

Kansas Agricultural Experiment Station Research Reports

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

Article 1171

2008

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J R. Bergstrom

Terry A. Houser

Michael D. Tokach

See next page for additional authors

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Recommended Citation

Bergstrom, J R.; Houser, Terry A.; Tokach, Michael D.; Gunderson, J A.; Gipe, A N.; Jacela, J; Benz, J M.; Sulabo, R C.; Nelssen, Jim L.; DeRouchey, Joel M.; Goodband, Robert D.; and Dritz, Steven S. (2008) "Effects of ractopamine hcl (paylean) and α -lipoic acid on the growth performance and carcass characteristics of finishing pigs," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 10. <https://doi.org/10.4148/2378-5977.7011>

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Effects of ractopamine hcl (paylean) and α -lipoic acid on the growth performance and carcass characteristics of finishing pigs

Authors

J R. Bergstrom, Terry A. Houser, Michael D. Tokach, J A. Gunderson, A N. Gipe, J Jacela, J M. Benz, R C. Sulabo, Jim L. Nelssen, Joel M. DeRouchey, Robert D. Goodband, and Steven S. Dritz

EFFECTS OF RACTOPAMINE HCL (PAYLEAN) AND α -LIPOIC ACID ON THE GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF FINISHING PIGS

J. R. Bergstrom, J. L. Nelssen, T. Houser, M. D. Tokach, J. A. Gunderson, A. N. Gipe, J. Jacela¹, J. M. Benz, R. C. Sulabo, J. M. DeRouchey, R. D. Goodband, and S. S. Dritz¹

Summary

A total of 48 gilts (initially 211 lb) were used to evaluate the effects of ractopamine HCl and α -lipoic acid on finishing pig performance and carcass characteristics. Pigs were blocked by weight and randomly allotted to 1 of 4 dietary treatments in a 22-d experiment. Pigs were fed corn-soybean meal-based diets. Treatments were arranged as a 2×2 factorial with main effects of ractopamine HCl (0 or 9 g/ton) and α -lipoic acid (0 or 300 ppm). For overall growth performance (d 0 to 22), ADG tended ($P < 0.09$) to be greater for pigs fed ractopamine HCl. Although F/G improved ($P < 0.01$) for pigs fed ractopamine HCl, there was a trend ($P < 0.07$) for an interaction between ractopamine HCl and α -lipoic acid. For pigs fed diets without ractopamine HCl, added α -lipoic acid numerically improved F/G, whereas in pigs fed ractopamine HCl, added α -lipoic acid numerically worsened F/G. Average final weight tended ($P < 0.06$) to be greater for pigs fed ractopamine HCl. No other differences in growth performance were observed. For the comparison of carcass characteristics, average live weight, HCW, yield, loin eye area at the 10th rib, and standardized fat-free lean were increased ($P < 0.04$) for pigs fed ractopamine HCl. Average backfat thickness tended ($P < 0.06$) to decrease for pigs fed

ractopamine HCl. Tenth-rib backfat increased ($P < 0.05$) for pigs fed α -lipoic acid, and the percent fat-free lean of pigs fed α -lipoic acid tended ($P < 0.10$) to decrease as a result. In conclusion, the growth performance and carcass characteristics of pigs fed ractopamine HCl were improved. Feeding 300 ppm of α -lipoic acid did not affect growth performance but did tend to increase carcass fat content.

Key words: carcass characteristics, finishing pigs, ractopamine HCl

Introduction

Ractopamine HCl (Paylean, Elanco Animal Health, Indianapolis, IN) is commonly fed to late-finishing pigs to improve growth rate, feed efficiency, and carcass lean. A vast amount of research and field data supports the appropriate use of this compound in feeding programs.

Alpha-lipoic acid is an antioxidant compound that has been demonstrated to reduce carcass fat in male mice and increase muscle pH values 20 min and 24 h postmortem. Similar improvements in postmortem muscle pH have been reported for pigs. This probably occurs because α -lipoic acid enhances the action of insulin, which increases the intramus-

¹ Food Animal Health and Management Center, College of Veterinary Medicine, Kansas State University.

cular uptake of glucose that can be stored as glycogen. Thus, recent studies in pigs have demonstrated the potential of α -lipoic acid to enhance pork quality. Supplemental α -lipoic acid could potentially enhance amino acid deposition in muscle as well, resulting in improvements in the proportion and quality of lean in pork. Studies to evaluate the potential effects of supplemental α -lipoic acid on the growth performance and carcass characteristics of pigs are lacking.

Therefore, our objective was to evaluate the effects of feeding α -lipoic acid to finishing pigs for 22 d prior to slaughter on growth performance and carcass characteristics. Additionally, we hoped to determine whether an independent response to α -lipoic acid would result in an additive or synergistic benefit to ractopamine HCl.

Procedures

Procedures used in this experiment were approved by the Kansas State University (KSU) Institutional Animal Care and Use Committee. The project was conducted at the KSU Swine Teaching and Research Farm. Pigs were housed in an environmentally regulated finishing building with pens over a totally slatted floor that provided approximately 8 ft² per pig. Each pen was equipped with a dry self-feeder and 1 nipple waterer, providing ad libitum access to feed and water. The facility was a mechanically ventilated room with a pull-plug manure storage pit.

Forty-eight gilts (PIC TR4 $\times$ C22) averaging 211 lb were used in this study. Pigs were blocked by weight and randomly allotted to 1 of 4 dietary treatments. There were 2 pigs per pen and 6 pens per treatment. Experimental diets were fed in meal form with 9 g/ton ractopamine HCl, 300 ppm α -lipoic acid, or both added to a control diet at the expense of corn starch to achieve the dietary treatments (Table 1). This provided a 2 $\times$ 2 factorial arrangement of treatments. Pigs and feeders were weighed on d 0, 7, 14, and 22 to determine the

growth performance criteria of ADG, ADFI, and F/G.

Table 1. Diet composition^{1,2}

Ingredient	%
Corn	72.17
Soybean meal (46.5% CP)	25.22
Monocalcium P (21% P)	0.45
Limestone	0.85
Salt	0.35
L-lysine HCl	0.15
Vitamin premix	0.08
Trace mineral premix	0.08
Corn starch	0.65
Total	100.00
Calculated analysis	
Standardized ileal digestible amino acids	
Lysine, %	0.95
Isoleucine:lysine ratio, %	70
Leucine:lysine ratio, %	156
Methionine:lysine ratio, %	28
Met & Cys:lysine ratio, %	57
Threonine:lysine ratio, %	61
Tryptophan:lysine ratio, %	19
Valine:lysine ratio, %	79
Lysine:ME ratio, g/Mcal	2.84
CP, %	18.0
Total lysine, %	1.07
ME, kcal/lb	1,519
Ca, %	0.51
P, %	0.47
Available P, %	0.16

¹ Experimental diets fed for 22 d before slaughter.

² 0.05% Paylean (ractopamine HCl), 0.60% of a 5% α -lipoic acid premix containing wheat-mids, or their combination replaced corn starch in the control diet to achieve the dietary treatments.

On d 23, 1 pig per pen was transported to the KSU meats lab for humane slaughter and collection of carcass data. Hot carcass weights were collected immediately after evisceration. First-rib, tenth-rib, last-rib, and last-lumbar backfat depth as well as loin eye area at the 10th rib were collected from the right half of each carcass 24 h postmortem.

Data were analyzed as a randomized complete block design by using the PROC MIXED procedure of SAS with pen as the ex-

perimental unit. Least squares means were used to determine the differences and possible interactions among treatments.

Results and Discussion

For overall growth performance (d 0 to 22), ADG tended ($P < 0.09$) to be greater for pigs fed ractopamine HCl (Tables 2 and 3). Although F/G improved ($P < 0.01$) for pigs fed ractopamine HCl, there was a trend ($P < 0.07$) for an interaction between ractopamine HCl and α -lipoic acid. Pigs fed the α -lipoic acid diet without ractopamine HCl had numerically better F/G than pigs fed the control, but pigs fed α -lipoic acid with ractopamine HCl had numerically poorer F/G than pigs fed ractopamine HCl only. Average final weight tended ($P < 0.06$) to be greater for pigs fed ractopamine HCl. No other differences in growth performance were observed.

For the comparison of carcass characteristics, average live weight, HCW, yield, loin eye area at the 10th rib, and standardized fat-free lean were increased ($P < 0.04$) for pigs fed ractopamine HCl. Average backfat depth tended ($P < 0.06$) to decrease for pigs fed ractopamine HCl. Tenth-rib backfat increased ($P < 0.05$) for pigs fed α -lipoic acid, and the percent fat-free lean of pigs fed α -lipoic acid tended ($P < 0.10$) to decrease as a result.

In conclusion, the improved performance and carcass characteristics observed for pigs fed ractopamine HCl agree with previous research. Feeding 300 ppm of α -lipoic acid did not affect growth performance but did tend to increase carcass fat content.

Table 2. Growth performance and carcass characteristics of pigs fed ractopamine HCl (Paylean) and α -lipoic acid—interactive means¹

Item	0 g/ton Paylean		9 g/ton Paylean		SE Mean	Probability, $P <$		
	0 ppm α -lipoic acid	300 ppm α -lipoic acid	0 ppm α -lipoic acid	300 ppm α -lipoic acid		Paylean $\times$ α -Lipoic acid	Paylean	α -Lipoic acid
Growth performance, d 0 to 22								
Initial wt, lb	211	211	211	211	3.00	---	---	---
ADG, lb	1.99	2.22	2.48	2.35	0.16	---	0.09	---
ADFI, lb	5.61	6.08	5.89	5.81	0.31	---	---	---
F/G	2.84	2.70	2.33	2.52	0.10	0.07	0.01	---
Final wt, lb	256	261	269	264	4.46	---	0.06	---
Carcass characteristics								
Live wt, lb	255	260	265	266	3.99	---	0.04	---
HCW, lb	179	184	190	194	2.94	---	0.01	---
Yield, %	70.4	70.8	71.7	72.9	0.64	---	0.02	---
Average backfat thickness, in.	0.86	0.89	0.72	0.83	0.05	---	0.06	---
10th rib fat depth, in.	0.57	0.73	0.50	0.61	0.06	---	---	0.05
Loin eye area, in. ²	7.58	7.28	8.32	8.30	0.35	---	0.03	---
Standardized fat-free lean, lb	102	100	111	110	1.96	---	0.01	---
Fat-free lean index, %	57.1	54.4	58.5	57.0	1.15	---	---	0.10

¹ A total of 48 gilts (PIC TR4 × C22), with 2 pigs per pen and 2 pens per treatment, were used for comparing growth performance. Carcass data were obtained from 1 pig per pen for the determination of carcass characteristics.

Table 3. Growth performance and carcass characteristics of pigs fed ractopamine HCl (Paylean) and α -lipoic acid—main effects¹

	Paylean, g/ton		α -lipoic acid, ppm		SE Mean	Probability $P <$		
Item	0	9	0	300		Paylean $\times$ α -Lipoic acid	Paylean	α -Lipoic acid
Growth performance, d 0 to 22								
Initial wt, lb	211	211	211	211	3.00	---	---	---
ADG, lb	2.11	2.42	2.24	2.29	0.16	---	0.09	---
ADFI, lb	5.85	5.85	5.75	5.95	0.31	---	---	---
F/G	2.77	2.43	2.59	2.61	0.10	0.07	0.01	---
Final wt, lb	259	267	263	263	4.46	---	0.06	---
Carcass characteristics								
Live wt, lb	258	266	260	263	3.99	---	0.04	---
HCW, lb	182	192	185	189	2.94	---	0.01	---
Yield, %	70.6	72.3	71.1	71.9	0.64	---	0.02	---
Average backfat thickness, in.	0.88	0.78	0.79	0.86	0.05	---	0.06	---
10th rib fat depth, in.	0.65	0.56	0.54	0.67	0.06	---	---	0.05
Loin eye area, in. ²	7.43	8.31	7.95	7.79	0.35	---	0.03	---
Standardized fat-free lean, lb	101	111	107	105	1.96	---	0.01	---
Fat-free lean index, %	55.8	57.8	57.8	55.7	1.15	---	---	0.10

¹ A total of 48 gilts (PIC TR4 × C22), with 2 pigs per pen and 2 pens per treatment, were used for comparing growth performance. Carcass data were obtained from 1 pig per pen for the determination of carcass characteristics.