

EFFECT OF FAT SOURCE AND REPLACING SOYBEAN MEAL WITH PLASMA PROTEIN IN PRESTARTER DIETS ON EFFICIENCY OF GAIN AND FEED UTILIZATION IN EARLY-WEANED PIGS

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Story in Brief

A study involving 252 Yorkshire and Hampshire early-weaned pigs was conducted to determine the effects fat source and protein source on performance. Pigs were group weaned at 21 to 26 days of age and randomly allotted to one of six dietary treatments in a 2 X 3 factorial arrangement of treatments. A complex prestarter diet was used with either soybean meal or plasma protein with each diet containing either 8% coconut oil or 8% soy oil or 8% tallow. Experimental diets were fed for two weeks, with weekly gain and feed intake measurements recorded. Early weaned pigs fed a complex prestarter diet containing plasma proteins had superior performance when compared to pigs fed a complex prestarter diet containing soybean meal. The type of added fat used in these prestarter diets did not significantly affect performance.

(Key Words: Early Weaned Pig, Plasma Protein, Fat Source.)

Introduction

Maintenance of growth during the early post weaning period would logically require a high energy diet to replace sow milk (30-40% fat). Early weaned pig diets are commonly supplemented with fat in order to increase the caloric density of the diet and thus more fully meet the energy requirements of the pig. Several studies have been conducted in order to evaluate the effects of fat supplemented diets for early weaned pigs, but the results of research on utilization of various fat sources are conflicting (Kennington et al., 1958; Leibbrandt et al., 1975 and Aherne et al., 1982). Investigators have determined that the source of supplemental fat influences the ability of the young pig to utilize fat in starter diets (Lawrence and Maxwell, 1983; Cera et al., 1988). One possible reason for the conflicting data is that in these

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previous studies, pigs were fed a simple corn-soybean based starter diet.

Although the young pig can utilize a simple corn-soybean diet when weaned as early as 18 days of age, performance is improved by incorporating alternate sources of protein into the diet. It has been shown that feeding early weaned pigs a diet containing soybean meal results in decreased growth performance, lowered villus height and increased serum anti-soy IgG titers (Li et al., 1991). Increased usage of milk products, particularly dried skim milk and dried whey, has been shown to increase performance of early weaned pigs. Protein sources which have the potential of replacing the more expensive milk proteins or the soy proteins in early weaned pig diets should be readily accepted by the swine industry. One such readily available protein is spray dried plasma protein. The extent to which protein source affects utilization of other dietary ingredients has not been determined.

Therefore, this study was conducted in order to determine the effect of fat source on performance in early weaned pigs fed a complex prestarter diet containing plasma proteins compared to those fed a complex soybean meal prestarter diet. Experiment one was conducted with pigs housed in individual pens, while pigs in experiment two were housed in pens in order to more fully simulate on farm conditions.

Materials and Methods

Experiment One

One hundred eight Yorkshire pigs (36 in each of three trials) were group weaned at 21 to 26 days of age and allotted by sex and weight within litter to one of six dietary treatments providing a total of eighteen pigs per treatment. Pigs were housed in individual, elevated metal pens in an environmentally controlled room. For the duration of the experiment (14 days), pigs were assigned to one of six dietary treatments in a 2 X 3 factorial arrangement of treatments (Table 1). Diets were: 1) complex prestarter diet containing soybean meal with 8% added tallow; 2) diet one with 8% coconut oil; 3) diet one with 8% soybean oil; 4) complex prestarter diet containing plasma protein with 8% added tallow; 5) diet four with 8% coconut oil; and 6) diet four with 8% soybean oil. Plasma protein was substituted for soybean meal on a equal lysine basis.

Experiment Two

This experiment was conducted to determine if treatment responses would be similar in pigs reared in more conventional nursery facilities. One hundred

Table 1. Composition of diets^a.

Ingredient	Soybean meal	Plasma protein
Dried skim milk	10.0	10.0
Whey	20.2	20.0
Corn	38.4	46.2
AP-820 ^b	----	6.8
Soybean meal, 44 %	15.0	----
Fat source ^c	8.0	8.0
Lysine, HCl	.25	.25
Fishmeal, Menhaden	5.0	5.0
Ethoxyquin	.025	.025
FOA 390 ^d	1.0	1.0
Flavor, Berry	.1	.1
Cupric sulfate	.1	.1
DL-Methionine	.2	----
Vitamin trace mineral premix ^e	.74	.74
Dicalcium phosphate	1.35	1.75
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Calculated composition of diet		
Metabolizable energy (Mcal/lb)	1.62	1.63
Crude protein (%)	19.40	18.21
Lysine (%)	1.40	1.40
Tryptophan (%)	.25	.25
Threonine (%)	.86	.91
Methionine + Cysteine (%)	.70	.72
Calcium (%)	.99	1.07
Phosphorous (%)	.85	.85

^a As fed basis.

^b Plasma protein source, American Protein Corporation, Ames, Iowa.

^c Coconut oil, soy oil or tallow.

^d Provided 10 g Furazolidone, 5 g Oxytetracycline, 4.5 g Arsanilic acid per lb of diet.

^e Supplied 4,160 IU vitamin A, 416 IU vitamin D, 18 IU vitamin E, 20 mg pantothenic acid, 28 mg niacin, 4.0 mg riboflavin, 7.3 mg menadione sodium bisulfate, .02 mg vitamin B₁₂, 1.3 mg biotin, 2.7 mg pyridoxine, .9 mg folic acid, 3.9 mg thiamin, 267 mg choline, .1 mg selenium, .03 g manganese, .1 g zinc, .1 g iron, .1 g copper, .2 g magnesium, .43 g potassium and .2 mg iodine per lb of feed.

thirty-two Yorkshire and Hampshire pigs (72 in rep one and 60 in rep two) were group weaned at 21 to 26 days and assigned to pens with six pigs per pen in rep one and five pigs per pen in rep two. Pigs were housed in an environmentally controlled room in elevated pens. Each pen was randomly assigned to one of the six treatments imposed in experiment one. During the trial, two pigs died and three sick pigs were removed from treatment. Pen was used as the experimental unit in all statistical analyses.

Results and Discussion

Experiment One

The effect of fat source and diet type on average daily gain is presented in Table 2. During week 1, pigs fed diets containing plasma protein tended to grow faster than pigs fed the diets with soybean meal and pigs fed soy oil or tallow grew faster ($P < .05$) than those fed coconut oil. For week 2 and for the two week period, pigs fed diets containing plasma protein grew 16 and 13% faster ($P < .01$) respectively than pigs fed the diets with soybean meal. For the two week period, pigs fed tallow grew more rapidly ($P < .05$) than those fed coconut oil. Pigs fed the plasma protein diets consumed 18% more feed ($P < .001$) during week 2 than pigs fed the diets containing soybean meal (Table 2). There was no observed difference in feed intake due to fat source. Efficiency of feed utilization was not affected by fat source during week 1 or for the two week period, but during week 2, pigs fed coconut oil were 9% more efficient ($P < .05$) than those fed soy oil.

Experiment Two

Pigs consuming diets with plasma protein diet grew 24, 18 and 21% faster ($P < .05$) than pigs fed diets containing soybean meal during week 1, week 2 and for the overall period respectively (Table 2). No differences were observed in average daily gain due to fat source. Average daily feed intake (Table 2) during weeks 1 and 2 and for the overall period did not differ due to fat or protein source. Feed efficiency (Table 2) during week 1 and for the overall period were 24 and 14% larger ($P < .05$) respectively in pigs consuming diets containing plasma protein. No differences in feed efficiency due to fat source were observed.

The search for alternate protein and energy sources for use in early weaned pig diets in order to increase performance and profits continues. This study indicates that replacing soybean meal with plasma proteins in complex prestarter diets for early weaned pigs results in increased performance and that

Table 2. Effect of protein and fat source on performance^a.

Item	Protein source		Fat source		
	AP-820	SBM	Coconut	Soy oil	Tallow
Experiment one:					
Average daily gain (lb)					
Week 1	.49	.45	.40 ^b	.51 ^c	.51 ^c
Week 2	.96 ^b	.83 ^c	.88	.89	.92
Period	.71 ^b	.63 ^c	.62 ^d	.69 ^{de}	.70 ^e
Average daily feed intake (lb)					
Week 1	.89	.86	.84	.88	.91
Week 2	1.39 ^b	1.09 ^c	1.19	1.30	1.24
Period	1.25	1.11	1.07	1.23	1.24
Average daily feed efficiency (gain:feed)					
Week 1	.61	.58	.54	.65	.60
Week 2	.75 ^b	.82 ^c	.82 ^d	.76 ^e	.79 ^{de}
Period	.68	.68	.66	.70	.69
Experiment two ^f :					
Average daily gain (lb)					
Week 1	.52 ^d	.42 ^e	.46	.49	.45
Week 2	.87 ^d	.74 ^e	.83	.82	.76
Period	.70 ^d	.58 ^e	.64	.66	.61
Average daily feed intake (lb)					
Week 1	.53	.52	.55	.52	.52
Week 2	1.16	1.04	1.08	1.18	1.04
Period	.85	.78	.81	.85	.78
Average daily feed efficiency (gain:feed)					
Week 1	.99 ^d	.80 ^e	.84	.94	.89
Week 2	.76	.71	.77	.72	.72
Period	.84 ^d	.74 ^e	.79	.79	.78

^a Least squares means.

^{b,c} Means within row and within main effect with different superscripts differ ($P < .01$).

^{d,e} Means within row and within main effect with different superscripts differ ($P < .05$).

^f Pen means used as the experimental unit in statistical analyses.

the source of supplemental fat in these complex prestarter diets did not significantly affect performance. Although no statistical analyses could be performed, pigs housed in individual pens performed comparably to pigs housed in a more conventional nursery with six pigs per pen.

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