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Effects of excess dietary crude protein from soybean meal and dried distillers grains with solubles in diets for finishing pigs

Abstract

A total of 180 pigs (90 barrows and 90 gilts, average initial weight of 148 lb) were used in a 67-d experiment to determine the effects of excess dietary CP on growth performance and carcass measurements in finishing pigs. The pigs were sorted by ancestry and blocked by weight with 12 pigs per pen and 5 pens per treatment. Treatments were corn-soybean meal-based diets formulated to 15.3 and 18.3% CP and a corn-soybean-DDGS-based diet formulated to 18.3% CP. Feed and water were consumed on an ad libitum basis until the pigs were slaughtered (average final weight of 282 lb) at a commercial abattoir. Pigs fed diets with high CP had lower ($P < 0.001$) final weight, ADG, ADFI, and HCW, but these results were caused entirely by the diet with 40% DDGS. Our results indicated that diets with 40% DDGS decreased growth performance and economically important carcass measurements. However, the excess CP in those diets does not seem to be the culprit.; Swine Day, 2008, Kansas State University, Manhattan, KS, 2008

Keywords

Swine day, 2008; Kansas Agricultural Experiment Station contribution; no. 09-074-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 1001; Carcass; Dried distillers grains with solubles; Finishing pigs; Growth; Protein

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EFFECTS OF EXCESS DIETARY CRUDE PROTEIN FROM SOYBEAN MEAL AND DRIED DISTILLERS GRAINS WITH SOLUBLES IN DIETS FOR FINISHING PIGS

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Summary

A total of 180 pigs (90 barrows and 90 gilts, average initial weight of 148 lb) were used in a 67-d experiment to determine the effects of excess dietary CP on growth performance and carcass measurements in finishing pigs. The pigs were sorted by ancestry and blocked by weight with 12 pigs per pen and 5 pens per treatment. Treatments were corn-soybean meal-based diets formulated to 15.3 and 18.3% CP and a corn-soybean-DDGS-based diet formulated to 18.3% CP. Feed and water were consumed on an ad libitum basis until the pigs were slaughtered (average final weight of 282 lb) at a commercial abattoir. Pigs fed diets with high CP had lower ($P < 0.001$) final weight, ADG, ADFI, and HCW, but these results were caused entirely by the diet with 40% DDGS. Our results indicated that diets with 40% DDGS decreased growth performance and economically important carcass measurements. However, the excess CP in those diets does not seem to be the culprit.

Key words: carcass, dried distillers grains with solubles, finishing pigs, growth, protein

Introduction

Many scientists (particularly in Europe) suggest that excess CP in diets reduces energetic efficiency in pigs. This lost efficiency should be reflected in poor growth performance measurements. Additionally, excess CP in diets has been blamed for increased organ weights leading to lower carcass yields. These arguments are of particular interest to us because diets with high inclusion of dried distill-

ers grains with soluble (DDGS) have an abundance of CP. Thus, we designed an experiment to determine the effects of excess dietary CP from soybean meal vs. DDGS on growth performance and carcass measurements of finishing pigs.

Procedures

A total of 180 pigs (90 barrows and 90 gilts, average initial weight of 148 lb) were used in a 67-d growth assay. The pigs were sorted by sex and ancestry, blocked by weight, and assigned to pens. There were 12 pigs per pen and 5 pens per treatment. The pigs were housed in a finishing facility with 6-ft \times 16-ft pens having half solid and half slatted concrete flooring. Each pen had a self-feeder and nipple waterer to allow ad libitum consumption of feed and water until the pigs were slaughtered at an average weight of 282 lb.

The first treatment was a corn-soybean meal-based diet formulated to 15.3% CP with added lysine and threonine (Table 1). For the second treatment, a simple corn-soybean meal-based diet was formulated to 18.5% CP. Finally, a diet with 40% DDGS (Sioux River Ethanol, Hudson, SD) was formulated; that diet also had 18.5% CP.

Pigs and feeders were weighed on d 0, 34, and 67 to allow calculation of ADG, ADFI, and F/G. The pigs were killed on d 67 (average weight of 282 lb), and carcass data were collected. Because differences in slaughter weight and, thus, HCW are known to affect carcass measurements, carcass data were analyzed without and with HCW used as a

covariate to remove the effects of slaughtering pigs at a constant age rather than constant weight.

All data were analyzed as a randomized complete block design by using the MIXED procedure of SAS. Orthogonal contrasts were used to separate treatment means with comparisons between the control vs. high protein treatments and high protein from soybean meal vs. high protein from DDGS.

Results and Discussion

Pigs fed the 15.3% CP corn-soybean meal-based diet had greater ($P < 0.03$) ADG, ADFI, HCW, and dressing percentage than pigs fed the 18.3% CP treatments. The negative effects of the high protein treatments were caused entirely by the low ($P < 0.001$) ADG, ADFI, and

HCW for pigs fed the DDGS diet compared with pigs fed the high protein corn-soybean meal-based diet. For further analysis of our results, HCW was used as a covariate to adjust the pigs to the same carcass weight. When this was done, there were no treatment effects ($P > 0.1$) for dressing percentage and percentage carcass lean. However, pigs fed the control diet had greater ($P < 0.09$) fat thickness than pigs fed the high protein treatments. Also, pigs fed the soybean meal treatment had less ($P < 0.04$) backfat than those fed the DDGS diet.

In conclusion, our data demonstrate that pigs fed 15.3% protein had greater ADG, ADFI, and HCW than pigs fed the 18.5% protein treatments. However, those negative effects resulted only from addition of 40% DDGS, suggesting that it is not the excess CP causing the negative effects.

Table 1. Composition of diets

| Ingredient, % | d 0 to 34 | | | d 34 to 67 | | |
|-------------------------------|-----------|-----------------------|-----------------------|------------|----------|----------|
| | Control | High SBM ¹ | 40% DDGS ² | Control | High SBM | 40% DDGS |
| Corn | 79.78 | 72.06 | 52.82 | 81.70 | 74.13 | 54.74 |
| DDGS | --- | --- | 40.00 | --- | --- | 40.00 |
| Soybean meal (47.5% CP) | 17.80 | 25.85 | 4.95 | 16.20 | 24.00 | 3.25 |
| Limestone | 1.09 | 1.05 | 1.34 | 1.06 | 1.01 | 1.24 |
| Monocalcium phosphate (21% P) | 0.73 | 0.67 | 0.05 | 0.54 | 0.49 | --- |
| Salt | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 |
| L-lysine HCl | 0.20 | --- | 0.47 | 0.13 | --- | 0.40 |
| L-threonine | 0.03 | --- | --- | --- | --- | --- |
| Vitamin premix | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| Trace mineral premix | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| Antibiotic ³ | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| Calculated analysis, % | | | | | | |
| Lysine | 0.90 | 0.97 | 0.90 | 0.80 | 0.92 | 0.80 |
| Ca | 0.60 | 0.60 | 0.60 | 0.55 | 0.55 | 0.55 |
| Total P | 0.50 | 0.52 | 0.50 | 0.45 | 0.48 | 0.48 |
| CP | 15.3 | 18.3 | 18.3 | 14.6 | 17.6 | 17.6 |

¹ Soybean meal.

² Dried distillers grains with solubles.

³ To provide 40 g/ton tylosin.

Table 2. Effects of excess dietary CP from soybean meal and dried distillers grains with solubles in diets for finishing pigs¹

| Item | Control | High CP corn-soy | High CP DDGS ² | SE | <i>P</i> value | |
|---------------------------------------|---------|---------------------|------------------------------|------|-----------------------|--------------|
| | | | | | Control vs. others | SBM vs. DDGS |
| d 0 to 67 | | | | | | |
| ADG, lb | 2.11 | 2.10 | 1.88 | 0.03 | 0.001 | 0.001 |
| ADFI, lb | 6.55 | 6.41 | 5.82 | 0.09 | 0.001 | 0.001 |
| F/G | 3.10 | 3.05 | 3.10 | 0.03 | ---3 | 0.09 |
| HCW, lb | 215.2 | 213.9 | 200.9 | 3.55 | 0.001 | 0.001 |
| Dress, % | 74.2 | 74.2 | 73.3 | 0.33 | 0.02 | 0.08 |
| Backfat thickness, in. | 0.77 | 0.70 | 0.73 | 0.02 | 0.03 | --- |
| Loin depth, in. | 2.42 | 2.46 | 2.36 | 0.05 | --- | 0.11 |
| Carcass lean, % | 54.3 | 55.6 | 54.8 | 0.4 | 0.06 | 0.15 |
| Adjusted dress, % ⁴ | 73.8 | 73.6 | 74.0 | 0.41 | --- | --- |
| Adjusted backfat, in. ⁴ | 0.76 | 0.68 | 0.75 | 0.02 | 0.09 | 0.03 |
| Adjusted loin depth, in. ⁴ | 2.38 | 2.43 | 2.42 | 0.03 | --- | --- |
| Adjusted carcass lean, % ⁴ | 55.2 | 55.7 | 54.8 | 0.4 | --- | 0.11 |

¹ A total of 180 pigs (90 barrows and 90 gilts, initially 148 lb) with 12 pigs per pen and 5 pens per treatment.

² Dried distillers grains with solubles.

³ Dashes indicate $P > 0.15$.

⁴ HCW used as a covariate.