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Effects of Feeding Excess Dietary Crude Protein from Soybean Meal and Dried Distillers Grains with Solubles on Nursery Pig Performance

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Summary

Two experiments were conducted to determine the effects of feeding excess dietary CP to nursery pigs. In Exp. 1, a total of 105 nursery pigs (PIC TR4 × 1050, initially 22.9 lb and 35 d of age) were used in a 21-d growth assay to determine the effects of feeding excess CP from soybean meal to nursery pigs. The pigs were fed a pelleted commercial starter diet for the first 14 d after weaning, and the experimental treatments were fed for the next 21 d. Treatments consisted of 3 corn-soybean meal-based diets formulated to different CP levels: (1) 22.5%, (2) 25%, and (3) 27.5% CP. Increasing CP from 22.5 to 27.5% had no effect ($P > 0.19$) on ADG, ADFI, or F/G. In Exp. 2, a total of 105 nursery pigs (PIC TR4 × 1050, initially 22.1 lb and 35 d of age) were used in a 21-d growth assay to determine the effects of excess CP from dried distillers grains with solubles (DDGS) on nursery pig growth. The pigs were fed a pelleted commercial starter diet for the first 14 d after weaning and the experimental treatments for the next 21 d. Treatments were corn-soybean meal-based diets formulated to 22.9 and 25% CP and a diet with 30% DDGS formulated to 25% CP. Increasing the CP concentration had no effect ($P > 0.12$) on ADG, ADFI, or F/G. However, pigs fed the DDGS had poorer ($P < 0.04$) F/G compared to pigs fed the corn-soybean meal-based diet formulated to 25% CP. Our data suggest that nursery pigs can tolerate CP levels up to 27.5% without negative effects on growth performance. Additionally, the inclusion of 30% DDGS in nursery pig diets did not have a significant impact on ADG or ADFI, but did negatively affect F/G.

Key words: dried distillers grains with solubles, excess crude protein, soybean meal

Introduction

Adding dried distillers grains with solubles (DDGS) to diets is a common practice in today's swine industry. As cereal starch is converted to ethanol, the other proximal components of corn (such as protein, fiber, and fat) are concentrated by about 3 times the original amount. Thus, diets formulated with moderate to high levels of DDGS will result in CP concentrations greater than with corn-soybean meal-based formulations. It has been suggested that growth performance may suffer due to excess CP in swine diets. Therefore, the objective of the experiment was to determine the impact of excess CP from both soybean meal and DDGS in diets for nursery pigs.

Procedures

In Exp. 1, a total of 105 nursery pigs (56 barrows and 49 gilts, PIC line TR4 × 1050, initially 22.9 lb and 35 d of age) were used in a 21-d growth assay to determine the effects on growth performance from feeding excess CP from soybean meal. The pigs were weaned at 21 d of age, sorted by sex and ancestry, blocked by weight, and assigned to pens. Pigs were fed a pelleted commercial starter diet for the first 14 d postwean-

ing and the experimental treatments for the next 21 d. Treatments were corn-soybean meal-based and fed in meal form. The treatments consisted of 3 different CP levels: (1) 22.5%, (2) 25%, and 27.5% CP (Table 1). There were 7 pigs per pen and 5 pens per treatment. The pigs were housed in an environmentally controlled nursery with 4-ft x 4-ft pens and woven-wire flooring. Each pen had a self-feeder and nipple water to allow ad libitum consumption of feed and water. Pigs and feeders were weighed on d 14 and 35 postweaning to allow calculation of ADG, ADFI, and F/G.

In Exp. 2, a total of 105 nursery pigs (49 barrows and 56 gilts, PIC TR4 × 1050, initially 22.1 lb and 35 d of age) were used in a 21-d growth assay to determine the effects of excess CP from dried distillers grains with solubles (DDGS). The pigs were weaned at 21 d of age, sorted by sex and ancestry, blocked by weight, and assigned to pens. The pigs were housed and managed as in Exp. 1, with the commercial starter diet consumed for the first 14 d postweaning and the experimental treatments for the next 21 d. Treatments were corn-soybean meal-based diets formulated to 22.9 and 25% CP and a diet with 30% DDGS formulated to 25% CP. There were 7 pigs per pen and 5 pens per treatment. Pigs and feeders were weighted on d 14 and 35 postweaning to allow calculation of ADG, ADFI, and F/G.

The feed and DDGS were analyzed for concentrations of N. The DDGS were also analyzed for ether extract (EE), GE, ADF, and NDF (Table 1).

All data in Exp. 1 and 2 were analyzed as a randomized complete block design using the MIXED procedure of SAS (SAS Institute, Inc., Cary NC). In Exp. 1, linear and quadratic polynomial contrasts were used to determine the effects of increasing dietary CP. In Exp. 2, orthogonal contrasts were used to compare the corn-soy control vs. the mean of the two higher CP treatments and the 25% CP diets with or without 30% DDGS.

Results and Discussion

In Exp. 1, a corn-soybean meal-based diet that meets the amino acid requirements for nursery pigs was stated to have 23.7% CP for 11- to 22-lb pigs and 20.9% for 22- to 44-lb pigs (NRC 1998[1]). The diets in our experiment were in excess of those concentrations and, thus, should have the potential to produce negative effects. Yet, increasing the CP concentration of the diet from 22.5 to 27.5% CP had no effect ($P > 0.19$) on ADG, ADFI, or F/G (Table 2).

In Exp. 2 there was no difference ($P > 0.12$) in ADG, ADFI, or F/G when comparing the control diet with 22.9% CP versus the mean of the two higher CP diets (Table 3). However, within the 25% CP treatments, pigs fed the diet with DDGS had numerically lower ADG and ADFI and poorer ($P < 0.04$) F/G.

Our results indicate that feeding nursery pigs diets with 22.5 to 27.5% CP had no negative effects on growth performance. However, inclusion of 30% DDGS resulted in poorer F/G independent of CP concentration in the diet for the 21-d feeding period.

[1] NRC. 1998. Nutrient Requirements of Swine. 10th ed. Natl. Acad. Press, Washington, DC.

Table 1. Composition of diets (Exp. 1 and 2; as-fed basis)

	Experiment 1			Experiment 2		
	CP, %			22.9% CP	25.0% CP	
Item	22.5	25.0	27.5	Control	30% DDGS	SBM
Ingredient, %						
Corn	48.32	41.71	35.44	47.30	27.30	41.67
Corn DDGS[1]	—	—	—	—	30.00	—
Soybean meal (47.5% CP)	30.23	37.44	43.95	31.35	21.65	37.51
Spray-dried whey	15.00	15.00	15.00	15.00	15.00	15.00
Menhaden fish meal	3.00	3.00	3.00	3.00	3.00	3.00
Monocalcium P (21% P)	0.74	0.60	0.46	0.72	0.21	0.60
Limestone	0.80	0.81	0.81	0.80	0.99	0.81
L-lysine HCl	0.30	0.04	—	0.26	0.46	0.04
DL- methionine	0.14	0.06	—	0.13	0.03	0.06
L-threonine	0.11	—	—	0.09	0.04	—
L-tryptophan	0.01	—	—	—	—	—
Salt	0.30	0.30	0.30	0.30	0.30	0.30
Vitamin premix	0.09	0.09	0.09	0.09	0.09	0.09
Mineral premix	0.07	0.06	0.05	0.07	0.03	0.03
Zinc oxide[2]	0.19	0.19	0.20	0.19	0.20	0.19
Antibiotic[3]	0.70	0.70	0.70	0.70	0.70	0.70
Total	100	100	100	100	100	100
Calculated analysis, %						
CP	22.5	25.0	27.5	22.9	25.0	25.0
SID lysine[4]	1.41	1.39	1.52	1.41	1.37	1.39
Ca	0.80	0.80	0.80	0.80	0.80	0.80
Total P	0.70	0.70	0.70	0.70	0.70	0.70
Chemical analysis, %						
CP	21.9	24.4	26.0	21.3	24.2	22.6

[1] Dried distillers grains with solubles.
[2] To supply 1,500 mg/kg Zn.
[3] To provide 154 g/ton oxytetracycline and 154 g/ton neomycin.
[4] Standardized ileal digestible lysine.

Table 2. Effects of excess crude protein from soybean meal on growth performance in nursery pigs (Exp. 1)[1]

	Crude Protein, %				P value	
Item	22.5	25	27.5	SE	Linear	Quadratic
ADG, lb	1.30	1.26	1.27	0.05	—[2]	—
ADFI, lb	1.93	1.87	1.86	0.08	—	—
F/G, lb/lb	1.48	1.49	1.46	0.01	—	—

1 A total of 105 pigs (average initial BW of 22.9 lb) with 7 pigs per pen and 5 pens per treatment.
2 Dashes indicate P > 0.15.

Table 3. Effects of excess crude protein from soybean meal (SBM) and distillers dried grains with soluble (DDGS) on growth performance on nursery pigs (Exp. 2)[1]

	Treatments				P value	
Item	22.9% CP control	25% CP SBM	25% CP 30% DDGS	SE	Control vs. High CP	25% CP: SBM vs. DDGS
ADG, lb	1.29	1.29	1.20	0.04	—[2]	0.12
ADFI, lb	1.90	1.89	1.84	0.06	—	—
F/G, lb/lb	1.47	1.46	1.53	0.02	—	0.04

1 A total of 105 pigs (average initial BW of 22.1 lb) with 7 pigs per pen and 5 pens per treatment.
2 Dashes indicate P > 0.15.