing additions of PF and CWG added at levels of 2, 4 or 6%.

Results and Discussion

Neither energy source nor level (Table 4) affected ADG. Increasing CWG tended to increase then decrease ADFI (quadratic, P<.10). Feed efficiency improved as pigs were fed increasing CWG or PF (linear, P<.01 and .10 respectively). Similar to ADFI, lysine and energy intakes increased then decreased as additions of dietary CWG increased (quadratic, P<.10). Additions of CWG or PF did not affect standard carcass characteristics of pigs in this experiment (Table 5).

Increasing CWG tended to increase and then decrease longissimus muscle visual color (quadratic, P<.10; Table 6). Visual color score of longissimus muscles increased for pigs fed 4% CWG compared to longissimus muscles from pigs fed 2% CWG. This represents a progression toward a darker color. As the level of CWG in the diet increased to 6%, the color score decreased, indicating a paler color. Pigs fed CWG tended (P=.10) to have increased longissimus muscle firmness compared with pigs fed PF. The firmness and wetness scores of pigs fed PF and CWG showed a quadratic effect. As PF or CWG levels were increased to 4%, their firmness and wetness scores increased. This indicates a firmer, less exudative sample. The scores decreased at 6%, indicating a wetter, less firm sample. Increasing CWG decreased and then increased longissimus muscle Minolta L* (quadratic, P<.10). Longissimus muscle A:B ratio increased and then decreased with increasing CWG (quadratic, P<.05). These results suggest that CWG or PF can be added to finishing pig diets to improve feed efficiency with minimal effects on standard carcass characteristics and longissimus muscle quality.

Table 4. Effects of Choice White Grease and Poultry Fat on Finishing Pig Growth Performance[a]

		Choice White Grease, %			Poultry Fat, %			
Item	Control	2	4	6	2	4	6	CV
ADG, lb	2.02	2.11	2.15	2.08	2.05	2.05	2.07	5.6
ADFI, lb[bc]	6.77	7.11	6.73	6.33	6.70	6.77	6.36	7.4
F/G[cd]	3.32	3.36	3.13	3.04	3.26	3.32	3.08	6.3
Lysine intake, g[be]	23.04	24.20	22.97	21.55	23.43	24.27	23.40	7.3
Energy intake, Mcal[be]	10.21	10.72	10.15	9.54	10.37	10.75	10.37	7.3

[a]Means derived from 84 pigs housed at two per pen with six replicate pens per treatment.
[b,c]Linear effect of choice white grease (P<.10 and .01, respectively).
[d]Linear effect of poultry fat (P<.10).
[e]Quadratic effect of choice white grease (P<.10).

Table 5. **Effects of Choice White Grease and Poultry Fat on Finishing Pig Carcass Characteristics[a]**

		Choice White Grease, %			Poultry Fat, %			
Item	Control	2	4	6	2	4	6	CV
Backfat								
First rib, in	1.54	1.47	1.51	1.47	1.53	1.51	1.51	9.5
Tenth rib, in	.79	.74	.81	.78	.80	.78	.76	18.6
Last rib, in	.94	.89	.93	.93	.90	.90	.94	14.3
Last lumbar, in	.77	.67	.80	.75	.78	.77	.81	18.6
Average, in[b]	1.08	1.01	1.08	1.05	1.07	1.06	1.09	9.7
LMA, in^2	6.64	6.87	6.51	6.72	6.57	6.17	6.69	11.4
Lean, %[c]	54.47	54.87	53.50	54.73	53.75	53.95	54.35	2.1
Muscle, %[d]	56.59	57.39	56.42	56.81	56.49	56.17	57.03	3.0
Dressing percentage	76.49	75.36	75.29	75.95	75.95	75.77	74.94	3.2

[a]Means derived from 84 pigs slaughtered at 240 lb with 12 pigs per treatment. Hot carcass weight was used covariant in the statistical analysis.
[b]AVGBF calculated as the average of first rib, last rib, and last lumbar fat depths.
[c]Lean percent was derived from NPPC equations for carcasses with 5% fat.
[d]Muscle percent was derived from NPPC equations for carcasses with 10% fat.

Table 6. **Effects of Choice White Grease and Poultry Fat on Longissimus Muscle and Fat Characteristics[a]**

		Choice White Grease, %			Poultry Fat, %			
Item	Control	2	4	6	2	4	6	CV
Drip Loss								
24 hour, %[b]	2.26	3.19	2.34	2.88	2.94	2.41	3.6	64.2
48 hour, %[b]	3.91	4.98	3.94	4.57	4.58	3.67	4.81	54.6
Visual color[c]	2.50	2.57	2.67	2.34	2.46	2.46	2.45	16.1
Visual marbling[d]	2.61	2.44	2.56	2.33	2.40	2.53	2.20	26.4
Visual firmness/wetness[e]	2.86	2.83	3.02	2.80	2.66	2.81	2.66	16.2
Longissimus Fat								
Minolta L*[fi]	77.76	77.70	77.28	77.16	77.74	77.52	76.54	1.7
Minolta a*[f]	5.20	4.94	4.99	4.86	4.76	4.68	4.80	18.8
Minolta b*[f]	5.88	5.86	5.88	5.79	5.76	5.92	5.87	11.3
Longissimus Muscle								
Minolta L*[gh]	51.54	50.56	49.50	52.24	51.58	50.64	52.06	5.8
Minolta a*[g]	11.45	12.10	11.00	11.19	11.52	11.85	13.00	18.4
Minolta b*[g]	7.99	8.02	7.30	7.92	8.09	7.95	8.94	22.8
Saturation index[g]	13.99	14.56	13.24	13.73	14.10	14.29	15.80	19.2
Hue angle[g]	48.77	46.05	45.16	50.59	49.42	45.27	47.90	16.2
A:B ratio[gh]	1.46	1.35	1.59	1.42	1.44	1.53	1.46	13.4

[a]Means derived from 84 pigs slaughtered at 240 lb with 12 pigs per treatment.
[b]Expressed as a percentage loss of the original sample weight.
[c]Scored on a scale of 1 = pale pinkish grey to 5 = dark purplish red (NPPC, 1991).
[d]Scored on a scale of 1 = practically devoid to 5 = moderately abundant (NPPC, 1991).
[e]Scored on a scale of 1 = very soft and watery to 5 = very firm and dry (NPPC, 1991).
[f]Means derived from two readings of the fat surrounding the loin eye.
[g]Means derived from two readings per loin. Measure of dark to light (Minolta L*), redness, (Minolta a*), yellowness (Minolta b*), vividness or intensity (saturation index), or red to orange (Hue angle).
[h]Quadratic choice white grease effect ($P < .05$).
[i]Linear poultry fat effect ($P < .05$).