Evaluation of Ractopamine HCl Feeding Programs on Growth Performance and Carcass Characteristics of Finishing Pigs[1]

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Summary

A total of 934 barrows and gilts (PIC 337 × 1050, initially 240 lb) were used in a 26-d experiment to evaluate the effect of different Ractopamine HCl (RAC) feeding programs on growth and carcass traits of finishing pigs. Treatments included a basal diet with (1) no RAC for 26 d (control), (2) 7.5 ppm RAC for 26 d (constant), (3) 5 ppm RAC for d 0 to 14 and 10 ppm for d 14 to 26 (step-up), and (4) RAC concentration increased daily from 5 ppm on d 0 to 10 ppm on 26 d by using the FEEDPro (Feedlogic Corp., Willmar, MN) system (curve). Each treatment had 10 pens with a similar number of barrows and gilts in each pen. From d 0 to 14, pigs fed diets containing RAC had greater ($P < 0.001$) ADG and better ($P < 0.001$) F/G than those fed the control diet. Pigs fed the constant or step-up RAC feeding methods had greater ($P < 0.04$) ADFI compared with those fed the control diet. From d 14 to 26, all RAC-fed pigs had greater ($P < 0.001$) ADG and better ($P < 0.001$) F/G than control pigs.

Overall, pigs fed diets containing RAC had improved ($P < 0.001$) ADG and better F/G than pigs fed the control diet. Pigs fed the step-up RAC program had greater ($P = 0.01$) ADG and better ($P = 0.02$) F/G than the constant RAC program. Pigs marketed on d 14 and 26 had heavier ($P < 0.001$) HCW when fed diets containing RAC compared with control pigs. Pigs fed constant RAC had greater ($P = 0.002$) carcass yield than control pigs. Pigs fed the constant RAC program also had greater ($P = 0.03$) loin depth on d 14 than control pigs. No differences were found in carcass traits among RAC treatments. Feeding RAC improved performance regardless of feeding method, but few differences were present among the RAC feeding programs in carcass weights or measurements.

Key words: feeding program, finishing pig, growth, Ractopamine HCl

Introduction

Ractopamine HCl (RAC; Paylean; Elanco Animal Health, Greenfield, IN) has been widely used to improve growth and carcass characteristics of late-finishing pigs. The maximal growth responses to feeding RAC occur during the initial feeding period, but these responses decline over time. The cause of the reduced performance to RAC over time is thought to be down-regulation of beta receptors. Although different RAC feeding strategies have been studied, data are not consistent on the ideal approach between a constant or step-up feeding method. With the application of automatic feeding system

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in swine barns, pigs can be fed following a curve, slowly increasing the RAC dosage through time. We hypothesized that gradually increasing RAC dosage on a daily basis may provide for an improved growth and economic return compared to constant or step-up feeding.

Procedures

All experimental procedures were approved by the Kansas State University Animal Care and Use Committee. The experiment was conducted in a commercial research finishing barn in southwestern Minnesota. The barn was naturally ventilated and double-curtain-sided. Pens had completely slatted flooring and deep pits for manure storage. Each pen was equipped with a 5-hole, stainless steel, dry self-feeder and a cup waterer for ad libitum access to feed and water. The barn had an automated feeding system (FeedPro; Feedlogic Corp., Willmar, MN) capable of delivering and measuring feed amounts added on an individual pen basis.

A total of 934 barrows and gilts (PIC 337 × 1050) averaging approximately 240 lb were used in a 26-d experiment with 22 to 24 pigs per pen and 10 pens per treatment. Pens were ranked by average pig weight, then allotted to 1 of 4 experimental treatments in a randomized design. Pigs had ad libitum access to feed and water. Treatments included a basal diet (Table 1) with (1) no RAC for 26 d (control), (2) 7.5 ppm RAC for 26 d (constant), (3) 5 ppm RAC from d 0 to 14 and 10 ppm from d 14 to 26 (step-up), and (4) RAC dosage increased daily from 5 ppm on d 0 to 10 ppm on 26 d by using the FeedPro system (curve). Average daily gain, ADFI, and F/G were determined by weighing pigs and measuring feed disappearance every 7 d.

According to the normal marketing procedure of the farm, the 9 heaviest pigs (determined visually) were topped from each pen on d 14 of trial. The rest of pigs, except cull (6 with umbilical rupture, 2 with tail bites, and 2 lame pigs) and light pigs (BW less than 200 lb; 4 pigs) that didn't meet the minimum acceptable packing plant specifications, were marketed on d 26. All pigs were tattooed with a specific pen identity to attribute carcass data back to the specific pen. All pigs were transported to JBS Swift and Company (Worthington, MN) for processing and data collection. Carcass yield, backfat, lean percentage, and loin depth were collected with pen as the experimental unit.

All data were analyzed using the MIXED procedure of SAS (SAS Institute, Inc., Cary, NC) with pen as the experimental unit for analysis. Pen was the experimental unit for backfat, loin depth, and lean percentage, for which HCW was used as a covariate. The main effects of different RAC feeding methods were compared.

Results and Discussion

From d 0 to 14, pigs fed diets containing RAC had improved ($P < 0.001$) ADG and F/G compared with control pigs (Table 2). In addition, constant and step-up RAC feeding programs had greater ($P < 0.04$) ADFI than the control fed pigs. No significant differences in growth performance were observed among the RAC feeding programs.

From d 14 to 26, regardless of feeding program, pigs fed diets containing RAC had better ($P < 0.001$) ADG and F/G than control-fed pigs; however, differences in growth performance were observed among RAC treatments. Pigs fed the step-up RAC program (10 ppm) had greater ($P < 0.001$) ADG and better ($P = 0.005$) F/G compared with those fed the constant RAC program (7.5 ppm); pigs fed the curve RAC program were intermediate.

Overall (d 0 to 26), pigs fed RAC had improved ($P < 0.001$) ADG and F/G. Additionally, pigs fed the step-up RAC program had greater ($P = 0.01$) ADG and better ($P = 0.02$) F/G than those fed the constant RAC program. No differences in growth were observed between pigs fed the RAC step-up and curve treatments. Due to the improved ADG for pigs fed RAC, final BW was heavier ($P < 0.001$) than pigs fed the control diet at the end of the trial.

For carcass characteristics, pigs fed diets containing RAC had heavier ($P < 0.001$) HCW than control pigs on d 14, 26, and for the combined data (Table 3). Additionally, pigs fed the constant RAC program had greater ($P = 0.002$) carcass yield compared with control pigs. Pigs marketed on d 14 had greater ($P = 0.03$) loin depth when fed Ractopamine than control pigs. Carcass traits among the 3 RAC feeding programs did not differ.

In conclusion, regardless of feeding method, pigs fed diets containing RAC had improved growth performance compared with those fed the control diet. Pigs fed the step-up RAC program had improved ADG and F/G from d 14 to 26 compared with pigs fed the constant RAC program. Pigs fed the RAC curve program had similar growth performance compared with other RAC feeding programs. In addition, feeding RAC resulted in heavier HCW, and pigs fed the constant RAC diet showed improved carcass yield compared with the control pigs.

Table 1. Composition of basal diet (as-fed basis)[1]

Item	
Ingredient, %	
Corn	62.40
Soybean meal (46.5% CP)	20.60
Dried distillers grains with solubles	15.00
Limestone	1.025
Salt	0.35
Vitamin and trace mineral premix	0.09
L-Threonine	0.06
Biolys (50% Lys)	0.475
Phytase[2]	0.005
Total	100.00
Calculated analysis	
Standardized ileal digestible (SID) amino acids, %	
Lysine	1.00
Isoleucine:lysine	66
Leucine:lysine	164
Methionine:lysine	29
Met & Cys:lysine	59
Threonine:lysine	65
Tryptophan:lysine	17.5
Valine:lysine	78
Total lysine, %	1.14
ME, kcal/lb	1,527
SID lysine:ME, g/Mcal	2.97
CP, %	19.4
Ca, %	0.48
Available P, %	0.21

[1] Ractopamine HCl (Paylean; Elanco Animal Health, Greenfield, IN) was added to provide the control diet (none), 7.5 ppm RAC for 26 d (constant), 5 ppm RAC for d 0 to 14 and 10 ppm for d 14 to 26 (step-up), and RAC concentration increased daily from 5 ppm on d 0 to 10 ppm on d 26 (curve).

[2] OptiPhos 2000 (Enzyvia LLC, Sheridan, IN) provided 0.12% available P.

Table 2. Effect of Ractopamine HCl (RAC) feeding program on growth performance of finishing pigs[1]

	Feeding program[2]				
Item	Control	Constant	Step-up	Curve	SEM
d 0 to14					
ADG, lb	1.83[a]	2.33[b]	2.38[b]	2.40[b]	0.06
ADFI, lb	5.40[a]	5.74[b]	5.74[b]	5.48[ab]	0.15
F/G	2.97[a]	2.47[b]	2.42[b]	2.30[b]	0.10
d 14 to 26					
ADG, lb	1.96[a]	2.19[b]	2.56[c]	2.39[bc]	0.10
ADFI, lb	6.54	6.14	6.27	6.45	0.21
F/G	3.37[a]	2.83[b]	2.46[c]	2.72[b]	0.13
d 0 to 26					
ADG, lb	1.87[a]	2.29[b]	2.44[c]	2.40[bc]	0.06
ADFI, lb	5.79	5.88	5.92	5.81	0.15
F/G	3.11[a]	2.57[b]	2.43[c]	2.44[bc]	0.07
BW[3], lb					
d 0	240.2	240.3	240.4	240.4	3.5
d 14 (before topping)	265.8[a]	273.0[b]	273.7[b]	274.0[b]	3.3
d 26	277.8[a]	288.7[b]	294.7[b]	292.8[b]	4.2

[a,b,c] Means on the same row with different superscripts differ ($P < 0.05$).

[1] A total of 934 pigs (PIC 337 × 1050, initially 240 lb) were used with 22 to 24 pigs per pen and 10 pens per treatment. Nine pigs were marketed per pen on d 14 of the experiment.

[2] Control = no RAC for 26 d; constant = 7.5 ppm RAC for 26 d; step-up = 5 ppm RAC from d 0 to 14 and 10 ppm from d 14 to 26; curve = RAC concentration increased daily from 5 ppm on d 0 to 10 ppm on d 26 using the FeedPro system.

[3] BW was obtained at farm site.

Table 3. Effect of Ractopamine HCl (RAC) feeding program on carcass traits of finishing pigs[1]

	Feeding program[2]				
Item	Control	Constant	Step-up	Curve	SEM
d 14 marketing					
Live wt, lb[3]	270.8	277.6	275.0	276.7	2.3
HCW, lb	201.4[a]	208.6[b]	206.0[b]	207.0[b]	1.7
Yield, %[4]	74.4[a]	75.1[b]	74.9[ab]	74.8[ab]	0.2
Backfat, in.[5]	0.67	0.67	0.69	0.66	0.02
Loin depth, in.[5]	2.20[a]	2.39[b]	2.24[ab]	2.24[ab]	0.05
Lean, %[5]	55.2	55.8	55.0	55.5	0.4
d 26 marketing[6]					
Live wt, lb[3]	269.3[a]	280.0[b]	281.3[b]	281.0[b]	2.5
HCW, lb	200.0[a]	211.3[b]	210.2[b]	210.1[b]	2.2
Yield, %[4]	74.3[a]	75.4[b]	74.7[ab]	74.8[ab]	0.3
Backfat, in.[5]	0.63	0.57	0.60	0.61	0.02
Loin depth, in.[5]	2.55	2.57	2.57	2.64	0.03
Lean, %[5]	56.9	57.0	56.7	57.0	0.6
Overall marketing[7]					
Live wt, lb[3]	270.0[a]	279.1[b]	278.8[b]	279.4[b]	2.1
HCW, lb	200.6[a]	210.2[b]	208.6[b]	208.9[b]	1.8
Yield, %[4]	74.3[a]	75.3[b]	74.8[ab]	74.8[ab]	0.2
Backfat, in.[5]	0.64	0.61	0.63	0.63	0.02
Loin depth, in.[5]	2.42	2.49	2.43	2.49	0.04
Lean, %[5]	56.3	56.5	56.0	56.4	0.4

[a,b,c] Means on the same row with different superscripts differ ($P < 0.05$).

[1] A total of 904 pigs (PIC 337 × 1050, initially 240 lb) were used for obtaining carcass data with 9 pigs per pen marketed on d 14 and the remaining pigs marketed on d 26.

[2] Control = no RAC for 26 d; constant = 7.5 ppm RAC for 26 d; step-up = 5 ppm RAC for d 0 to 14 and 10 ppm for d 14 to 26; curve = RAC concentration increased daily from 5 ppm on d 0 to 10 ppm on d 26 using the FeedPro system.

[3] Live wt was obtained at packing plant.

[4] Percentage yield was calculated by dividing HCW by live wt obtained at the packing plant.

[5] Values are adjusted to a common carcass weight.

[6] All pigs were marketed, except 14 cull or light pigs that included 4 pigs from treatment A, 5 pigs from treatment B, 3 pigs from treatment C, and 2 pigs from treatment D.

[7] Overall marketing data combines data from marketing group on d 14 and d 26.