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Supplemental Zinc Sulfate Interacts with Optaflexx in Feedlot Heifers

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Abstract

Optaflexx is a beta-adrenergic agonist, and is fed to cattle during the final 28 to 42 days on feed to improve growth rate and feed efficiency. Beta-adrenergic agonists are repartitioning agents that stimulate muscle deposition at the expense of fat deposition. Zinc is a trace mineral element that functions as an important component of many enzyme systems, including those associated with nucleic acid synthesis and metabolism of proteins and carbohydrates, thus making it an essential nutrient for growth. The purpose of this study was to evaluate growth, carcass characteristics, and plasma urea nitrogen concentrations in finishing heifers supplemented with Optaflexx at 0 or 200 mg/animal daily, in the presence of 30 or 100 ppm supplemental zinc. We hypothesized that feeding Optaflexx could increase requirements for dietary zinc, and that additional zinc supplementation could increase the growth response to Optaflexx.

Keywords

feedlot cattle, Optaflexx, zinc sulfate

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Introduction

Optaflexx is a beta-adrenergic agonist, and is fed to cattle during the final 28 to 42 days on feed to improve growth rate and feed efficiency. Beta-adrenergic agonists are repartitioning agents that stimulate muscle deposition at the expense of fat deposition. Zinc is a trace mineral element that functions as an important component of many enzyme systems, including those associated with nucleic acid synthesis and metabolism of proteins and carbohydrates, thus making it an essential nutrient for growth. The purpose of this study was to evaluate growth, carcass characteristics, and plasma urea nitrogen concentrations in finishing heifers supplemented with Optaflexx at 0 or 200 mg/animal daily, in the presence of 30 or 100 ppm supplemental zinc. We hypothesized that feeding Optaflexx could increase requirements for dietary zinc, and that additional zinc supplementation could increase the growth response to Optaflexx.

Key words: feedlot cattle, Optaflexx, zinc sulfate

Experimental Procedures

One hundred fifty-six crossbred heifers (initial body weight = 1,162 ± 14.6 lb) were blocked by weight and randomly assigned within block to one of 4 treatments for a 43-day feeding trial. Factors (Table 1) consisted of: 1) supplemental zinc (as zinc sulfate) fed at 30 or 100 ppm of diet dry matter; and 2) Optaflexx fed to provide 0 or 200 mg/animal daily of active ingredient (ractopamine hydrochloride). Heifers were allocated to 52 partially covered, concrete surfaced pens with 3 heifers/pen (13 pens per treatment). Optaflexx was fed for 42 days, then removed from the diet until cattle were harvested on day 43. Heifers were fed finishing diets once daily to allow *ad libitum* access to feed. Two heifers per pen were randomly selected for blood collection, and on days 0 and 36 blood was drawn by jugular venipuncture and processed by centrifugation to recover plasma. Plasma was placed into 5-mL plastic tubes and stored frozen until analysis of plasma urea nitrogen. Final body weights (gross body weight × 0.96) were determined immediately before transporting cattle to a commercial abattoir (Tyson Fresh Meats) in Holcomb, KS. Hot carcass weights and incidence and severity of liver abscesses were recorded the day of harvest. After approximately 32 hours of refrigeration, marbling score, 12th-rib fat thickness, ribeye area, and U.S. Department of Agriculture yield grade were obtained from camera images, and USDA quality grade and

incidence and severity of dark cutting beef were determined by a USDA grader. Data were analyzed using the MIXED procedure of SAS (SAS Inst. Inc., Cary, NC; version 9.4). The model included fixed effects of zinc, Optaflexx, and the interaction between zinc and Optaflexx, the random effect was block, and the experimental unit was pen. A P value of ≤ 0.05 was declared significant.

Results and Discussion

Effects of zinc and Optaflexx on feedlot performance are presented in Table 2. Zinc supplementation did not interact with Optaflexx supplementation for final body weight, dry matter intake, or feed efficiency ($P \geq 0.24$). Supplementing Optaflexx increased final body weight by 18.5 lb ($P = 0.02$) and increased average daily gain by 9% ($P < 0.01$), but did not affect feed intake ($P = 0.63$). This resulted in a 10% improvement in feed efficiency ($P < 0.01$). Increasing supplemental zinc from 30 to 100 ppm of the diet tended to decrease average daily gain ($P = 0.07$), but did not affect final body weight, feed intake, of feed efficiency ($P \geq 0.12$). Effects of zinc and Optaflexx on carcass characteristics are presented in Table 3. Zinc × Optaflexx interactions were observed for ribeye area ($P < 0.01$) and yield grade ($P = 0.01$), in which case heifers supplemented 100 ppm zinc and no Optaflexx had decreased ribeye area ($P < 0.01$) and increased yield grade ($P < 0.05$) compared to other treatments. This effect was no longer evident with addition of Optaflexx to the diet. A tendency for a zinc × Optaflexx interaction for dressing percentage ($P = 0.08$) also was observed, in which heifers supplemented 30 ppm zinc in combination with Optaflexx tended to have decreased dressing percentage compared to heifers supplemented 100 ppm zinc in combination with Optaflexx. No other interactions were detected for carcass traits ($P \geq 0.11$). Hot carcass weight increased approximately 11 lb with Optaflexx supplementation, but dressing percentage, incidence of liver abscesses, 12th rib fat thickness, marbling score, or quality grade were not affected by addition of Optaflexx to the diet ($P \geq 0.13$). Results suggest Optaflexx increased lean tissue deposition, but did not affect deposition of carcass fat. Zinc supplementation did not affect incidence of liver abscesses, 12th rib fat thickness, marbling score, or quality grade ($P > 0.15$). There were no zinc × Optaflexx × day ($P = 0.26$), zinc × Optaflexx ($P = 0.62$), or zinc × day ($P = 0.98$) interactions observed for plasma urea nitrogen concentration (Figure 1). There was a tendency for Optaflexx × day interaction ($P = 0.08$), in which plasma urea nitrogen concentration tended to decrease with Optaflexx supplementation by day 36 compared to day 0. Increased supplemental zinc did not affect plasma urea nitrogen concentration ($P = 0.25$). No effect of zinc on plasma urea nitrogen concentration would be expected due to the lack of an effect of zinc supplementation on hot carcass weight and ribeye area. Plasma urea nitrogen concentration increased day 36 compared to day 0 ($P < 0.01$), possibly indicating an increased rate of protein degradation compared to protein synthesis towards the end of finishing.

Implications

Supplementing increased concentrations of zinc sulfate to finishing heifers had little impact on feedlot performance and plasma urea nitrogen concentration; however, muscle and fat deposition may be altered when fed in combination with Optaflexx.

Table 1. Diet and nutrient composition (dry matter basis)

	No Optaflexx		Optaflexx	
	30 ppm zinc	100 ppm zinc	30 ppm zinc	100 ppm zinc
Ingredients, %				
Steam-flaked corn	58.90	58.88	58.90	58.88
Wet corn gluten feed	30.00	30.00	30.00	30.00
Ground alfalfa hay	7.00	7.00	7.00	7.00
Vitamin/mineral premix[1]	0.11	0.11	0.11	0.11
Limestone	1.49	1.49	1.49	1.49
Salt	0.30	0.30	0.30	0.30
Optaflexx mix[2]	-	-	2.20	2.20
Ground corn	2.20	2.20	-	-
Zinc sulfate	-	0.02	-	0.02
Calculated nutrient composition[3]				
Crude protein, %	14.08	14.08	14.08	14.08
Calcium, %	0.69	0.69	0.69	0.69
Phosphorus,%	0.48	0.48	0.48	0.48
Neutral detergent fiber,%	19.03	19.03	19.03	19.03
Zinc (total diet), ppm	61.90	131.90	61.90	131.90

[1]Formulated to provide; 300 mg/day monensin (Elanco Animal Health, Greenfield, IN); 1,000 IU/lb vitamin A; 10 IU/lb vitamin E; 10 ppm added copper; 30 ppm added zinc; 20 ppm added manganese; 0.5 ppm added iodine; 0.10 ppm added selenium; and 0.15 ppm cobalt.
[2]Optaflexx was fed 42 days and formulated to provide 200 mg/animal daily mixed in a ground corn carrier, then removed from the diet until cattle were harvested on day 43.
[3]Calculated from NRC (2000) values for individual ingredients.

Table 2. Feedlot performance of heifers fed 0 or 200 mg/animal daily Optaflexx and supplemented 30 or 100 ppm zinc[1]

	No Optaflexx		Optaflexx			P-value		
Item	30 ppm zinc	100 ppm zinc	30 ppm zinc	100 ppm zinc	SEM	Zinc	Optaflexx	Zinc × Optaflexx
Initial weight, lb[2]	1,162	1,160	1,161	1,164	14.58	0.85	0.75	0.47
Final weight, lb[2]	1,337	1,330	1,359	1,345	14.09	0.17	0.02	0.58
Average daily gain, lb	4.07	3.97	4.63	4.20	0.14	0.07	< 0.01	0.24
Dry matter intake, lb/day	24.84	24.84	25.05	24.23	0.43	0.32	0.63	0.32
Feed:gain	6.11	6.25	5.41	5.77	0.19	0.12	< 0.01	0.39

[1]Optaflexx (Elanco Animal Health, Greenfield, IN) was fed for 42 days, then removed from the diet until cattle were harvested on day 43.
[2]Calculated as: gross body weight × 0.96.

Table 3. Carcass traits of heifers receiving 0 or 200 mg/animal daily Optaflexx and 30 or 100 ppm zinc as zinc sulfate[1,2]

	No Optaflexx		Optaflexx			P-value		
Item	30 ppm zinc	100 ppm zinc	30 ppm zinc	100 ppm zinc	SEM	Zinc	Optaflexx	Zinc × Optaflexx
Carcass weight, lb	849	842	856	857	8.96	0.50	0.03	0.43
Dressed yield, %	63.54	63.33	62.97	63.71	0.26	0.33	0.74	0.08
Liver abscess, %	43.6	30.8	30.8	23.1	7.71	0.19	0.19	0.74
Ribeye area, in.^{2}	15.49[a]	14.21[b]	15.14[a]	15.36[a]	0.24	0.03	0.07	< 0.01
12th-rib fat, in.	0.55	0.62	0.57	0.52	0.04	0.78	0.32	0.11
USDA yield grade	2.3[b]	2.9[a]	2.5[b]	2.3[b]	0.14	0.14	0.14	0.01
Marbling score[3]	521	523	509	485	18.71	0.48	0.13	0.41
Prime, %	5.13	5.13	7.69	5.13	3.63	0.72	0.72	0.72
Choice, %	74.36	64.10	61.54	66.67	7.18	0.72	0.48	0.29
Select, %	10.25	23.08	15.38	20.51	6.24	0.16	0.84	0.54
Sub-Select,[4] %	5.13	2.56	2.56	5.13	2.63	1.00	1.00	0.34
Dark cutters, %	5.13	5.13	12.82	2.56	4.63	0.22	0.53	0.22

[a,b]Within a row, means without a common superscript are different (P<0.05).
[1]Optaflexx (Elanco Animal Health, Greenfield, IN) was fed for 42 days, removed from the diet until cattle were harvested on day 43.
[2]Following 32 hours of refrigeration, 12th rib fat thickness, ribeye area, and USDA yield grade were obtained from camera images provided by the abattoir, and USDA quality grade and incidence and severity of dark cutting beef were determined by a certified USDA grader.
[3]Marbling scores were determined by camera images (VBG 2000, E+V Technology GmbH & Co. KG, Oranienburg, Germany) provided by the abattoir; Small=400 to 499; Modest=500 to 599.
[4]Includes carcasses that graded standard or commercial.

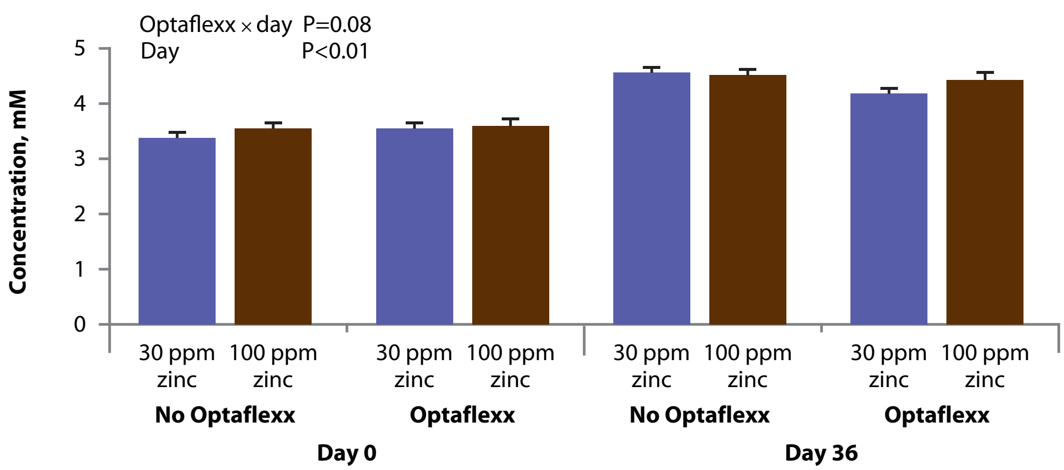

Figure 1. Plasma urea nitrogen concentration of finishing heifers supplemented 30 or 100 ppm zinc as zinc sulfate in combination with Optaflexx at 0 or 200 mg/animal daily.