Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 10 *Swine Day (1968-2014)*

Article 715

1996

The effect of ingredient processing and diet complexity on growth performance of the segregated early-weaned pig

K Hongtrakul

J R. Bergstrom

I H. Kim

W B. Nessmith

See next page for additional authors

Recommended Citation

Hongtrakul, K; Bergstrom, J R.; Kim, I H.; Nessmith, W B.; Goodband, Robert D.; Behnke, Keith C.; Tokach, Michael D.; and Nelssen, Jim L. (1996) "The effect of ingredient processing and diet complexity on growth performance of the segregated early-weaned pig," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 10. https://doi.org/10.4148/2378-5977.6555

The effect of ingredient processing and diet complexity on growth performance of the segregated early-weaned pig

Abstract

A 14-day growth trial was conducted to determine the interactive effects of ingredient processing and diet complexity on growth performance of segregated early-weaned pigs. Three processing combinations were used with either a simple or complex diet formulation in 2 x 3 factorial arrangement. Diets were pelleted (control); the corn was moist-extruded, then the complete diet pelleted (extruded); or the complete diet was expanded then pelleted (expanded). An interaction was observed between ingredient processing and diet complexity. Pigs fed the control or extruded diets had improved growth performance as diet complexity increased. However, pigs fed the expanded diets showed little response to increasing diet complexity. Under these experimental conditions, pigs fed moist-extruded corn had the best growth performance. However, further research is warranted to evaluate expander conditioning of complex starter diets.; Swine Day, Manhattan, KS, November 21, 1996

Keywords

Swine day, 1996; Kansas Agricultural Experiment Station contribution; no. 97-142-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 772; Swine; Segregated early-weaned pigs; Diet complexity; Feed processing

Authors

K Hongtrakul, J R. Bergstrom, I H. Kim, W B. Nessmith, Robert D. Goodband, Keith C. Behnke, Michael D. Tokach, and Jim L. Nelssen

THE EFFECT OF INGREDIENT PROCESSING AND DIET COMPLEXITY ON GROWTH PERFORMANCE OF THE SEGREGATED EARLY-WEANED PIG[1]

K. Hongtrakul, J. R. Bergstrom, R. D. Goodband, K. C. Behnke[2], I. H. Kim, W. B. Nessmith, M. D. Tokach, and J. L. Nelssen

Summary

A 14-day growth trial was conducted to determine the interactive effects of ingredient processing and diet complexity on growth performance of segregated early-weaned pigs. Three processing combinations were used with either a simple or complex diet formulation in 2 × 3 factorial arrangement. Diets were pelleted (control); the corn was moist-extruded, then the complete diet pelleted (extruded); or the complete diet was expanded then pelleted (expanded). An interaction was observed between ingredient processing and diet complexity. Pigs fed the control or extruded diets had improved growth performance as diet complexity increased. However, pigs fed the expanded diets showed little response to increasing diet complexity. Under these experimental conditions, pigs fed moist-extruded corn had the best growth performance. However, further research is warranted to evaluate expander conditioning of complex starter diets.

(Key Words: Segregated Early-Weaned Pigs, Diet Complexity, Feed Processing.)

Introduction

In a previous study, we evaluated extrusion processing of the carbohydrate source in diets for segregated early-weaned pigs. We observed no beneficial effects of extrusion processing on pig performance. Because previous experiments have reported positive effects of extrusion processing on starter pig performance, the objective of this study was to investigate possible interactive effects of different ingredient processing and diet complexity on pig growth performance.

Procedures

Three hundred and sixty high-lean growth potential high-health barrows were initially weaned at 10 ± 2 d of age and delivered to the segregated early weaning facilities at Kansas State University. The pigs were blocked by weight (initially 10 lb ± 1.0 lb) and allotted randomly to one of six experimental diets. Each treatment had five pigs per pen and 12 replications (pens). Treatments were arranged in a 3 × 2 factorial with main effects including ingredient processing and diet complexity. Processing treatments included a pelleted (3/32 in. diameter) diet (control), moist extrusion processing of only the corn, then pelleting of the complete diets (extruded), and expander conditioning of the complete diet followed by pelleting (expanded).

The extruder conditions were: 280°F barrel jacket temperature at the 8th head, 300 psig cone pressure, 5 lb/min retention time, and approximately 212°F exit temperature. Extruded corn then was mixed in the complex and simple diets and pelleted through a 3/32 in. die. The expander conditions were .9 ton/hr production rate, 175 psig cone pressure, and 130°F conditioner temperature. For all diets, the conditioner temperature of the pellet mill was 140°F.

[1]The authors thank Newsham Hybrids, Colorado Springs, CO, for providing the pigs used in this experiment.

[2]Department of Grain Science and Industry.

Diet complexity main effects included a relatively simple (1% spray-dried plasma protein and 15% dried whey) or complex (6% spray-dried plasma protein and 25% dried whey) diet (Table 1). All diets were formulated to 1.7% total lysine and .48% methionine, with all other amino acids above suggested estimates. Pigs were housed in 4 ft × 4 ft pens and allowed ad libitum access to water and feed. Pigs were weighed and feed disappearance was determined on d 7 and 14 postweaning. Average daily gain, ADFI, and F/G were the response criteria. In addition, fecal samples were collected on d 14 from at least three pigs per pen to calculate apparent digestibility of DM, CP, and energy.

Results and Discussion

From d 0 to 7 and 0 to 14 postweaning, ingredient processing by diet complexity interactions ($P<.10$) were observed (Table 2). These interactions appeared to be the results of a large improvement in growth performance as diet complexity increased for pigs fed either the control or extruded diets compared to a small improvement with increasing diet complexity for pigs fed the expanded diets.

From d 0 to 7 postweaning, pigs fed the complex diets had increased ($P<.05$) ADG and ADFI compared with those fed the simple diets. Diet complexity had no effect on F/G ($P>.10$). Pigs fed extruded corn had increased ADG and ADFI compared with those fed either the control or expanded diets. Pigs fed expanded diets had poorer F/G compared with those fed control or extruded diets ($P<.01$).

From d 7 to 14, no ingredient processing by diet complexity interactions were observed ($P>.10$). Pigs fed complex diets had increased ($P<.05$) ADG compared with those fed the simple diets. Average daily feed intake and F/G were not affected by diet complexity; however, pigs fed the complex diets had numerically better F/G than those fed the simple diets. Pigs fed extruded corn had increased ADG compared with those fed either the control or expanded diets. Average daily feed intake of pigs fed either the extruded corn or expanded diets was higher than that of pigs fed the control diet. As a result, F/G was best for pigs fed extruded corn, followed by control, and pigs fed the expanded diets had the poorest F/G.

For the overall study (d 0 to 14 postweaning), ingredient processing by diet complexity interactions were observed for ADG, ADFI, and F/G ($P<.10$). The interaction appeared to be a result of a large increase in ADG of pigs fed the control or extruded diets as diet complexity increased compared with a smaller increase for pigs fed the expanded diets. For ADFI, the interaction appeared to be the result of a large increase in ADFI for pigs fed the extruded and expanded diets compared with no change in feed intake for pigs fed the control diets as diet complexity increased. Finally, for F/G, the interaction appeared to be the result of improved efficiency of pigs fed the control and extruded diets as diet complexity increased compared with poorer F/G of pigs fed the expanded diets.

On d 14, fecal samples were collected from at least three of the pigs in each pen to calculate apparent digestibility of DM, CP and energy. No ingredient processing by diet complexity interactions were observed ($P>.10$). Pigs fed the complex diets had greater apparent digestibility of DM, CP, and energy than those fed simple diets. Pigs fed extruded diets had greater apparent digestibility of DM, CP, and energy than those fed either the control or expanded diets.

Under the ingredient processing conditions used in this experiment, pigs fed extruded corn had improved ADG and F/G compared with those fed control or expanded diets. Pigs fed expanded diets and extruded diets had similar ADFI; however, F/G for the former was much poorer. This was especially evident for those fed the complex diets. Because the complete diet was expanded, temperatures or other expander conditions may have negatively affected the milk products or specialty protein sources contained in the diet. Therefore, further research is warranted to evaluate expander conditioning in

association with complex starter diets. Furthermore, the beneficial response observed to extrusion processing of the corn in this study and variable results in others may be explained by correlations between extruder conditions (degree of cook) and growth performance.

Table 1. Compositions of Experimental Diets[a]

Ingredient, %	Complex	Simple
Corn	31.96	37.17
Dried whey	25.00	15.00
Plasma protein	6.00	1.00
Fish meal	6.00	4.00
Soybean meal	14.70	33.73
Soybean oil	6.00	4.00
Lactose	5.00	---
Spray-dried blood meal	1.75	1.00
Monocalcium phosphate	.76	1.09
Limestone	.45	.68
Zinc oxide	.38	.38
Vitamin premix	.25	.25
Lysine-HCL	.15	.15
Methionine	.15	.10
Trace minerals	.15	.15
Salt	.10	.10
Antibiotic[b]	1.00	1.00
Cromic oxide	.20	.20
Total	100.00	100.00

[a]All diets were formulated to contain 1.70% lysine, .48% methionine, .90% Ca, and .80% P. Complex and simple diets were either pelleted (control); the corn was extruded, then the complete diet was pelleted (extruded); or the complete diet was expanded then pelleted (expanded) to provide the experimental treatments. Diets were fed from weaning to d 14.
[b]Provided 50 g/ton carbadox.

Table 2. The Effects of Ingredient Processing and Diet Complexity on Weanling Pig Growth Performance[a]

	Simple			Complex			
Item	Control	Extruded	Expanded	Control	Extruded	Expanded	CV
d 0 to 7							
ADG, lb[bcd]	.35	.38	.35	.36	.47	.38	17.77
ADFI, lb[bcd]	.31	.33	.34	.32	.40	.39	13.24
F/G[c]	.89	.87	.97	.89	.85	1.03	16.62
d 7 to 14							
ADG, lb[bc]	.66	.75	.63	.73	.87	.66	13.27
ADFI, lb[c]	.80	.82	.84	.77	.90	.87	11.65
F/G[c]	1.21	1.09	1.33	1.05	1.03	1.32	11.62
d 0 to 14							
ADG, lb[bcd]	.50	.57	.49	.54	.67	.51	11.32
ADFI, lb[bcd]	.55	.57	.59	.54	.65	.63	10.39
F/G[bcd]	1.10	1.00	1.20	1.00	.97	1.24	8.21
Apparent digestibility, %							
DM[bc]	89.88	90.94	90.07	93.48	94.03	93.22	.99
N[bc]	85.78	88.44	86.75	90.37	91.27	90.30	1.91
DE[bc]	90.39	91.73	90.67	93.76	94.58	93.73	.99

[a]Three hundred sixty weaning pigs (initially 10 ± 1.0 lb and 10 ± 2 d of age), five pigs/pen, 12 pens/treatment. All diets were pelleted through a 3/32 inch die. Complex and simple diets were either pelleted (control); the corn was extruded, then the complete diet was pelleted (extruded); or the complete diet was expended then pelleted (expanded) to provide the experimental treatments. Diets were fed from weaning to d 14.
[b]Complexity effect ($P < .05$).
[c]Processing effect ($P < .01$).
[d]Complexity × processing interaction ($P < .10$).