Growth and Carcass Characteristics of High-Lean Finishing Pigs Fed Reduced Lysine Diets in Bedded Hoop Barns

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Introduction

Pork quality is an important attribute for niche pork markets. Diet and genetics are two important factors influencing growth performance and carcass characteristics of finishing pigs. It is well documented that matching dietary amino acids with genetic potential for growth is a sound strategy to maximize lean growth. The impact of underfeeding lysine and other amino acids on carcass quality attributes is less certain. The purpose of this study was to compare growth performance and carcass characteristics of market pigs fed reduced lysine diets in bedded hoop barns with the intended goal of improving intramuscular fat. This article reports the results from four trials conducted March 2015 through January 2016.

Materials and Methods

Pigs were housed and fed ad libitum in bedded hoop barns at the ISU Western Research and Demonstration Farm, Castana, Iowa. Growing pigs with a high lean-growth potential were sourced from the Iowa State University Swine Nutrition Farm. Pens of pigs were assigned to one of two dietary treatments fed in phase from 45–136 kg. The first dietary treatment was a corn-soybean meal-based finishing pig diet formulated to meet or exceed recommended standardized ileal digestible (SID) lysine concentration. The second dietary treatment also was a corn-soybean meal-based diet formulated to deliver 24 percent less SID lysine. All diets were formulated to meet calcium and phosphorus needs of the pigs. Composition and calculated analysis of diets are shown in Tables 1 and 2.

Two trials consisted of six pens of six barrows housed in three small-scale bedded hoop barns (6.0 × 10.8 m). Each test pen (3 × 6.1 m) had one water space and six feeder spaces. Pigs were weighed every 28 days to determine growth, and feed disappearance also was recorded. When pigs reached a market weight of 130–140 kg, they were scanned using real-time ultrasound to determine loin eye area (LEA) and back fat depth (BF).

Two trials consisted of three pens of barrows and three pens of gilts housed in three large-scale bedded hoop barns (9.1 × 18.3 m). Each pen (4.55 × 18.3 m) had two water spaces and 12 feeder spaces. Pens of pigs were randomly assigned to one of the two previously described dietary treatments.

Pigs were weighed every 28 days to determine growth, and feed disappearance also was recorded. When pigs reached a market weight of 120–125 kg, 36 pigs (6/pen) were scanned using real-time ultrasound to determine LEA and BF. Those same pigs were transported to Tyson, Storm Lake, Iowa, for processing. At slaughter, one loin from each pig was collected and transported to Iowa State University, Ames, Iowa, for evaluation.

Results and Discussion

Growth performance of finishing pigs housed in small-scale bedded hoop barns is summarized in Table 3. As expected, pigs underfed lysine grew slower and less efficiently. Average daily feed intake also was

lower for pigs underfed lysine. Backfat depth was not influenced by dietary treatment. There was a trend towards smaller loin muscle area for pigs underfed lysine. Season impacted growth and performance of pigs housed in the small-scale hoops with pigs fed during spring (March–May) growing faster and more efficiently. Pigs fed during spring were heavier at the start and end of the feeding period, making it difficult to determine if differences in growth are actually caused by seasonal differences.

Growth performance and loin quality characteristics of finishing pigs housed in large-scale, deep-bedded hoop barns are summarized in Table 4. Finishing pigs underfed lysine grew slower and less efficiently, with no detectable improvement in loin quality. There were seasonal differences in performance and loin quality, but these preliminary results should be interpreted with caution because of an unbalanced gender × diet × season assignment of pens.

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Table 1. Composition and calculated analysis of finishing pig diets containing recommended levels of SID lysine[a].

	Phase 1[b]	Phase 2[b]	Phase 3[b]
Ingredient			
Corn	77.55	81.55	85.45
Soybean meal	20.00	16.25	12.50
Salt	0.40	0.40	0.40
Ground limestone	0.95	0.90	0.85
Dicalcium phosphate	0.60	0.40	0.30
Vitamin mix	0.15	0.15	0.15
Trace mineral mix	0.15	0.15	0.15
Lysine HCl	0.20	0.20	0.20
Total	100.00	100.00	100.00
Calculated Analysis			
ME, kcal/kg	3,300	3,300	3,300
Crude protein, %	15.94	14.48	13.01
SID lysine, %	0.83	0.73	0.64
Ca:P	1.31	1.28	1.26

[a]NRC, 2012.
[b]Phase 1: 45–75 kg; Phase 2: 76–100 kg; Phase 3: 101–136 kg.

Table 2. Composition and calculated analysis of finishing pig diets containing reduced levels of SID lysine[a].

	Phase 1[b]	Phase 2[b]	Phase 3[b]
Ingredient			
Corn	85.00	81.55	91.65
Soybean meal	12.50	8.75	6.25
Salt	0.40	0.40	0.40
Ground limestone	0.95	0.90	0.85
Dicalcium phosphate	0.65	0.40	0.35
Vitamin mix	0.15	0.15	0.15
Trace mineral mix	0.15	0.15	0.15
Lysine HCl	0.20	0.20	0.20
Total	100.00	100.00	100.00
Calculated Analysis			
ME, kcal/kg	3,300	3,300	3,300
Crude protein, %	12.97	11.51	10.54
SID lysine, %	0.64	0.55	0.49
Ca:P	1.36	1.34	1.31

[a]Diets formulated to deliver 76% of NRC 2012 recommendation.
[b]Phase 1: 45–75 kg; Phase 2: 76–100 kg; Phase 3: 101–136 kg.

Table 3. Growth performance of finishing pigs housed in small-scale bedded hoop barns and fed low lysine diets[a,]

	Diet[b]		Season[c]			P-value	
	76%	100%	Fall	Spring	SEM	Diet	Season
Start wt, kg	54.20	53.71	42.20	65.71	0.40	0.41	< 0.0001
End wt, kg	133.20	139.00	127.58	144.62	1.29	0.0131	< 0.0001
ADG, kg	1.05	1.14	1.03	1.16	0.02	0.0056	0.0003
ADFI, kg	3.49	3.63	3.38	3.74	0.03	0.0107	< 0.0001
G:F	0.30	0.31	0.30	0.31	0.03	0.0114	0.1411
Backfat, cm	2.64	2.82	2.53	2.92	0.07	0.1055	0.0040
LMA, cm^2	44.84	47.43	44.76	47.50	1.15	0.0551	0.0449

[a]Six pens (3.0 × 6.0 m) within 3 small-scale hoop barns (6.0 × 10.8 m) per season.
[b]Diets formulated to deliver 76% or 100% of NRC 2012 recommendation.
[c]Fall = September–December; Spring = March–May.

Table 4. Growth performance and loin quality characteristics of finishing pigs housed in large-scale deep bedded hoop barns and fed low lysine diets[a]

	Diet[b]		Season[c]			P-value	
	76%	100%	Fall	Spring	SEM	Diet	Season
Start wt, kg	45.52	46.18	44.36	46.18	1.30	0.7295	0.1739
End wt, kg	123.52	125.52	124.10	124.79	1.76	0.4417	0.8386
ADG, kg	0.87	0.97	0.95	0.89	0.01	0.0004	0.0089
ADFI, kg	3.20	3.28	3.39	3.09	0.06	0.3123	0.9745
G:F	0.270	0.295	0.291	0.274	0.004	0.0059	0.0335
Backfat, cm	2.18	2.26	2.15	2.29	0.12	0.6696	0.4531
LMA, cm^2	42.00	45.52	45.10	42.43	0.96	0.0602	0.1472
FFL live basis, %	37.15	37.93	38.14	36.95	0.27	0.0781	0.0219
Marbling, % fat	2.19	2.07	1.82	2.45	0.11	0.4401	0.0070
Loin wt, kg	3.72	3.96	4.16	3.52	0.12	0.2016	0.0106
Loin purge, %	1.33	1.11	1.07	1.38	0.31	0.6163	0.5120
pH blade end	5.73	5.70	5.76	5.67	0.02	0.2415	0.0177
pH center	5.69	5.66	5.69	5.66	0.01	0.2209	0.0906
pH sirloin end	5.70	5.68	5.70	5.68	0.01	0.0283	0.0379
Color	3.04	2.98	2.87	3.14	0.11	0.7312	0.1465
Minolta-Hunter L blade end	554.45	54.27	53.24	55.49	0.59	0.8350	0.0391
Minolta-Hunter L center	51.09	51.38	50.27	52.20	0.58	0.7209	0.0617
Minolta-Hunter L sirloin end	51.11	52.34	50.18	53.28	0.28	0.0195	0.0003
Instron force, kg	5.89	5.91	6.21	5.59	0.18	0.9474	0.0603

[a]Six pens (4.55 × 18.3 m) within 3 large-scale hoop barns (9.1 × 18.3 m) per season.
[b]Diets formulated to deliver 76% or 100% of NRC 2012 recommendation.
[b]Fall = September–December; Spring = March–May.