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Abstract

A total of 1,035 finishing pigs (initially 79.4 lb) were used in an 84-d growth trial to evaluate the effects of increasing hominy feed on finishing pig growth performance. Pens of pigs were blocked by average initial pig BW and randomly allotted to 1 of 4 dietary treatments (10 pens per treatment) with initial weights balanced across the treatment groups. Treatments were increasing levels (0%, 12.5%, 25%, and 37.5%) of corn hominy feed added to a corn-soybean meal-based diet. All treatment diets were fed in 4 phases, and hominy feed inclusion was constant among phases. Increasing hominy feed resulted in a linear decrease ($P < 0.01$) in ADG and ADFI from d 0 to 84. Regardless of treatment, there was no difference ($P > 0.35$) in F/G. The lower feed consumption and poorer growth performance resulted in pigs fed diets containing any level of hominy feed weighing less than pigs fed standard corn-soybean meal-based diets at the end of the trial. These data indicate that adding corn hominy feed as an alternative ingredient in swine diets is a viable option; however, a decrease in performance should be considered when deciding if it is cost-effective to include hominy feed in finishing diets.; Swine Day, Manhattan, KS, November 19, 2009

Keywords

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Effects of Increasing Hominy Feed in Diets on Finishing Pig Performance[1]

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Summary
A total of 1,035 finishing pigs (initially 79.4 lb) were used in an 84-d growth trial to evaluate the effects of increasing hominy feed on finishing pig growth performance. Pens of pigs were blocked by average initial pig BW and randomly allotted to 1 of 4 dietary treatments (10 pens per treatment) with initial weights balanced across the treatment groups. Treatments were increasing levels (0%, 12.5%, 25%, and 37.5%) of corn hominy feed added to a corn-soybean meal-based diet. All treatment diets were fed in 4 phases, and hominy feed inclusion was constant among phases. Increasing hominy feed resulted in a linear decrease ($P < 0.01$) in ADG and ADFI from d 0 to 84. Regardless of treatment, there was no difference ($P > 0.35$) in F/G. The lower feed consumption and poorer growth performance resulted in pigs fed diets containing any level of hominy feed weighing less than pigs fed standard corn-soybean meal-based diets at the end of the trial.

These data indicate that adding corn hominy feed as an alternative ingredient in swine diets is a viable option; however, a decrease in performance should be considered when deciding if it is cost-effective to include hominy feed in finishing diets.

Key words: alternative ingredient, hominy feed, growth

Introduction
Corn by-products produced from a variety of processing procedures are widely used as alternative feed ingredients in swine diets. These ingredients are used with the intent of reducing feed cost. However, if inclusion of these ingredients also affects performance, the benefit of reduced cost must be weighed against the economic value of lost performance. Corn hominy feed is fed as an alternative ingredient to reduce dependency on ground corn. Corn is composed of 3 main fractions: bran, endosperm, and germ. The major contributions from these fractions are fiber, starch, and protein and oil, respectively. Hominy feed is a by-product of the dry-milling production of the corn grits, cornmeal, and corn flour industry, which primarily uses the endosperm fraction. Depending on the product produced, hominy feed consists of the remaining corn bran, corn germ, and some starch. Generally, hominy feed is reported to have a higher fiber and protein content and a lower dietary energy value than corn (corn ME = 1,551 kcal/lb, corn hominy feed ME = 1,456 kcal/lb; NRC, 1998[3]). Therefore, the objective of this trial was to determine the effects of feeding increasing amounts of hominy feed on ADG, ADFI and F/G of commercial finishing pigs.

[1] Appreciation is expressed to J-Six Enterprises, Seneca, KS, for their assistance and for providing the pigs and facilities used in this experiment.

[2] Department of Diagnostic Medicine/Pathobiology, Kansas State University.

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

Procedures

Procedures used in this study were approved by the Kansas State University Institutional Animal Care and Use Committee. A total of 1,035 finishing pigs (initially 79.4 lb) were used in an 84-d growth trial performed in a commercial research finishing barn. The barn, located in northeastern Kansas, was naturally ventilated and double curtain sided with completely slatted flooring. Barrows and gilts were comingled within pens in approximately equal numbers, with 23 to 27 pigs per pen (10 × 18 ft). Each pen was equipped with a double swinging waterer and a 3-hole dry self-feeder to allow ad libitum access to water and feed. An automated feeding system (FeedPro; Feedlogic Corp., Willmar, MN) was used in the barn to deliver and measure feed amounts added to individual pen feeders. Pens of pigs were blocked by average initial pig BW and randomly allotted to 1 of 4 dietary treatments, resulting in 10 replicate pens per treatment. Initial weight and gender distribution were balanced across the 4 dietary treatment groups. Dietary treatments were increasing levels (0%, 12.5%, 25%, and 37.5%) of hominy feed. A sample of the hominy feed was collected and analyzed for DM, CP, ADF, NDF, crude fiber, ash, Ca, P, and fat (Table 1). Metabolizable energy was calculated using the following equations:

$$GE = 4{,}143 + (56 \times \%\ \text{ether extract}) + (15 \times \%\ CP) - (44 \times \%\ \text{Ash})$$ [4]

$$DE = 949 + (0.789 \times GE) - (43 \times \%\ \text{Ash}) - (41 \times \%\ NDF)$$ [5]

$$ME = DE \times (1.003 - (0.0021 \times \%\ CP))$$ [5]

All diets were fed in 4 phases based on formulations for average pig weights of 80 to 130, 130 to 180, 180 to 230, and 230 to 310 lb (Tables 2 and 3). Pens of pigs were weighed and feed intake was collected on d 0, 12, 26, 40, 54, 70, and 84. From these data, ADG, ADFI, and F/G were calculated.

Data were analyzed as a randomized complete block design using the GLIMMIX procedure of SAS (SAS Institute Inc., Cary, NC) with pen as the experimental unit. Level of hominy feed was a fixed effect, and weight block was a random effect. Differences between treatments were determined by using least squares means ($P < 0.05$). The effects of increasing hominy feed in the diet were determined by linear and quadratic polynomial contrasts.

Results and Discussion

Of the 40 pens of pigs that were initially started on test, 5 pens were taken off test during the trial, and data for these pens after removal were managed as missing observations in the analysis (Table 4). Reasons for pen removal included diet delivery errors or loss of pen integrity due to pigs from 2 pens becoming mixed during the trial.

From d 0 to 84 as the level of corn hominy feed increased from 0 to 37.5%, ADG and ADFI decreased (linear; $P < 0.01$). There was no effect of hominy feed on F/G ($P > 0.35$). Weight on d 84 decreased (linear; $P < 0.01$) as more hominy feed was included in the

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[4] Ewan, R. C. 1989. Predicting the energy utilization of diets and feed ingredients by pigs. Pages 271-274 in Energy Metabolism, European Association of Animal Production Bulletin No. 43, Y. van der Honing and W. H. Close, eds. Pudoc Wageningen, Netherlands. As cited in NRC. 1998. Nutrient Requirements of Swine, 10th ed. Natl. Acad. Press, Washington, DC.

[5] Noblet, J., and J. M. Perez. 1993. Prediction of digestibility of nutrients and energy values of pig diets from chemical analysis. J. Anim. Sci. 71:3389-3398. As cited in NRC. 1998. Nutrient Requirements of Swine, 10th ed. Natl. Acad. Press, Washington, DC.

diet. At off test, these performance differences resulted in pigs fed diets containing 37.5% hominy feed weighing almost 15 lb less than pigs fed the diet without hominy feed.

Although these diets were formulated to a similar lysine percentage, the lysine:calorie ratio was allowed to vary because of initial best estimates of energy value for corn hominy feed. The NRC (1998) ME value of hominy feed (1,456 kcal/lb) was used for diet formulation. As hominy feed increased and corn quantity decreased, the calculated energy value of the diet decreased. Analysis of the corn hominy product used in this trial showed that this product had lower percentages of NDF, ADF, and fat than the NRC (1998) reported values for hominy feed. This product appears to have ADF, NDF, and fat content closer to the NRC (1998) published values for corn (2.9%, 9.6%, and 3.9%, respectively). It is assumed that the lower fiber content would raise the energy value of this product, compared with published values for corn hominy, but at least a portion of this energy advantage is lost because of the product's lower fat content. The calculated ME for the product used in this trial was 1,569 kcal/lb, which is slightly higher than the NRC (1998) published ME value for corn (1,551 kcal/lb). The similar energy values for corn and corn hominy in this trial explain why increasing corn hominy inclusion did not affect F/G. However, the decrease in growth rate and feed intake suggest that besides the energy content, there is some other factor associated with the hominy feed that could be affecting growth rate. One factor of concern is diet flowability. Out-of-feed events occurred during this trial because of diets bridging in the bins. Although it seemed that this occurred most with the diet containing high levels of corn hominy feed, the number of times diets bridged in the bins for each treatment was not recorded. These observations are noteworthy, and the feed interruptions likely affected growth performance; however, the severity of the effects of out-of-feed events is unknown. A second factor could be that the hominy feed may be affecting palatability of the diet and thus decreasing feed intake. This explanation seems less likely because hominy feed has been reported to be quite palatable.

These data indicate that increasing corn hominy feed in the diet reduced growth rate and feed consumption. Therefore, using corn hominy feed as an alternative ingredient to provide energy to swine diets is a viable option; however, a decrease in performance should be considered when deciding if it is cost-effective to include corn hominy feed in finishing diets.

Table 1. Analysis of corn hominy feed and NRC published values for hominy feed

Item, %	Analysis as-fed	Hominy feed[1]
DM	90.4	90
CP	9.5	10.3
Fat	4.4	6.7
ADF	3.6	8.1
NDF	10.0	28.5
CF	2.8	---
Ash	2.35	---
Ca	0.02	0.05
P	0.51	0.43

[1] NRC (1998) published values for corn grits by-product (hominy feed) on an as-fed basis.

Table 2. Phase 1 and 2 diet composition (as-fed basis)[1]

	Diet[2]			
	Phase 1		Phase 2	
Hominy feed, %:	0	37.5	0	37.5
Ingredient, %				
Corn	72.23	36.15	77.96	41.86
Soybean meal (46.5% CP)	25.59	24.20	20.01	18.62
Corn hominy feed	---	37.50	---	37.50
Monocalcium phosphate (21% P)	0.50	0.48	0.40	0.40
Limestone	0.88	0.88	0.88	0.88
Salt	0.35	0.35	0.35	0.35
Vitamin premix with phytase	0.15	0.15	0.13	0.13
Trace mineral premix	0.15	0.15	0.13	0.13
L-lysine HCl	0.15	0.15	0.15	0.15
Total	100.00	100.00	100.00	100.00
Calculated analysis				
SID[3] amino acids, %				
Lysine	0.96	0.96	0.82	0.82
Isoleucine:lysine	70	70	70	70
Leucine:lysine	155	152	166	162
Methionine:lysine	28	27	29	29
Met & Cys:lysine	57	56	61	59
Threonine:lysine	61	62	62	64
Tryptophan:lysine	19	20	19	20
Valine:lysine	79	81	81	83
SID Lysine:ME, g/Mcal	2.87	2.94	2.45	2.51
ME, kcal/lb[4]	1,516	1,481	1,519	1,484
Total lysine, %	1.08	1.09	0.93	0.93
CP, %	18.18	18.33	16.08	16.22
Ca, %	0.53	0.53	0.50	0.50
P, %	0.48	0.53	0.44	0.49
Available P, %	0.27	0.27	0.24	0.24

[1] Phase 1 diets were fed from approximately 80 to 130 lb; Phase 2 diets were fed from 130 to 180 lb.
[2] Treatment diets shown contain 0% or 37.5% hominy feed; additional diets contained 12.5% and 25.0% corn hominy.
[3] Standardized ileal digestible.
[4] The NRC (1998) ME value for hominy feed (1,456 kcal/lb) was used for diet formulation. Based on chemical analysis and subsequent calculation, the ME value of the hominy feed used in the trial was 1,569 kcal/lb. Therefore, the actual ME values for the diets containing 37.5% corn hominy were 1,523 and 1,526 kcal/lb for Phase 1 and 2 diets, respectively.

Table 3. Phase 3 and 4 diet composition (as-fed basis)[1]

	Diet[2]			
	Phase 3		Phase 4	
Hominy feed, %:	0	37.5	0	37.5
Ingredient, %				
Corn	81.99	45.89	85.17	49.07
Soybean meal (46.5% CP)	16.03	14.64	12.85	11.46
Corn hominy feed	---	37.50	---	37.50
Monocalcium phosphate (21% P)	0.48	0.45	0.50	0.45
Limestone	0.85	0.88	0.83	0.88
Salt	0.35	0.35	0.35	0.35
Vitamin premix with phytase	0.08	0.08	0.08	0.08
Trace mineral premix	0.08	0.08	0.08	0.08
L-lysine HCl	0.15	0.15	0.15	0.15
Total	100.00	100.00	100.00	100.00
Calculated analysis				
SID[3] amino acids, %				
Lysine	0.72	0.72	0.64	0.64
Isoleucine:lysine	71	71	71	71
Leucine:lysine	176	171	187	181
Methionine:lysine	31	31	33	32
Met & Cys:lysine	64	62	67	65
Threonine:lysine	63	65	64	66
Tryptophan:lysine	19	19	18	19
Valine:lysine	83	86	85	88
SID Lysine:ME, g/Mcal	2.15	2.20	1.91	1.95
Metabolizable energy, kcal/lb[4]	1,521	1,485	1,521	1,486
Total lysine, %	0.82	0.82	0.73	0.73
CP, %	14.57	14.71	13.36	13.50
Ca, %	0.49	0.49	0.48	0.48
P, %	0.44	0.49	0.43	0.47
Available P, %	0.22	0.22	0.22	0.22

[1] Phase 3 diets were fed from approximately 180 to 230 lb; Phase 4 diets were fed from 230 to 310 lb.
[2] Treatment diets shown contain 0% or 37.5% hominy feed; additional diets contained 12.5% and 25.0% corn hominy.
[3] Standardized ileal digestible.
[4] The NRC (1998) ME value for hominy feed (1,456 kcal/lb) was used for diet formulation. Based on chemical analysis and subsequent calculation, the ME value of the hominy feed used in the trial was 1,569 kcal/lb. Therefore, the actual ME values for the diets containing 37.5% corn hominy were 1,528 and 1,528 kcal/lb for Phase 3 and 4 diets, respectively.

Table 4. Effect of corn hominy feed inclusion in swine diets on growth performance of finishing pigs[1]

	Corn hominy feed, %					Probability, *P* <	
Item	0.0	12.5	25.0	37.5	SEM[2]	Linear	Quadratic
Pen numbers[3]							
Pen count (d 0)	10	10	10	10	---	---	---
Pen count (d 84)	8	9	10	8	---	---	---
d 0 to 84							
ADG, lb	2.24	2.13	2.11	2.05	0.02	<0.01	0.19
ADFI, lb	6.32	5.90	5.91	5.72	0.09	<0.01	0.18
F/G	2.82	2.78	2.80	2.78	0.03	0.35	0.64
Weight, lb							
d 0	79.4	78.8	79.4	79.6	2.0	0.68	0.49
d 84	268.2	257.8	258.9	253.3	2.6	<0.01	0.21

[1] Initially, a total of 1,035 pigs (barrows and gilts) were used with 23 to 27 pigs per pen and 10 pens per treatment.
[2] SEM among treatment groups differed because of missing observations. The highest SEM among the treatment groups is reported.
[3] Pens were removed from test because of diet delivery error or loss of pen integrity.