



EMULSIFICATION OF DIETARY FAT FOR FINISHING PIGS

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Summary

Diets high in unsaturated fat result in soft carcass fat depots, which may be sub-optimal for subsequent pork processing, especially in lean genotype pigs. Increasing the saturated fatty acid content of added dietary fat can improve pork quality, provided the fat is adequately digestible. In North Carolina, saturated fats are not currently available in large volumes or at competitive prices. Rendered lard (iodine value ≈ 80) tends to be recycled in the North Carolina swine industry by inclusion in the diets of finishing pigs. This does benefit the state by reducing costs related to grain importation by providing an alternate energy source. However, it has a negative impact on pork quality. Lean genotype pigs fed diets high in unsaturated fat may result in thinner, lower quality bellies with a soft fat composition. Because the fatty acid content of pork carcasses is reflective of the relative contribution of each dietary fat source, increasing the saturated fatty acid content of the diet can improve the saturated fatty acid content of the carcass. If the digestibility of that supplemented fat source were improved by emulsifier addition, further improvements in pork quality may lead to reduced loss during the slaughter and processing procedures.

Introduction

We have investigated the apparent digestibility of fully hydrogenated, partially hydrogenated, and partially hydrogenated products blended with other fat sources in three experiments using chromic oxide as a digestibility marker (Averette et al., 1999). In trial 1, as the amount of fully hydrogenated fat in the diets increased, digestibility was near zero when no other fat sources were added to the diet. Further, in trial 2, digestibility of diets formulated with partially hydrogenated tallow was greater than those containing blended fat sources. In trial 3, we investigated the effects of supplementing 5% choice white grease that had been chemically hydrogenated to iodine values (IV) of 80, 60, 40 or 20. Barrows and gilts of two lean genotypes had increased belly thickness as diet IV declined. This was complemented by a decrease in belly C18:2 content. Diets formulated with the range of IV values from 80 to 20 had no effect on fat digestibility, average daily feed intake or growth performance. These results indicate that reduction of dietary fat IV by chemical hydrogenation has the desirable effect of improving pork quality and does not alter growth performance. Despite this, measured apparent fat digestibilities were only in the 70 percent range. Therefore, we hypothesize that addition of a lipid emulsifier could further improve the digestibility of chemically hydrogenated dietary fat. If digestibility was enhanced, further

improvements in pork quality may be realized.

Materials and Methods

Effects of emulsifier addition (Lysoforte PC, Kemin Industries, Inc.) to diets formulated with 8% supplemental partially-hydrogenated fat on growth performance, feed intake and digestibility were evaluated. Thirty-two gilts (avg. wt. 113.5 kg) were randomly allotted to one of four dietary treatments (Table 1). After a one-week acclimation period, feed and fecal samples were collected over a 3 d period. Pig weight and feed intake were measured at the end of the 19 d study to determine ADFI, ADG, and G/F.

Table 1. Diet Composition	
Ingredient, %	
Corn	74.232
SBM 48%	15.06
Hydrogenated Fat (IV30/IV50)	8.0
Dicalcium Phosphate	1.018
Limestone	.916
Salt	.35
L-Lysine 98%	.15
Vitamin / TM Premix	.25
Antibiotic	.025
Chromic Oxide	.1
Emulsifier	.1
Calculated Content	
ME, kcal/kg	3684.14
Lysine, %	.766
Calcium, %	.65
Phosphorus, total %	.50

Results and Discussion

Average daily feed intake, average daily gain, gain to feed ratio, and digestibility are shown in Table 2. Emulsifier addition did not affect feed intake, gain or digestibility ($P > .10$). Theoretically, lipid hydrolysis should be improved by an increase in the amount of oil dispersion in the digestive tract, since the surface area of the triglycerides would be more accessible for enzymatic breakdown by pancreatic lipase (Bayley and Lewis, 1965). Perhaps the .1% inclusion rate of the emulsifier product was not great enough to create an emulsion which could increase the surface area available for digestion.

Table 2. Growth Performance, Feed Intake and Digestibility					
Fat	Emulsifier	ADFI, kg	ADG, kg	G/F	Digestibility, %
IV 30	+	3.17 ± .18	1.00 ± .07	.32 ± .02	68.73 ± 2.74
IV 30	-	3.17 ± .18	1.06 ± .07	.34 ± .02	69.51 ± 2.74
IV 50	+	3.27 ± .18	1.10 ± .07	.34 ± .02	79.28 ± 2.74
IV 50	-	2.86 ± .18	0.94 ± .07	.32 ± .02	79.01 ± 2.74

Digestibility was 14.5% greater in the diet containing 8% supplemental fat with an iodine value (IV) of 50 compared to the diet supplemented with fat of an iodine value of 30 ($P < .001$). This improvement in the digestibility of the less saturated fat (IV 50) was not expected given the results from our previous study (Averette, L. A., et al., *in press*). In that study supplemented fat ranged in IV from 20 to 80 and digestibility (avg. 70%) was not significantly different. The difference in fat digestibility in this study with no congruent changes in growth and performance could be due to the short duration of the study (19 d) or due to our inability to detect the differences. The previous study compared 240 animals, while this study evaluated only 32 pigs, which greatly decreases our ability to detect statistical significance.

The IV 50 supplemented fat had an unsaturated to saturated fatty acid ratio (U/S) of 1.3 compared to the .37 U/S of the IV 30 fat (Table 3). The digestibility of fats in diets containing a U/S ratio greater than 1.5 is fairly high (85 - 92%) and lower (35 - 75%) in diets with a U/S ratio less than 1.0 to 1.3 (Stahly, 1984).

Table 3. Fatty Acid Composition		
Fatty Acid, %	IV 30	IV 50
C 12		.21
C 13		.11
C 14	3.28	2.64
C 14:1	.2	.57
C 15	.57	.46
C 16	25.08	22.25
C 16:1 c	.6	3.4
C 17	1.25	.87
C 18	37.11	12.35
C 18:1 t	15.2	4.15
C 18:1 c	8.33	35.1
C 18:2	.45	6.68
C 20	.89	.24
C 20:1 c	.35	.5
C 18:3		.37
C 22		.29
C 22:1	.02	.34
% saturates	68.18	39.42
% monounsatur.	24.68	44.06
% polyunsatur.	.45	7.05
U/S ratio	.37	1.30

In conclusion, the .1% addition of emulsifier did not increase lipid digestibility. Further, effects on performance of the difference in digestibility of IV 30 and IV 50 supplemented fat were not detected in this study. This was likely due to the small number of animals

used and could be verified with another trial.

Literature Cited

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