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Effects of spray-dried porcine plasma in the high nutrient density diet

Abstract

A total of 740 weanling pigs was used in three separate experiments to evaluate the effects of additions of spray-dried porcine plasma in the HNDD starter diet. In Trial 1, 534 weanling pigs (initially 14.1 lb and 21 d of age) were used to evaluate various levels of spray-dried porcine plasma. Pigs were assigned to one of six experimental diets with either 0, 2, 4, 6, 8, or 10% spray-dried porcine plasma replacing dried skim milk. Pigs were fed this diet for the first 14 days postweaning, when they were switched to a common phase II diet (d 14 to 28). During phase I (d 0 to 14), linearÂ· and quadratic improvements occurred in average daily gain and average daily feed intake. No significant differences occurred in feed efficiency for any phase of the eXPeriment. In Trial 2, 68 weanling pigs (12.7 lb and 21 d of age) were used to determine if supplemental methionine is needed for diets containing high levels of spray-dried porcine plasma. Pigs were fed identical diets containing 20% dried whey, 7.5%spray-dried porcine plasma, and 1.75% spray-dried blood meal except that one diet contained 2 lblton supplemental DL-methionine. Pigs receiving diets containing supplemental methionine had improved average daily gain and average daily feed intake during the first week postweaning. Feed efficiency also was improved for the overall trial. In Trial 3, 144 weanling pigs (initially 12.61b and 19 d of age) were used in a 21-d growth trial to evaluate two different sources of spray-dried porcine plasma. Pigs were assigned one of two diets containing 20% dried whey and 10% spray-dried porcine plasma. Pigs receiving the diet containing spray-dried porcine plasma obtained from source 1 had improved average daily gain for all phases of the eXPeriment and increased average daily feed intake for d 0 to 14 and d 0 to 21 compared to pigs fed the diet containing spraydried porcine plasma from source 2. There were no differences in feed efficiency. In conclusion, these trials demonstrate three key points concerning spray-dried porcine plasma: 1) starter pig performance is improved linearly with increasing levels of spray-dried porcine plasma through 10% of the diet; 2) DL-methionine must be added to diets containing high levels of spray-dried porcine plasma to obtain optimal performance; and 3) there are differences in commercially available sources of spray-dried porcine plasma.; Swine Day, Manhattan, KS, November 19, 1992

Keywords

Swine day, 1992; Kansas Agricultural Experiment Station contribution; no. 93-142-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 667; Swine; Starter; Spray-dried porcine plasma; Performance

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EFFECTS OF SPRAY-DRIED PORCINE PLASMA IN THE HIGH NUTRIENT DENSITY DIET[1]

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Summary

A total of 740 weanling pigs was used in three separate experiments to evaluate the effects of additions of spray-dried porcine plasma in the HNDD starter diet. In Trial 1, 534 weanling pigs (initially 14.1 lb and 21 d of age) were used to evaluate various levels of spray-dried porcine plasma. Pigs were assigned to one of six experimental diets with either 0, 2, 4, 6, 8, or 10% spray-dried porcine plasma replacing dried skim milk. Pigs were fed this diet for the first 14 days postweaning, when they were switched to a common phase II diet (d 14 to 28). During phase I (d 0 to 14), linear and quadratic improvements occurred in average daily gain and average daily feed intake. No significant differences occurred in feed efficiency for any phase of the experiment. In Trial 2, 68 weanling pigs (12.7 lb and 21 d of age) were used to determine if supplemental methionine is needed for diets containing high levels of spray-dried porcine plasma. Pigs were fed identical diets containing 20% dried whey, 7.5% spray-dried porcine plasma, and 1.75% spray-dried blood meal except that one diet contained 2 lb/ton supplemental DL-methionine. Pigs receiving diets containing supplemental methionine had improved average daily gain and average daily feed intake during the first week postweaning. Feed efficiency also was improved for the overall trial. In Trial 3, 144 weanling pigs (initially 12.6 lb and 19 d of age) were used in a 21-d growth trial to evaluate two different sources of spray-dried porcine plasma. Pigs were assigned one of two diets containing 20% dried whey and 10% spray-dried porcine plasma. Pigs receiving the diet containing spray-dried porcine plasma obtained from source 1 had improved average daily gain for all phases of the experiment and increased average daily feed intake for d 0 to 14 and d 0 to 21 compared to pigs fed the diet containing spray-dried porcine plasma from source 2. There were no differences in feed efficiency. In conclusion, these trials demonstrate three key points concerning spray-dried porcine plasma: 1) starter pig performance is improved linearly with increasing levels of spray-dried porcine plasma through 10% of the diet; 2) DL-methionine must be added to diets containing high levels of spray-dried porcine plasma to obtain optimal performance; and 3) there are differences in commercially available sources of spray-dried porcine plasma.

(Key Words: Starter, Spray-dried Porcine Plasma, Performance.)

Introduction

Previous research conducted at Iowa State University has shown the optimum level of spray-dried porcine plasma in the phase I high nutrient density diet to be 6 to 8%. However, spray-dried porcine plasma replaced soybean meal in those experiments without holding methionine at a constant

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level. Recommendations by the NRC (1988) suggest that methionine becomes the first-limiting amino acids in diets containing greater than 6% spray-dried porcine plasma. Therefore, it is possible that starter pigs would respond to a higher level of spray-dried porcine plasma, if sufficient synthetic methionine were added to the diet. In addition, multiple sources of spray-dried porcine plasma are available to the swine industry. These sources may vary in quality for use in starter pig diets. Therefore, three experiments were conducted to: 1) determine the optimal level of spray-dried porcine plasma in the phase I diet; 2) evaluate the need for supplemental methionine in diets containing high levels of spray-dried porcine plasma; and 3) compare different sources of spray-dried porcine plasma in the phase I diet.

Procedures

Trial 1. A total of 534 weanling pigs (initially 14.1 lb and 21 d of age) was used on a commercial operation to evaluate various levels of spray-dried porcine plasma in the phase I diet. Pigs were blocked by weight and sex to the six experimental treatments. Pigs were housed 14 or 15 pigs per pen (six pens per treatment) in an environmentally controlled nursery with metal flooring and allowed ad libitum access to feed and water. Pigs and feeders were weighed on d 7, 14, 21, and 28 after weaning to determine ADG, ADFI, and F/G.

Experimental diets (Table 1) were formulated to contain either 0, 2, 4, 6, 8, or 10% spray-dried porcine plasma. Spray-dried porcine plasma replaced dried skim milk in the diet to maintain a constant level of soybean meal in all diets. Lactose also was added to the diet as skim milk was removed to maintain the same lactose level. All diets were formulated to contain 1.5% lysine, .41% methionine, .9% Ca, and .8% P. Methionine was held constant by adding DL-methionine to the diets containing spray-dried porcine plasma. Pigs were fed the experimental diets for the first 14 days postweaning, when they were switched to a common phase II (d 14 to 28) diet. The phase II diet contained 10% dried whey and 2.5% spray-dried blood meal and was formulated to 1.25% lysine.

Trial 2. A total of 68 weanling pigs (initially 12.7 lb and 21 d of age) was used to determine if supplemental methionine was limiting in a diet containing high levels of spray-dried porcine plasma. Pigs were allotted by sex, weight, and ancestry to pens containing five to six pigs per pen. Pens were assigned to one of two diets (Table 2) that contained 20% dried whey, 7.5% spray-dried porcine plasma, and 1.75% spray-dried blood meal and were formulated to contain 1.5% lysine. Diets were identical except for the inclusion of 2 lb/ton supplemental DL-methionine in one diet. Pigs were fed the same diet for the entire 21-d trial. Pigs and feeders were weighed on d 7, 14, and 21 postweaning to evaluate ADG, ADFI, and F/G.

Trial 3. A total of 144 weanling pigs (initially 12.6 lb and 19 d of age) was used to evaluate two different sources of spray-dried porcine plasma in the phase I diet. Pigs were allotted by weight to pens containing eight to nine pigs per pen. Pens were randomly assigned to one of two diets (Table 2) containing either a spray-dried porcine plasma from source 1 or source 2. Diets were formulated with 20% dried whey and 10% spray-dried porcine plasma and were formulated to contain 1.5% lysine with the only difference being the source of plasma. Pigs received this diet for the entire 21-d trial. Pigs and feed disappearance were measured on d 7, 14, and 21 postweaning to evaluate ADG, ADFI, and F/G.

Results and Discussion

Trial 1. During phase I (d 0 - 14 postweaning) linear ($P<.01$) and quadratic ($P<.11$) improvements occurred in ADG, with pigs receiving diets containing 10% spray-dried porcine plasma having the greatest performance (Table 3). Average daily feed intake also improved linearly (P<.01) and quadratically (P<.04) during phase I, with pigs receiving 8% and 10% spray-dried porcine plasma consuming the most feed. During the overall period, ADG also followed a linear (P<.01) trend, with pigs receiving 10% spray-dried porcine plasma having the greatest performance. No significant differences occurred in feed efficiency (F/G) for any phase of the trial. Results of this trial indicate that starter pig performance is improved linearly as spray-dried porcine plasma increases from 0 to 10% of the diet. These results contradict earlier research at Iowa State University that indicated that pig performance was maximized at the 6% plasma level. The major difference between this experiment and the Iowa State trials was the methionine level in the diets. Synthetic methionine must be added to diets containing greater than 6% spray-dried porcine plasma to maintain the methionine:lysine ratio above the ratio suggested by NRC (1988). Therefore, the Iowa State research may have reflected the point where methionine becomes deficient rather than the optimal plasma level.

Trial 2. Pigs receiving the diet containing supplemental methionine had improved (P<.05) ADG during the first week of the trial (Table 4). This improvement in performance led to the slight improvement (P<.15) in ADG for the overall trial. Average daily feed intake was increased (P<.05) from d 0 to 7 for pigs receiving supplemental methionine. Feed efficiency also was improved for d 0 to 14 (P<.11) and the overall trial (P<.05).

These results provide evidence that diets containing high levels of spray-dried porcine plasma are deficient in methionine unless DL-methionine is added to the diet. This evidence supports the conclusions discussed for trial 1.

Trial 3. During the first week (d 0 to 7), pigs receiving diets containing spray-dried porcine plasma from source 2 had improved ADG (P<.001), ADFI (P<.02), and F/G (P<.15) compared to pigs fed porcine plasma from source 1 (Table 5). Pigs receiving diets containing plasma from source 2 also had improved (P<.01) ADG and ADFI for d 0 to 14. A similiar trend was seen for the overall trial with increased (P<.02) ADG and a slight improvement (P<.12) in ADFI.

Although large differences in pig performance would not normally be expected when dietary treatments were nearly identical, these results indicate a very important factor to take into consideration. Differences in the handling and processing of spray-dried porcine plasma can be very influential in affecting performance. Quality control of spray-dried porcine plasma or any other feed ingredient used in diet formulation can play a major role in optimizing performance and should be considered when purchasing ingredients for use in swine diets.

Table 1. Diet Composition (Trial 1)[a]

	Spray-dried porcine plasma, %						
Item, %	0	2	4	6	8	10	Phase II
Corn	30.66	30.66	30.66	30.66	30.66	30.56	-
Milo	-	-	-	-	-	-	55.89
Soybean meal (48.5% CP)	19.52	19.52	19.52	19.52	19.52	19.52	24.08
Dried whey, edible grade	20.00	20.00	20.00	20.00	20.00	20.00	10.00
Spray-dried porcine plasma	-	2.00	4.00	6.00	8.00	10.00	-
Dried skim milk	20.00	16.00	12.00	8.00	4.00	-	-
Lactose	-	2.00	4.00	6.00	8.00	10.00	
Soy oil	5.00	5.00	5.00	5.00	5.00	5.00	3.00
Spray-dried blood meal	-	-	-	-	-	-	2.50
Monosodium phosphate (18% P)	1.52	1.24	1.00	.76	.29	-	
Limestone	1.22	1.12	1.04	.96	.75	.65	.82
Antibiotic[b]	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Monocalcium	-	.47	.90	1.32	2.00	2.48	1.92
Salt	.30	.20	.10	-	-	-	
Vitamin premix	.25	.25	.25	.25	.25	.25	.25
Trace mineral premix	.15	.15	.15	.15	.15	.15	.15
L-Lysine HCl	.15	.12	.098	.072	.046	.021	.15
Vitamin E premix	.10	.10	.10	.10	.10	.10	.10
Copper sulfate	.075	.075	.075	.075	.075	.075	.075
Selenium premix	.050	.050	.050	.050	.050	.050	
D-L Methionine	-	.024	.049	.075	.10	.12	.050

[a]Diets were formulated to contain 1.50% lysine, .41% methionine, .9% Ca, and .8% P in phase I and 1.25% lysine in phase II.
[b]Provided 150 g/ton Apramycin in phase I and 50 g/ton Carbadox in phase II.

Table 2. Diet Composition (Trial 2 and 3)

Item, %	Trial 2[a]	Trial 3[a]
Corn	44.23	45.47
Soybean meal, 48.5% CP	16.43	15.96
Dried whey, edible grade	20.00	20.00
Spray-dried porcine plasma	10.00	7.50
Spray-dried blood meal	-	1.75
Soy oil	5.00	5.00
Monocalcium phosphate, 18% P	1.92	1.91
Antibiotic[b]	1.00	1.00
Limestone	.69	.69
Vitamin premix	.25	.25
Trace mineral premix	.15	.15
L-Lysine HCL	.10	.10
D-L Methionine[c]	.10	.10
Copper sulfate	.075	.075
Selenium premix	.05	.050

[a]Diet was fed for the entire 21 d trial and was formulated to contain 1.5% lysine.
[b]Provided 150 g/ton Apramycin.
[c]Methionine replaced corn in Trial 2 in the + methionine diet.

Table 3. Performance of Pigs Fed Various Levels of Spray-Dried Porcine Plasma (Trial 1)[a]

	Spray-dried Porcine Plasma, %						
Item	0	2	4	6	8	10	CV
<u>d 0 - 14</u>							
ADG, lb[bc]	.36	.45	.47	.52	.54	.56	13.64
ADFI, lb[bd]	.45	.53	.56	.63	.66	.66	9.64
F/G	1.26	1.19	1.18	1.21	1.22	1.19	7.85
<u>d 0 - 28</u>							
ADG, lb[b]	.64	.72	.68	.73	.71	.72	6.67
ADFI, lb[be]	.90	.99	.95	1.03	1.01	1.01	5.34
F/G	1.40	1.38	1.38	1.40	1.41	1.39	5.21

[a]534 weanling pigs were used (initially 14.1 lb and 21 d of age), 14 to 15 pigs/pen with 6 pens/treatment.
[b]Linear response ($P < .01$).
[c]Quadratic response ($P < .11$).
[d]Quadratic response ($P < .04$).
[e]Quadratic response ($P < .08$).

Table 4. Growth Performance of Pigs Fed Supplemental Methionine in a High Nutrient Density Diet Containing Spray-Dried Porcine Plasma (Trial 2)[a]

Item	+ Methionine	Control	CV
d 0 - 7			
ADG, lb[b]	.55	.46	11.68
ADFI, lb[c]	.57	.48	9.88
F/G	1.02	1.02	4.34
d 0 - 14			
ADG, lb	.68	.61	11.68
ADFI, lb	.77	.75	7.36
F/G[d]	1.13	1.23	7.52
d 0 - 21			
ADG, lb	.83	.75	9.46
ADFI, lb	.99	.97	7.64
F/G[b]	1.19	1.28	5.46

[a]68 weanling pigs were used (initially 12.7 lb and 21 d of age), 5-6 pigs/pen.
[b]$P < .05$
[c]$P < .03$
[d]$P < .11$

Table 5. Growth Performance of Pigs Fed Different Sources of Spray-Dried Porcine Plasma (Trial 3)[a]

Item	Source 1	Source 2	CV
d 0 - 7			
ADG, lb[b]	.37	.44	14.86
ADFI, lb[b]	.53	.60	8.83
F/G	1.48	1.35	12.24
d 0 - 14			
ADG, lb[c]	.55	.64	7.94
ADFI, lb[b]	.70	.78	8.31
F/G	1.27	1.22	5.52
d 0 - 21			
ADG, lb[b]	.75	.81	6.28
ADFI, lb[d]	.94	.99	6.36
F/G	1.26	1.21	5.28

[a]144 weanling pigs were used (initially 12.6 lb and 19 d of age), 8-9 pigs/pen.
[b]$P<.02$.
[c]$P<.001$.
[d]$P<.12$.