EFFECTS OF LECITHIN AND LYSOLECITHIN ON THE DIGESTIBILITY OF FAT SOURCES IN DIETS FOR WEANLING PIGS

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Summary

Ninety-six pigs (17 d of age and 11.6 lb initial wt) were utilized to determine if adding emulsifiers (lecithin and lysolecithin) to diets containing 10% added fat would affect nutrient digestibility. Fat sources were: 1) soybean oil, 2) tallow, 3) lard, and 4) coconut oil. Lecithin and lysolecithin were added as 10% of the added fat. Pigs were limit fed using the following equation: daily feed allowance = .05 × body wt$^{.9}$. After a 7-d adjustment period, feces were collected for 4 d, pooled, and analyzed for fat, nitrogen, and energy content. Soybean oil and coconut oil were more digestible than tallow and lard. Tallow was 9% more digestible when lecithin was added and 4% more digestible when lysolecithin was added. Adding the emulsifiers increased nitrogen digestibility, and lecithin increased nitrogen digestibility more than lysolecithin. Gross energy digestibilities followed the same trends as fat digestibility. Lecithin and lysolecithin have a positive effect on nutrient digestibility for weanling pigs.

(Key Words: Lecithin, Lysolecithin, Fat Source, Nutrient Digestibility, Weanling Pig.)

Introduction

Early-weaned pigs have unique nutritional needs in regard to nutrient sources and concentrations in their diets. These pigs typically have low feed intakes after weaning, so their diets must be high in nutrient density to meet energy, protein, vitamin, and mineral needs. Fat additions to starter diets can increase caloric intake of weanling pigs, but the type of fat used may affect how well the dietary energy is utilized by the pigs. Soybean oil, a long chain, highly unsaturated fat source, is utilized well by pigs but is also expensive. Tallow and lard, both long chain, saturated fats, are less digestible than soybean oil but are much less expensive. Methods to increase the digestibility of less expensive fat sources would give producers options to help reduce feed costs. Lecithin and lysolecithin are byproducts of soybean oil processing that are used by the food industry to disperse lipids in aqueous mediums, such as fat in milk replacers and breakfast drinks. The increased fat dispersion enhances the "consumer appeal" of food products, and also may cause greater fat digestibility. The objective of this experiment was to determine the effects of lecithin and lysolecithin on digestibility of fat sources having different chain lengths and degrees of saturation.

Experimental Procedures

Ninety-six pigs (17 d of age and 11.6 lb initial wt) were weaned and started immediately on experimental diets. Pigs were housed individually in cages designed for collection of feces. Water was provided ad libitum, and feed was provided using the following equation: daily feed allowance = .05 × body wt$^{.9}$.

The basal diet is given in Table 1. Treatments were: fat source (soybean oil, tallow, lard, and coconut oil) and emulsifier (none, lecithin, and lysolecithin), arranged factorially. The diets contained .25% chromic oxide as an indigestible marker to allow the determination of nutrient digestibilities. Diets were fed in meal form. Pigs were allowed a 7-d adjustment period followed by 4-d collection of feces. Feces were freeze-dried, ground, and analyzed for fat, nitrogen, and gross energy.

Table 1. Experimental Diet[a]

Ingredients, %	Amount
Corn	25.65
Soybean meal (48%)	21.75
Dried skim milk	20.00
Dried whey	20.00
Fat[b]	10.00
Monocalcium phosphate	1.15
Limestone	.40
Lysine-HCl	.10
Vitamins, minerals, antibiotics	.95
Total	100.00

[a]Calculated analysis was: 1.5% lysine, .9% calcium, .8% phosphorus.

[b]Fat source was soybean oil, tallow, lard, and coconut oil with no emulsifier added or 10% of the fat as lecithin or lyso-lecithin.

Results and Discussion

Results from the experiment are given in Table 2. Soybean oil (a source of long chain, unsaturated fatty acids) was more digestible (P<.001) than tallow or lard (sources of long chain, saturated fatty acids). Coconut oil (a source of short and medium chain, saturated fatty acids) also was digested better (P<.001) than tallow or lard. Tallow was 9% more digestible when lecithin was added and 4% more digestible when lysolecithin was added. This increase in digestibility brought tallow very close to the digestibility of soybean oil without an emulsifier, although the digestibility of soybean oil was increased 3% when lecithin was added. Lard, on the other hand, was less digestible when the emulsifiers were added (P<.001). Coconut oil digestibility was not affected by addition of emulsifiers (P>.10), which may be explained by the already high digestibility of short and medium chain fatty acids and differences in absorptive mechanisms.

Addition of emulsifiers to the diets increased nitrogen digestibility (P<.06). Diets with added lecithin had higher nitrogen digestibilities than diets with added lysolecithin (P<.08). Addition of lysolecithin depressed nitrogen digestibility of diets containing coconut oil (P<.09).

Lecithin increased gross energy digestibility more than lysolecithin (P<.07). Other responses in gross energy digestibility were similar to responses in fat digestibility.

Overall, our data indicate that emulsifiers, when added to starter pig diets, have a positive effect on nutrient digestibility, and lecithin was more beneficial than lysolecithin. Also, the digestibility of tallow, a fat source traditionally considered to be of marginal value for early-weaned pigs, was improved markedly by adding lecithin to the diet.

Table 2. Effect of Lecithin and Lysolecithin on Nutrient Digestibility[a]

	Emulsifier												
	No emulsifier				10% of fat as lecithin				10% of fat as lysolecithin				
Item	Soybean oil	Tallow	Lard	Coconut oil	Soybean oil	Tallow	Lard	Coconut oil	Soybean oil	Tallow	Lard	Coconut oil	CV
Fat digestibility, %[b]	89.5	80.9	84.8	88.8	92.6	88.4	80.5	88.6	90.0	83.9	82.5	89.1	4.4
Nitrogen digestibility, %[c]	87.4	87.4	88.2	86.4	90.4	89.0	87.4	88.7	88.4	88.6	88.0	86.3	2.7
Gross energy digestibility, %[d]	89.7	88.0	88.9	90.0	91.8	90.3	87.0	90.2	90.0	88.6	87.7	89.2	2.3

[a]Determined using indirect ratio method, eight pigs per treatment.
[b]Tallow and lard vs coconut oil ($P<.001$); tallow and lard vs soybean oil ($P<.001$); no emulsifier vs lecithin and lysolecithin × tallow vs lard ($P<.001$); lecithin vs lysolecithin × tallow vs lard ($P<.02$).
[c]No emulsifier vs lecithin and lysolecithin ($P<.06$); lecithin vs lysolecithin ($P<.08$); lecithin vs lysolecithin × tallow and lard vs coconut oil ($P<.09$).
[d]Lecithin vs lysolecithin ($P<.07$); tallow and lard vs coconut oil ($P<.02$); tallow and lard vs soybean oil ($P<.001$); tallow vs lard ($P<.06$); no emulsifier vs lecithin and lysolecithin × tallow vs lard ($P<.03$); lecithin vs lysolecithin × tallow vs lard ($P<.10$).