Kansas Agricultural Experiment Station Research Reports

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

Article 952

2009

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Effects of Feeding Ractopamine HCl (Paylean) for Various Durations on Late-Finishing Pig Performance and Carcass Characteristics[1]

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Summary

A total of 627 pigs (241.5 lb) were used in a 21-d finishing trial to evaluate the effects of feeding ractopamine HCl (RAC; Paylean, Elanco Animal Health, Greenfield, IN) for different durations on growth performance and carcass characteristics. On d 0, pens of pigs containing both barrows and gilts in approximately equal numbers were blocked by average BW and randomly allotted to 1 of 3 dietary treatments (8 pens per treatment) with average initial weight balanced across treatments. Dietary treatments were feeding a control diet without RAC and feeding a diet containing 4.5 g/ton RAC for the last 14 or 21 d prior to marketing. Pens of pigs were weighed and feed intake was collected on d 0, 7, and 21 to calculate ADG, ADFI, and F/G. Carcass data were collected from the 4 heaviest pigs per pen marketed on d 7 and from all pigs marketed on d 21. Pigs fed RAC starting on d 0 gained faster ($P = 0.01$) and consumed less feed ($P = 0.01$) from d 0 to 7 than control pigs and pigs not yet fed RAC. From d 7 to 21, pigs started on RAC at d 7 had improved ($P \leq 0.04$) ADG and F/G compared with control pigs and pigs that remained on RAC. There was no difference ($P = 0.14$) in overall ADG between the treatment groups; however, ADFI was lower ($P < 0.01$) and F/G improved ($P < 0.01$) for pigs fed RAC, regardless of duration, compared with control pigs. There were no differences ($P \geq 0.32$) in overall live weight or HCW at market in this trial. Compared with control pigs, pigs fed RAC for 21 d had reduced ($P < 0.01$) backfat depth, increased ($P = 0.01$) loin depth, and improved ($P < 0.01$) percentage lean. Pigs fed RAC for 14 d had intermediate responses to these 2 treatments for loin and backfat depth but had a higher percentage lean than control pigs.

These data demonstrate that feeding RAC to pigs for 14 d reduced ADFI, improved F/G, and improved percentage lean compared with control pigs. Feeding RAC for an additional 7 d did not influence overall ADFI or F/G compared with feeding RAC for 14 d total but further improved percentage lean compared with feeding RAC for 14 d. Pigs fed RAC for 21 d had decreased backfat and increased loin depth compared with control pigs. This study demonstrates that for heavyweight pigs, F/G and ADFI responses are achieved with either duration of RAC feeding, but the magnitude of the carcass response to feeding RAC appears to be duration dependent.

Key words: carcass, growth, Paylean, ractopamine

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

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Introduction

Use of ractopamine HCl (RAC; Paylean, Elanco Animal Health, Greenfield, IN) in finishing pigs prior to market has been demonstrated to improve growth rate and carcass characteristics. Although many research trials have demonstrated the efficacy of RAC, few of these trials have been done at heavy market weights (greater than 240 lb). Ractopamine HCl, a β-adrenergic agonist, is labeled for use in swine diets during the last 45 to 90 lb of gain. When fed, it promotes lean growth rather than fat deposition by directing nutrients away from the fat toward muscle development. Because fat tissue deposition requires more energy than lean growth, increasing lean deposition leads to improved feed efficiency prior to market and a leaner carcass. Because of the impact of RAC on lean and fat deposition and the changing lean to fat deposition ratio as BW increases, pigs marketed at heavier weights may have a different magnitude of response to RAC feeding than pigs at lighter weights. Therefore, the objective of this trial was to determine the effects of feeding RAC for different durations prior to market on late commercial finishing pig performance and carcass characteristics for pigs marketed at a heavy weight.

Procedures

Procedures used in this study were approved by the Kansas State University Institutional Animal Care and Use Committee. A total of 627 commercial finishing pigs (initially 241.5 lb) were used in a 21-d study 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 in approximately equal numbers within each of 24 pens (10 × 18 ft), and pens initially contained 25 to 27 pigs. Each pen was equipped with a double swinging waterer and a 3-hole dry self-feeder, allowing for 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 3 treatments, resulting in 8 pens per treatment. Initial weights were balanced across the 3 treatment groups. Treatments were feeding a control diet without RAC and feeding a diet containing 4.5 g/ton RAC for the last 14 or 21 d prior to marketing (Table 1).

Pens of pigs were weighed and feed intake was collected on d 0, 7, and 21 (marketing day). From these data, ADG, ADFI, and F/G were calculated. On d 7, the 4 heaviest pigs per pen were marketed from each pen, with the balance of the pigs remaining on test until d 21. On d 21 of the trial, all pigs were marketed except the lightest pig from each pen. This allowed all pigs to be greater than 215 lb to meet the minimum acceptable weight for the packing plant specifications. Data from these lightweight pigs were included in the growth and performance calculations; however, these 24 pigs are not represented in the carcass data. To facilitate carcass data collection, pigs were tattooed according to pen number, and carcass data were collected for pigs marketed on both d 7 and 21.

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. Dietary treatment was a fixed effect, and weight block was a random effect. Backfat depth, loin depth, and percentage lean were adjusted to a common HCW. Percentage yield was

calculated by dividing the HCW total for each pen by the live weight obtained at the research barn prior to transport to the packing facility. Differences between treatments were determined by using least squares means ($P < 0.05$). In addition, for response criteria through d 7, comparisons between pigs not fed RAC (control and last 14-d RAC treatment) and pigs fed RAC (21-d RAC treatment) were made using contrast statements.

Results and Discussion

Within the first 7 d of the trial, pigs fed RAC starting on d 0 gained more ($P = 0.01$) and consumed less ($P = 0.01$) feed than control pigs and pigs not yet fed RAC (Table 2). This resulted in an improvement ($P < 0.01$) in F/G for d 0 to 7 and a trend ($P = 0.08$) toward heavier d-7 weights for pigs fed RAC compared with those not fed RAC.

From d 7 to 21, pigs started on RAC on d 7 had improved ($P < 0.04$) ADG and F/G compared with control pigs and pigs that remained on RAC. There was no difference ($P \geq 0.12$) in ADG or F/G between the control pigs and pigs that received RAC for 21 d; however, d 7 to 21 feed intake was similar ($P = 0.29$) for pigs consuming RAC and lower ($P < 0.01$) than intake of control pigs.

Because of the fluctuation in gain response and the excellent growth rates of pigs fed the control diet, there was no difference ($P = 0.14$) in overall ADG between the three treatment groups, although rate of gain was numerically better for RAC-fed pigs. Compared with control pigs, ADFI was lower ($P < 0.01$) and F/G improved ($P < 0.01$) for pigs fed RAC, regardless of duration. Therefore, the improvement in F/G found in this trial was largely driven by the reduced feed consumption when RAC was fed, as overall gain was similar across the 3 treatment groups.

Evaluation of carcass characteristics of the 4 heaviest pigs per pen marketed on d 7 and remaining pigs marketed on d 21 showed that there was no difference ($P \geq 0.23$) in live weight or HCW of pigs marketed, regardless of treatment (Table 3). By d 7, pigs fed diets containing RAC were leaner ($P < 0.01$) and had greater ($P < 0.01$) loin depth than pigs not fed RAC. On d 21, pigs fed RAC for the last 14 or 21 d prior to market had greater ($P < 0.01$) percentage lean than control pigs. Compared with control pigs, the pigs fed RAC for 21 d had lower ($P < 0.05$) backfat depth. Pigs fed RAC for the last 14 d had backfat depths that were intermediate between control pigs and pigs fed RAC for 21 d.

Overall, there were no differences ($P \geq 0.32$) in live weight or HCW at market. Pigs fed RAC for 21 d had greater ($P = 0.02$) yield than pigs fed RAC for 14 d, whereas the control pigs were intermediate. Pigs fed RAC for 21 d had reduced ($P < 0.01$) backfat depth, increased ($P = 0.01$) loin depth, and improved ($P < 0.01$) percentage lean of carcasses compared with control pigs. Pigs fed RAC for 14 d had intermediate responses to these 2 treatments for loin and backfat depth and had a greater ($P = 0.04$) percentage lean compared with control pigs.

These data demonstrate that feeding RAC to pigs reduced feed intake and improved F/G compared with not feeding RAC. In addition, it appears that the majority of the

benefit in F/G was captured within the first 7 to 14 d of feeding duration. In this trial, improvements in carcass composition were achieved by feeding RAC for a short duration of 7 d in heavyweight pigs. However, improvements to carcass characteristics in the 14-d RAC treatment were intermediate between those of the control and 21-d RAC treatment groups, suggesting that the magnitude of carcass improvement is increased with longer feeding durations. Therefore, these factors and the cost of the product should be evaluated before deciding upon use or duration of including RAC in swine diets prior to market.

Pigs in this study were in the final stages of growth, when ADG decreases and fat deposition is increasing relative to lean tissue growth. Energy requirements to produce fat and lean tissue are different, as lean tissue requires less energy to deposit than fat. When RAC is fed, more nutrients are used to produce lean tissue than fat tissue, which decreases energy requirements and drops feed intake. The maintained growth during this period was achieved with lower feed consumption; thus, F/G was improved. Also, findings from this study indicate that lean deposition was increased by RAC feeding, suggesting that carcass traits can be influenced at later stages of maturity.

Given the rising cost of feed, RAC still could be considered as a tool to help improve feed efficiency and carcass value. This study demonstrates that for heavyweight pigs, F/G and ADFI responses are achieved with either duration of RAC feeding, but the magnitude of the carcass response to feeding RAC appears to be duration dependent.

Table 1. Diet composition (as-fed basis)

Ingredient,%	Control[1]	Ractopamine HCl[2]
Corn	55.76	44.20
Soybean meal (46.5% CP)	4.44	15.97
Beef tallow	1.00	1.00
Limestone	0.70	0.70
Salt	0.30	0.30
Vitamin premix with phytase	0.06	0.06
Trace mineral premix	0.06	0.06
L-lysine HCl	0.18	0.18
Ractopamine HCl (9 g/lb)	---	0.03
Fortified hominy	37.50	37.50
Phytase 600	0.01	0.01
Total	100.00	100.00
Calculated analysis		
SID[3] amino acid, %		
Lysine	0.64	0.93
Isoleucine:lysine	73	71
Leucine:lysine	193	162
Methionine:lysine	38	32
Met & Cys:lysine	74	62
Threonine:lysine	66	62
Tryptophan:lysine	18	19
Valine:lysine	92	84
SID Lysine:ME, g/Mcal	1.91	2.79
ME, kcal/lb	1,517	1,514
Total lysine, %	0.74	1.06
CP, %	14.48	18.86
Ca, %	0.53	0.56
P, %	0.48	0.52
Available P, %	0.21	0.22

[1] Control diets formulated for average weight range of 240 to 280 lb.
[2] Diets contained ractopamine HCl at 4.5 g/ton.
[3] Standardized ileal digestible.

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

	Feeding period				Probability, $P <$	
Item	Control[2]	Last 14 d[3]	Last 21 d[4]	SEM	Treatment	Contrast
d 0 to 7						
Initial wt, lb	241.6	241.5	241.5	2.8	1.00	0.97
ADG, lb[5]	2.29[a]	2.40[ab]	2.78[b]	0.13	0.04	0.01
ADFI, lb[5]	7.90[a]	7.89[a]	7.49[b]	0.12	0.04	0.01
F/G[5]	3.52[a]	3.34[a]	2.73[b]	0.14	<0.01	<0.01
d 7 wt, lb	257.7	258.4	260.9	2.6	0.20	0.08
d 7 to 21[6]						
ADG, lb	2.08[a]	2.25[b]	1.95[a]	0.06	<0.01	---
ADFI, lb	7.69[a]	7.09[b]	6.91[b]	0.15	<0.01	---
F/G	3.70[a]	3.17[b]	3.56[a]	0.09	<0.01	---
d 0 to 21						
ADG, lb	2.16	2.31	2.26	0.07	0.14	---
ADFI, lb	7.77[a]	7.39[b]	7.12[b]	0.12	<0.01	---
F/G	3.62[a]	3.22[b]	3.17[b]	0.08	<0.01	---
Final wt, lb	279.6	283.4	281.1	3.0	0.37	---

[1] A total of 627 pigs (barrows and gilts) were used with 25 to 27 pigs per pen and 8 pens per treatment.
[2] Pigs in the control treatment group were fed a diet without RAC.
[3] Pigs were fed the control diet until d 7 and then fed a diet containing 4.5 g/ton RAC until d 21.
[4] Pigs were fed a diet containing 4.5 g/ton RAC for 21 d.
[5] Control and last 14 d vs. last 21 d ($P < 0.05$).
[6] On d 7, the 4 heaviest pigs per pen were removed and marketed.
[ab] Within a row, means without a common superscript differ ($P < 0.05$).

Table 3. Effect of ractopamine HCl (RAC) on carcass characteristics of finishing pigs[1]

	Feeding period				Probability, $P <$	
Item	Control[2]	Last 14 d[3]	Last 21 d[4]	SEM	Treatment	Contrast
d 7 marketing[5,6,7]						
Live wt, lb[8]	297.7	294.1	300.7	5.0	0.64	0.43
HCW, lb[8]	222.0	219.0	225.0	3.8	0.46	0.29
Yield, %[8]	74.6	74.5	74.8	0.3	0.30	0.15
Lean, %[8]	51.9[a]	51.6[a]	52.8[b]	0.2	<0.01	<0.01
Backfat depth, mm[8]	20.3	21.3	19.8	0.6	0.28	0.22
Loin depth, mm[8]	59.7[a]	59.6[a]	63.7[b]	0.9	<0.01	<0.01
d 21 marketing[6,7,9]						
Live wt, lb	282.8	287.3	284.1	3.0	0.23	---
HCW, lb	212.7	215.2	214.8	2.4	0.33	---
Yield, %	75.2[ab]	74.9[a]	75.6[b]	0.2	0.05	---
Lean, %	51.6[a]	52.3[b]	52.5[b]	0.2	<0.01	---
Backfat depth, mm	22.2[a]	21.1[ab]	20.3[b]	0.4	0.02	---
Loin depth, mm	60.1	61.5	61.6	0.7	0.14	---
Overall marketing[6,7,10]						
Live wt, lb	285.2	288.2	286.8	2.9	0.43	---
HCW, lb	214.2	215.8	216.4	2.3	0.32	---
Yield, %	75.1[ab]	74.9[a]	75.4[b]	0.2	0.05	---
Lean, %	51.6[a]	52.2[b]	52.6[b]	0.2	<0.01	---
Backfat depth, mm	22.0[a]	21.1[ab]	20.2[b]	0.4	0.03	---
Loin depth, mm	59.9[a]	61.2[ab]	62.0[b]	0.7	0.04	---

[1] A total of 602 pigs (barrows and gilts; 8 pens/treatment) are represented in this carcass data.
[2] Pigs in the control treatment group were fed a diet without RAC.
[3] Pigs were fed the control diet until d 7 and then fed a diet containing 4.5 g/ton RAC until d 21.
[4] Pigs were fed a diet containing 4.5 g/ton RAC for 21 d.
[5] On d 7, the 4 heaviest pigs per pen were removed and marketed.
[6] Percentage lean, backfat depth, and loin depth were adjusted to a common HCW.
[7] Percentage yield was calculated by dividing HCW by live weight obtained prior to transport to the packing plant.
[8] Control and last 14 d vs. last 21 d ($P < 0.05$).
[9] On d 21, all but the single lightest pig in the pen were marketed.
[10] Overall marketing data combines data from all pigs marketed on d 7 and 21.
[ab] Within a row, means without a common superscript differ ($P < 0.05$).