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Effects of 200 ppb added chromium from chromium propionate on the growth performance and carcass characteristics of finishing pigs

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EFFECTS OF 200 PPB ADDED CHROMIUM FROM CHROMIUM PROPIONATE ON THE GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF FINISHING PIGS^{1,2}

J. R. Bergstrom, M. D. Tokach, S. S. Dritz³, J. L. Nelssen, J. M. DeRouchey, and R. D. Goodband

Summary

A total of 1,207 pigs (PIC 337 × 1050) were used in a 103-d experiment in a commercial research barn to evaluate the growth performance and carcass characteristics of finishing pigs fed 200 ppb chromium propionate. There were 22 replicate pens per treatment with 25 to 28 pigs per pen for the evaluation of chromium propionate from d 0 to 84 and 11 replicates per treatment for evaluating chromium propionate (0 and 200 ppb) and Paylean (0 and 9 g/ton) in a split-plot arrangement from d 84 to 103. Pigs were weighed (avg. 67.7 lb) and randomly allotted to 2 corn-soybean meal-based dietary treatments, a control diet and the control diet with 200 ppb chromium from chromium propionate. The treatments were fed through three 4-wk dietary phases (d 0 to 28, d 28 to 56, and d 56 to 84). On d 84, pigs fed the control or chromium treatment were allotted to a fourth dietary phase containing either 0 or 9 g/ton Paylean, resulting in a split-plot design. For the overall period (d 0 to 84), growth performance of pigs fed the control or 200 ppb chromium propionate was not different. From d 84 to 103 and overall (d 0 to

103), pigs fed diets containing Paylean had increased ($P < 0.01$) ADG and final weight. However, a chromium propionate × Paylean interaction ($P < 0.04$) was observed for ADFI and F/G from d 84 to 103 and overall (d 0 to 103) F/G. The reason for the interaction was that the magnitude of response to Paylean was slightly greater in pigs fed the control than in pigs fed chromium. Regardless, the F/G of pigs fed Paylean was considerably better ($P < 0.01$) from d 84 to 103 (2.43 vs. 2.89) and overall (d 0 to 103, 2.50 vs. 2.56) than that of those not fed Paylean. Carcass data from 500 of the pigs were available for comparison of carcass characteristics. Pigs fed Paylean had greater ($P < 0.05$) plant live weight than pigs not fed Paylean. Chromium propionate did not influence any of the carcass characteristics measured. This experiment provides further evidence that Paylean improves late-finishing growth performance. In this trial, growing and finishing pigs did not respond to the dietary inclusion of chromium from chromium propionate.

Key words: chromium, lysine, ractopamine HCl

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Introduction

Chromium is a micromineral that enhances insulin sensitivity and glucose uptake by cells. Some research with growing and finishing pigs has demonstrated that organic chromium may increase muscling and decrease fatness of pigs. Much of the early research utilized chromium picolinate as the chromium source. Chromium propionate also has been demonstrated to be a bioavailable source of chromium and was approved by the FDA for use in pigs.

Few studies, however, have evaluated chromium supplementation with chromium propionate in growing and finishing pigs. Therefore, our objective was to evaluate the effects of 200 ppb supplemental chromium from chromium propionate on the growth performance and carcass characteristics of growing and finishing pigs reared in commercial conditions. Additionally, we were interested in determining whether chromium supplementation would provide further performance and carcass benefits for pigs fed Paylean (Elanco Animal Health, Indianapolis, IN) for 19 d preslaughter.

Procedures

Procedures used in the experiment were approved by the Kansas State University Institutional Animal Care and Use Committee. The experiment was conducted in a commercial research finishing facility in southwest Minnesota. The facility was double curtain sided with pit fans for minimum ventilation and completely slatted flooring over a deep pit for manure storage. Individual pens were 18 ft × 10 ft. Each pen contained 1 self-feeder and 1 cup waterer.

A total of 1,207 pigs were weighed and allotted to 1 of 2 dietary treatments. There were 22 replicate pens per treatment. Each pen contained 25 to 28 pigs; average pig number per pen and weight were balanced across dietary treatment. The 2 dietary treatments

consisted of a corn-soybean meal-based control diet and the control diet with 200 ppb chromium from chromium propionate (Table 1). Diets were fed through three 4-wk dietary phases (d 0 to 28, d 28 to 56, and d 56 to 84). On d 84, pigs fed the control or chromium treatment were allotted to a fourth dietary phase containing either 0 or 9 g/ton Paylean, resulting in a split-plot design. Pigs were weighed and feeder measurements were taken on d 0, 14, 28, 42, 56, 70, 84, 98, and 103 to determine ADG, ADFI, and F/G. On d 103, pigs were individually tattooed by pen number and transported to Swift and Co. (Worthington, MN) for the collection of carcass data on the following day.

Data were analyzed as a split-plot completely randomized design by using the PROC MIXED procedure of SAS with chromium treatment as the whole plot and Paylean treatment as the subplot.

Results

For the period from d 0 to 84, growth performance of pigs fed the control or 200 ppb chromium propionate was not different ($P > 0.85$; Tables 2 and 3).

From d 84 to 103 and overall (d 0 to 103), pigs fed diets containing Paylean had improved ($P < 0.01$) ADG and final weight. However, a chromium propionate × Paylean interaction ($P < 0.04$) was observed for ADFI and F/G from d 84 to 103 and overall (d 0 to 103) F/G. This occurred because pigs fed chromium propionate in the absence of Paylean had numerically lower ADFI and F/G than pigs fed the control diet, whereas pigs fed chromium propionate in the presence of Paylean had numerically greater ADFI and F/G than pigs fed Paylean only. Regardless, F/G of pigs fed Paylean was considerably better ($P < 0.01$) from d 84 to 103 (2.43 vs. 2.89) and overall (d 0 to 103, 2.50 vs. 2.56) than that of those not fed Paylean.

Carcass data from 500 of the pigs were available for comparison of carcass characteristics. Pigs fed Paylean had greater ($P < 0.05$) plant live weight than those not fed Paylean. Chromium propionate did not influence any of the carcass characteristics measured.

In conclusion, this experiment provides further evidence that Paylean improves late-finishing pig growth performance. However, growing and finishing pigs did not respond to the dietary inclusion of chromium from chromium propionate.

Table 1. Diet composition^{1,2}

Ingredient, %	Dietary Phase			
	1 (d 0 to 28)	2 (d 28 to 56)	3 (d 56 to 84)	4 ³ (d 84 to 103)
Corn	65.84	73.87	79.02	69.57
Soybean meal (46.5% CP)	29.00	21.05	15.90	25.45
Choice white grease	3.00	3.00	3.00	3.00
Monocalcium P (21% P)	0.63	0.50	0.55	0.45
Limestone	0.90	0.90	0.90	0.90
Salt	0.35	0.35	0.35	0.35
L-lysine HCl	0.10	0.15	0.15	0.15
Vitamin premix with phytase	0.08	0.08	0.05	0.05
Trace mineral premix	0.10	0.10	0.08	0.08
Total	100.00	100.00	100.00	100.00
Calculated analysis				
Standardized ileal digestible (SID) amino acids				
Lysine, %	1.00	0.84	0.72	0.95
Isoleucine:lysine ratio, %	72	70	70	69
Leucine:lysine ratio, %	154	162	173	154
Methionine:lysine ratio, %	28	29	31	28
Met & Cys:lysine ratio, %	57	59	63	57
Threonine:lysine ratio, %	62	61	62	60
Tryptophan:lysine ratio, %	20	19	19	19
Valine:lysine ratio, %	80	80	82	78
Protein, %	19.2	16.2	14.4	17.9
Total lysine, %	1.13	0.95	0.81	1.07
ME, kcal/lb	1,576	1,580	1,581	1,580
SIDlysine:ME ratio, g/Mcal	2.88	2.41	2.07	2.73
Ca, %	0.58	0.53	0.52	0.53
P, %	0.52	0.46	0.45	0.46
Available P, %	0.26	0.23	0.21	0.20

¹ Experimental control diets fed from d 0 to 103 before slaughter.

² Chromium propionate was added at the expense of corn in the control diets to achieve the 200 ppb chromium from chromium propionate treatment.

³ Paylean (9 g/ton) was added at the expense of corn in the phase 4 (d 84 to 103) control diet to achieve the Paylean treatments during this phase.

Table 2. Effects of 200 ppb chromium from chromium propionate on growth performance and carcass characteristics with or without Paylean for 19-d preslaughter—interactive means¹

Item	0 ppb chromium		200 ppb chromium		SE Mean	Probability, <i>P</i> <		
	0 g/ton Paylean	9 g/ton Paylean	0 g/ton Paylean	9 g/ton Paylean		Chromium × Paylean	Chromium	Paylean
Growth performance								
d 0 to 84								
D 0 wt, lb	67.5	---	67.7	---	0.66	---	---	---
ADG, lb	2.02	---	2.02	---	0.01	---	---	---
ADFI, lb	5.06	---	5.07	---	0.04	---	---	---
F/G	2.51	---	2.51	---	0.01	---	---	---
d 84 to 103								
D 84 wt, lb	237.5	238.6	238.2	239.6	1.81	---	---	---
ADG, lb	2.13	2.49	2.14	2.55	0.04	---	---	0.01
ADFI, lb	6.24	5.98	6.05	6.27	0.09	0.02	---	-
F/G	2.94	2.40	2.83	2.47	0.04	0.04	---	0.01
d 0 to 103								
ADG, lb	2.03	2.10	2.05	2.10	0.02	---	---	0.01
ADFI, lb	5.24	5.21	5.21	5.28	0.06	---	---	---
F/G	2.58	2.48	2.55	2.52	0.01	0.02	---	0.01
Final wt, lb	274.0	282.7	273.9	283.3	2.43	---	---	0.01
Carcass characteristics ²								
Plant live wt, lb	271.5	278.7	268.7	279.6	3.47	---	---	0.05
HCW, lb	206.1	211.7	204.8	211.0	3.43	---	---	---
Yield, %	75.8	76.0	76.3	75.5	0.01	---	---	---
Backfat – 10 th rib, in.	0.69	0.67	0.70	0.70	0.02	---	---	---
Loin depth, in.	2.46	2.50	2.38	2.55	0.06	---	---	---
Percent lean	55.6	55.2	55.2	55.8	0.62	---	---	---
Fat free lean index,%	50.3	50.6	50.1	50.4	0.24	---	---	---

¹ A total of 1,207 pigs (PIC 337 × 1050), with 25 to 28 pigs per pen and 22 pens per treatment, were used in a 103-d experiment to evaluate the growth performance of pigs fed 200 ppb chromium from chromium propionate; 11 pens per treatment from d 84 to 103 were used to evaluate feeding chromium propionate with or without Paylean (9 g/ton).

² Carcass data from 500 of the pigs were available for comparison of carcass characteristics.

Table 3. Effects of 200 ppb chromium from chromium propionate on growth performance and carcass characteristics with or without Paylean for 19-d preslaughter—main effects¹

Item	Chromium, ppb		Paylean, g/ton		SE Mean	Probability, <i>P</i> <		
	0	200	0	9		Chromium × Paylean	Chromium	Paylean
Growth Performance								
d 0 to 84								
D 0 wt, lb	67.5	67.7	-	-	0.66	---	---	---
ADG, lb	2.02	2.02	-	-	0.01	---	---	---
ADFI, lb	5.06	5.07	-	-	0.04	---	---	---
F/G	2.51	2.51	-	-	0.01	---	---	---
d 84 to 103								
D 84 wt, lb	238.0	238.9	237.8	239.1	1.81	---	---	---
ADG, lb	2.31	2.34	2.13	2.52	0.04	---	---	0.01
ADFI, lb	6.11	6.16	6.15	6.12	0.09	0.02	---	---
F/G	2.67	2.65	2.89	2.43	0.04	0.04	---	0.01
d 0 to 103								
ADG, lb	2.06	2.07	2.04	2.10	0.02	---	---	0.01
ADFI, lb	5.23	5.24	5.22	5.25	0.06	---	---	---
F/G	2.53	2.53	2.56	2.50	0.01	0.02	---	0.01
Final wt, lb	278.3	278.6	273.9	283.0	2.43	---	---	0.01
Carcass characteristics ²								
Plant live wt, lb	275.1	274.1	270.1	279.1	3.47	---	---	0.05
HCW, lb	208.9	207.9	205.5	211.3	3.43	---	---	---
Yield, %	75.9	75.9	76.0	75.8	0.01	---	---	---
Backfat – 10 th rib, in.	0.68	0.70	0.70	0.68	0.02	---	---	---
Loin depth, in.	2.48	2.47	2.42	2.52	0.06	---	---	---
Percent lean	55.4	55.5	55.4	55.5	0.62	---	---	---
Fat free lean index, %	50.4	50.2	50.2	50.5	0.24	---	---	---

¹ A total of 1,207 pigs (PIC 337 × 1050), with 25 to 28 pigs per pen and 22 pens per treatment, were used in a 103-d experiment to evaluate the growth performance of pigs fed 200 ppb chromium from chromium propionate; 11 pens per treatment from d 84 to 103 were used to evaluate feeding chromium propionate with or without Paylean (9 g/ton).

² Carcass data from 500 of the pigs were available for comparison of carcass characteristics.