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B W. James

K Q. Owen

J C. Woodworth

See next page for additional authors

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Supplementation of L-carnitine and paylean improve growth performance of pigs in a commercial finishing facility

Abstract

Our previous experiments evaluating the interactive effects of dietary L-carnitine and Paylean have primarily focused on improved meat quality benefits of feeding carnitine in combination with Paylean. Although there were numeric trends for improved growth performance in the previous experiments conducted at university facilities, the responses were not statistically significant. A recent study conducted in a commercial finishing facility demonstrated improved growth performance in pigs fed carnitine for the 4-week period prior to slaughter. The cause for the growth response observed in the commercial facility compared to the two previous studies conducted at a university research facility may have been related to feed intake, stress, or the larger sample size compared to the first studies. In addition, pigs in the commercial facility study were fed carnitine from 97 lb until slaughter. Therefore, the objectives of this experiment were to confirm the growth performance results of the previous trial in a commercial finishing facility and to evaluate the interactive effect of L-carnitine and Paylean on growth performance and carcass characteristics when supplemented for only 3 weeks prior to slaughter.; Swine Day, Manhattan, KS, November 14, 2002

Keywords

Swine day, 2002; Kansas Agricultural Experiment Station contribution; no. 03-120-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 897; Swine; Carnitine; Paylean; Carcass characteristics

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Authors

B W. James, K Q. Owen, J C. Woodworth, Michael D. Tokach, Robert D. Goodband, Jim L. Nelssen, and Steven S. Dritz

SUPPLEMENTATION OF L-CARNITINE AND PAYLEAN IMPROVE GROWTH PERFORMANCE OF PIGS IN A COMMERCIAL FINISHING FACILITY

*B. W. James, M. D. Tokach, R. D. Goodband, J. L. Nelssen,
S. S. Dritz¹, K. Q. Owen², and J. C. Woodworth²*

Summary

Growth performance and standard carcass measurements were evaluated on 796 pigs fed dietary treatments of L-carnitine (0 or 50 ppm) and/or Paylean (0 or 9 g/ton) in a three-week experiment. Pigs fed Paylean had improved ($P<0.01$) ADG and F/G for the overall experiment. Growth performance of pigs fed carnitine also was improved ($P<0.04$) and was additive to the response of Paylean. Feeding carnitine did not affect ($P>0.18$) any of the carcass criteria in this experiment. Pigs fed Paylean had greater ($P<0.01$) carcass weight, fat free lean index, loin depth, percentage lean, and yield compared to pigs not fed Paylean. The combined growth performance results from our four research experiments evaluating L-carnitine (0 or 50 ppm) and/or Paylean (0 or 9 g/ton) suggest that Paylean improves ($P<0.01$) ADG and F/G and L-carnitine tends to increase ($P<0.07$) ADG and improves ($P<0.01$) feed efficiency.

(Key Words: Carnitine, Paylean, Carcass Characteristics.)

Introduction

Our previous experiments evaluating the interactive effects of dietary L-carnitine and Paylean have primarily focused on improved meat quality benefits of feeding carnitine in combination with Paylean. Although there were numeric trends for improved growth per-

formance in the previous experiments conducted at university facilities, the responses were not statistically significant. A recent study conducted in a commercial finishing facility demonstrated improved growth performance in pigs fed carnitine for the 4-week period prior to slaughter. The cause for the growth response observed in the commercial facility compared to the two previous studies conducted at a university research facility may have been related to feed intake, stress, or the larger sample size compared to the first studies. In addition, pigs in the commercial facility study were fed carnitine from 97 lb until slaughter. Therefore, the objectives of this experiment were to confirm the growth performance results of the previous trial in a commercial finishing facility and to evaluate the interactive effect of L-carnitine and Paylean on growth performance and carcass characteristics when supplemented for only 3 weeks prior to slaughter.

Procedures

Seven hundred ninety-six barrows (initially 227 lb, PIC C22 × L326) were allotted by weight in a randomized complete block design to each of the four experimental treatments arranged in a 2 × 2 factorial. There were 18 or 19 pigs/pen and 10 replicates/treatment. Main effects included dietary L-carnitine (0 and 50 ppm) and Paylean (0 and 9 g/ton).

¹Food Animal Health and Management Center.

²Lonza, Inc., Fair Lawn, NJ.

Pigs were fed a corn-soybean meal diet (Table 1) with or without L-carnitine or Paylean for the 3-week experiment. The basal diet was formulated to contain 1.00% lysine (total lysine:calorie ratio of 3.00 g/Mcal).

Table 1. Basal Diet Composition (As-Fed Basis)^a

Ingredient, %	
Corn ^b	75.10
Soybean meal (46.5% CP)	22.75
Limestone	0.84
Monocalcium phosphate, 21%P	0.64
Salt	0.35
L-Lysine-HCl	0.15
Trace mineral premix	0.10
Vitamin premix	0.09
Calculated composition	
CP (N × 6.25), %	17.0
Lysine, %	1.00
Lysine:calorie ratio, g/Mcal	3.00
ME, kcal/lb	1,514
Calcium, %	0.54
Phosphorus, %	0.50

^aDiets were formulated to meet or exceed NRC (1998) requirements.

^bL-Carnitine replaced corn to provide either 0 or 50 ppm L-Carnitine and Paylean replaced corn to provide either 0 or 9 g/ton ractopamine-HCl.

Weights were obtained on every pen and feed disappearance recorded weekly to calculate ADG, ADFI, and F/G. At the end of the experiment all pigs were slaughtered at a commercial facility and standard carcass measurements were recorded.

Data were analyzed as a randomized complete block. Pen was the experimental unit for growth performance data and standard carcass measurements. Analysis of variance was performed using the GLM procedure of SAS. In addition, growth performance data from common treatments of L-carnitine (0 or 50 ppm) and Paylean (0 or 9 g/ton) from the four research experiments summarized in the 2002 KSU Swine Day report were combined and analyzed for main effects and interactions.

Results and Discussion

Growth Performance. There were no carnitine × Paylean interactions ($P>0.31$) for growth performance during any week of the experiment or for the overall experiment (Table 2). Paylean improved ($P<0.01$) ADG and F/G during each week and for the overall trial. Carnitine increased ($P<0.05$) ADG from d 7 to 14 and tended ($P<0.08$) to increase ADG from d 14 to 21. Thus, carnitine improved ($P<0.01$) ADG from d 0 to 14 and for the overall trial (d 0 to 21). The numeric improvements in F/G during week 2 and 3 of the experiment resulted in an overall improvement ($P<0.04$) with carnitine added to the diet. Researchers at Purdue University have reported a similar benefit to adding carnitine to diets containing Paylean; however, the greatest response occurred during the first 2 weeks of their 4-week feeding period. Overall, ADG and F/G was improved due to adding Paylean and carnitine to diet for the last 3 weeks before market with the response being additive in this experiment. In our previous trial conducted in a commercial finishing facility, the response was not additive.

Carcass Characteristics. There were no carnitine × Paylean interactions observed ($P>0.13$) for any of the carcass measurements in this experiment (Table 3). Pigs fed carnitine or Paylean had similar backfat ($P>0.31$) to pigs fed the control diet. Feeding carnitine to pigs did not affect ($P>0.18$) any of the carcass criteria in this experiment. Pigs fed Paylean had greater ($P<0.01$) carcass weight, fat free lean index, loin depth, percentage lean, and yield compared to pigs not fed Paylean.

Although carnitine did not affect the carcass parameters measured in this experiment, it can not be concluded that carnitine did not have an effect on meat quality. Drip loss, pH, visual color, and Hunter L*, a*, and b* measurements were not recorded in this experiment as in our other experiments. These analyses

were not conducted because the responses were consistent in the previous trials and it was not possible to do these measurements at the commercial facility where these pigs were slaughtered.

Other research on feeding Paylean to pigs has demonstrated that growth performance improvements occur with relatively short Paylean supplementation durations; however, improvements in lean tissue accretion, longissimus muscle area, and decreased backfat typically require a longer Paylean supplementation duration. It is currently not understood whether L-carnitine demonstrates a similar response. In this experiment, pigs were fed L-carnitine for 3 weeks. This may suggest that a longer duration is needed to detect differences in carcass characteristics; however, a growth performance response was observed with the 3-week supplementation period.

Combined Growth Performance. The growth performance data from common treatments of L-carnitine (0 or 50 ppm) and Paylean (0 or 9 g/ton) from our four experiments were combined (Table 4). There were no carnitine \times Paylean interactions ($P>0.27$). Feeding pigs Paylean improved ($P<0.01$) ADG and F/G in these experiments. Interestingly, a trend was observed for increased ADG ($P<0.07$) when pigs were fed carnitine compared to controls. Pigs fed carnitine in the last 3 to 4 weeks of the finishing period also had improved ($P<0.01$) F/G compared to pigs not fed carnitine. These results suggest that L-carnitine and Paylean improve growth performance of finishing pigs. Future research is needed to determine the optimal lysine level to be fed in combination with L-carnitine and the optimal supplementation duration for L-carnitine.

Table 2. Interactive Effects of L-Carnitine and Paylean on Commercial Finishing Pig Growth Performance^{a,b}

Item	Paylean, g/ton				SEM	Probability (<i>P</i> <)		
	0		9			Carnitine× Paylean	Carnitine	Paylean
	Carnitine, ppm							
	0	50	0	50				
Day 0 to 7								
ADG, lb	1.67	1.73	2.23	2.27	0.08	0.93	0.56	0.01
ADFI, lb	4.57	4.63	4.76	4.81	0.12	0.96	0.60	0.12
Feed/gain	2.75	2.73	2.14	2.17	0.11	0.81	0.97	0.01
Day 7 to 14								
ADG, lb	1.74	1.88	1.91	2.09	0.08	0.82	0.05	0.02
ADFI, lb	5.37	5.36	5.30	5.54	0.12	0.31	0.33	0.64
Feed/gain	3.11	2.90	2.81	2.69	0.10	0.67	0.10	0.01
Day 14 to 21								
ADG, lb	1.62	1.76	1.88	1.98	0.07	0.74	0.08	0.01
ADFI, lb	5.86	6.10	5.74	5.87	0.10	0.59	0.07	0.08
Feed/gain	3.66	3.51	3.09	2.97	0.13	0.88	0.28	0.01
Day 0 to 14								
ADG, lb	1.70	1.80	2.07	2.18	0.05	0.90	0.04	0.01
ADFI, lb	4.97	5.00	5.03	5.18	0.10	0.57	0.38	0.24
Feed/gain	2.92	2.78	2.43	2.38	0.05	0.39	0.05	0.01
Day 7 to 21								
ADG, lb	1.68	1.82	1.90	2.04	0.05	0.98	0.01	0.01
ADFI, lb	5.61	5.73	5.52	5.70	0.08	0.68	0.07	0.45
Feed/gain	3.36	3.15	2.94	2.81	0.07	0.58	0.02	0.01
Day 0 to 21								
ADG, lb	1.68	1.79	2.01	2.11	0.04	0.94	0.01	0.01
ADFI, lb	5.27	5.36	5.26	5.41	0.08	0.80	0.15	0.81
Feed/gain	3.14	3.00	2.63	2.56	0.05	0.47	0.04	0.01

^aValues are means of 10 replications (pens) and 18 or 19 pigs per pen.

^bInitial BW, 227 lb.

Table 3. Standard Carcass Measurements of Finishing Pigs Fed L-Carnitine and Paylean^{a,b}

Item	Paylean, g/ton				SEM	Probability (<i>P</i> <)		
	0		9			Carnitine × Paylean	Carnitine	Paylean
	Carnitine, ppm							
	0	50	0	50				
Carcass wt, lb	196.25	199.89	204.72	207.10	2.22	0.78	0.18	0.01
Backfat, in	0.73	0.73	0.72	0.72	0.01	0.84	0.71	0.31
Fat free lean index	49.35	49.55	49.93	49.90	0.16	0.47	0.59	0.01
Loin depth, in	2.19	2.24	2.38	2.35	0.02	0.13	0.64	0.01
Lean, %	54.13	54.38	55.03	54.82	0.18	0.21	0.90	0.01
Yield	75.47	75.55	75.93	76.30	0.19	0.45	0.23	0.01

^aValues are means of ten replications replications (pens) and 18 or 19 pigs per pen.

^bMeasurements were obtained from commercial slaughter facility slaughter records.

Table 4. Interactive Effects of L-Carnitine and Paylean on Finishing Pig Growth Performance in Four Trials Combined

Item	Paylean, g/ton				SEM	Probability (<i>P</i> <)		
	0		9			Carnitine × Paylean	Carnitine	Paylean
	Carnitine, ppm							
	0	50	0	50				
ADG, lb	1.99	2.10	2.26	2.29	0.04	0.27	0.07	0.01
ADFI, lb	5.85	5.85	5.87	5.77	0.10	0.60	0.61	0.73
Feed/gain	2.97	2.82	2.62	2.54	0.04	0.40	0.01	0.01

^aValues are means of 33 replications from four different experiments with 2, 2, 22 to 26, and 18 to 19 pigs per pen in experiment 1, 2, 3, and 4, respectively.

^aTreatment diets were fed for 28 d in experiment 1, 2, and 3 and for 21 d in experiment 4.