EFFECT OF PROTEIN SOURCE ON THE PERFORMANCE OF EARLY WEANED PIGS

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Story in Brief

Seventy-two Yorkshire boar pigs were used to study growth rate and feed efficiency in pigs weaned at 3 weeks of age and fed either casein or soy-protein as a source of supplemental protein in corn based diets. Treatments consisted of a corn-casein diet, a corn-isolated soy protein diet, a corn-ethanol extracted soy protein diet and a corn soybean meal diet. Feed intake was not affected by source of dietary protein. Average daily gain ($P<.1$) and feed efficiency ($P<.01$) were improved when casein was the source of supplemental protein. Differences in feed efficiency were not apparent after the second week post weaning resulting in a week by treatment interaction ($P<.05$). Ethanol extraction of soy protein resulted in no improvement in pig performance over soybean meal as a source of supplemental protein.

Introduction

Weaning pigs as early as 3 weeks of age is considered essential to maximize the reproductive efficiency of the sow herd. Growth rate and feed efficiency of early weaned pigs have generally been found to be superior when starter diets contain milk protein; however, milk proteins are expensive relative to soybean meal.

Various treatments of soybean meal (alkali or acid treatment) as well as supplementation of corn-soybean rations, with amino acids and digestive enzymes in an attempt to improve the utilization of soybean meal protein by the early weaned pig have met with only limited success. Ethanol extraction of soy flour has been shown to prevent intestinal disorders of calves fed milk replacers containing heated soy flour but this has not been tested with early weaned pigs.

This study was conducted to compare casein vs. soybean meal as a protein source for early weaned pigs and to determine if ethanol extraction of soy protein will improve gain and efficiency of gain.

Methods and Materials

A growth study was conducted with a total of 72 Yorkshire boar pigs (6 replicates of 12 pigs each) to determine the effect on growth and efficiency of feed utilization of various sources of dietary protein. Experimental diets (Table 1) were formulated to contain .95 lysine as follows:

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Table 1. Composition of diets

Ingredient	Treatment (% of ration)			
	Casein	Isolated Soy-protein	Ethanol extracted Soy-protein	Soybean Meal
Corn	87.14	83.17	77.87	69.99
Calcium caseinate	9.74	---	---	---
Isolated soybean protein	---	13.39	---	---
Ethanol extracted soybean protein	---	---	18.69	---
Soybean meal	---	---	---	26.67
Calcium carbonate	0.87	1.21	1.15	1.19
Dicalcium phosphate	1.35	1.33	1.39	1.25
Vitamin trace mineral premix[a]	0.35	0.35	0.35	0.35
Salt	0.30	0.30	0.30	0.30
ASP-250[b]	0.25	0.25	0.25	0.25
	100.00	100.00	100.00	100.00
Calculated Analysis (%)				
Crude protein	17.11	18.97	18.81	17.89
Lysine	0.95	0.95	0.95	0.95
Calcium	0.80	0.80	0.80	0.80
Phosphorus	0.60	0.60	0.60	0.60

[a]Supplied 4,000,000 IU vitamin A, 3,000,000 IU vitamin D, 4 g riboflavin, 20 g pantothenic acid, 30 g niacin, 800 g choline chloride, 15 mg vitamin B_{12}, 10,000 IU vitamin E, 2 g menadione, 200 mg iodine, 90 g iron, 20 g manganese, 10 g copper, 90 g zinc and 100 mg selenium per ton of feed.

[b]Each pound of ASP 250 contained 20 g chloretracycline, 20 g sulfamethazine and 10 g pencillin.

Treatment 1: A corn-casein diet utilizing 97 percent crude protein calcium caseinate as a supplemental dietary protein source.

Treatment 2: A corn-isolated soy protein diet utilizing 87 percent crude protein isolated soybean protein as a supplemental dietary protein source.

Treatment 3: A corn-soy protein diet in which the soy protein has been extracted with ethanol to yield a 63 percent crude protein product.

Treatment 4: A simple corn-soybean meal diet utilizing 44 percent crude protein solvent extracted soybean meal as a supplemental dietary protein source.

Pigs were weaned at approximately 21 days of age and randomly alloted, within litter, to one of the four dietary treatments. Feed and water was available on an ad libitum basis throughout the trial. Pigs were housed in an environmentally controlled feeding room maintained at 80-90 F in individual elevated metal pens measuring 2.0 by 3.3 feet. Pigs were weighed at the start of the trial and at weekly intervals thereafter with feed intake being measured on a weekly basis. Trials were conducted for five week periods with interim gain and efficiency estimates obtained weekly.

Results and Discussion

Treatment effects for feed intake and average daily gain are presented in Table 2. Dietary protein source did not significantly effect the amount of feed consumed but did affect average daily gain ($P<.1$). Pigs fed casein as a source of supplemental protein gained 4.1, 10.8 and 9.5 percent faster than those fed either isolated soy protein, ethanol extracted soy protein or soybean meal as a source of supplemental protein, respectively.

Table 2. Effect of protein source on average daily feed intake (ADFI) and average daily gain (ADG)

Item	Treatment			
	Casein	Isolated Soy-protein	Ethanol extracted Soy-protein	Soybean Meal
Pigs per treatment, no	17.0	18.0	16.0	17.0
Initial age, days	20.9	20.9	21.1	20.9
Initial weight, lb	12.5	12.7	13.3	12.5
Final weight, lb	38.9	37.6	36.9	35.6
ADFI, lb	1.40	1.43	1.31	1.40
ADG, lb[a]	0.73	0.71	0.66	0.67

[a]Treatment effect ($P<.1$).

Source of dietary protein affected the efficiency of feed utilization (P<.01) as presented in Table 3. Pigs fed the casein based diets were more efficient (P<.05) during the first week on trial than pigs fed any of the soy protein based diets. In addition, pigs fed either isolated soy protein or soybean meal were more efficient than those fed ethanol extracted soy protein (P<.05). During the second week on trial, pigs fed casein were similar in efficiency to pigs fed isolated soy protein or ethanol extracted soy protein, but were more efficient (P<.05) than pigs fed soybean meal. Efficiency of feed utilization was similar for all treatments during the third, fourth and fifth weeks on trial resulting in a diet x week interaction (P<.01). In addition, when comparing pigs fed the casein based diets to pigs fed the soybean protein based diets, over the entire trial, the gain to feed ratio of pigs fed casein was higher (P<.01) than the average gain to feed ratio of all pigs fed soy protein diets (.52 vs .42 lb gain per lb feed for casein vs soybean protein, respectively).

Table 3. Adjusted least square means for gain to feed ratio[a]

	Treatment			
	Casein	Isolated Soy-protein	Ethanol extracted Soy-protein	Soybean Meal
Week 1	0.28[b]	0.02[c]	-0.23[d]	-0.01[c]
2	0.67[b]	0.62[bc]	0.64[bc]	0.50[c]
3	0.57	0.60	0.56	0.54
4	0.55	0.54	0.59	0.51
5	0.53	0.47	0.49	0.48

[a]Adjusted for age and weight on test.

[b,c,d]Means in the same row with different superscripts differ (P<.05).

This study indicates that faster growth and a higher gain to feed ratio during the first 2 weeks postweaning, may be achieved in pigs weaned at three weeks of age, if casein is used to replace soybean proteins as the supplemental protein source. Therefore, it would appear that milk proteins may be effectively utilized to improve performance in early weaned pigs. Equal gain and efficiency apparently can be achieved with either casein or soy proteins after the second week postweaning. Isolated soy protein provides some advantage over soybean meal when used as a source of supplemental protein. However, ethanol extraction of the soybean protein results in no improvement in gain or efficiency of gain over 44 percent crude protein soybean meal. Further studies are needed to determine why early weaned pigs do not perform as well, during the first few weeks postweaning, when soy proteins are used as the source of supplemental protein in corn based diets.