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Supplemental Zinc Oxide Does Not Interact With Zilmax in Feedlot Steers

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Introduction

Zilmax (Merck Animal Health; Summit, NJ) is in a class of feed additives known as beta agonists and is designed to improve production efficiency in cattle when fed 20 days prior to harvest. Zilmax works by altering deposition of body tissue to more lean muscle than fat. Zinc is an essential mineral necessary for normal growth and development of all mammals. Zinc functions largely in enzymes involved in protein synthesis and carbohydrate metabolism along with many other biological reactions. The purpose of this study was to assess changes in blood components and to evaluate the interactive effects of zinc and Zilmax supplementation on growth and carcass characteristics of finishing steers.

Experimental Procedures

Forty crossbred steers (initial body weight = 1,437 lb ± 31; gross body weight × 0.96) were blocked by initial body weight and randomly assigned, within block, to one of four treatments for a 25-day feeding trial. Steers were randomly assigned to individual, partially covered feeding pens equipped with concrete floors, automatic waterers, and fence-line feed bunks (10 pens per treatment) and were fed once daily *ad libitum*. The study was conducted using a 2 × 2 factorial arrangement of treatments that consisted of diets containing 0 or 7.56 g/ton Zilmax with 60 or 300 ppm added zinc (60 Zn or 300 Zn). Both diets contained 60 ppm zinc from zinc sulfate provided by the premade trace mineral premix that was included in the final experimental vitamin/mineral premix. Zinc oxide was added to the diet containing 300 ppm added zinc (Table 1). Zilmax was administered for 22 days followed by a 3-day withdrawal prior to harvest. Body weight measurements were taken day 0, 21, and prior to shipment on the day of harvest. Blood was collected from each steer via jugular venipuncture on d 0 and 21 and stored in 5-mL plastic tubes until analysis of plasma glucose, lactate, and urea nitrogen concentrations. Feed intakes were monitored daily, and unconsumed feed was removed from the bunk, weighed, and dried at weekly intervals or as needed to determine actual feed intake. Final body weights (gross body weight × 0.96) were determined immediately before cattle were shipped to a commercial abattoir in Holcomb, KS. Hot carcass weight and incidence and severity of liver abscesses were recorded the day of harvest. USDA yield grade; USDA quality grade; marbling score; 12th-rib fat thickness; loin-eye area; percentage kidney, pelvic, and heart fat; and incidence and severity of dark cutting beef were collected after carcasses were refrigerated for 24 hours. Data were analyzed as a MIXED model (SAS version 9.2; SAS Inst. Inc., Cary, NC) with zinc, Zilmax, and zinc × Zilmax as fixed effects, block as a random effect, and steer as the experimental unit. A P-value of 0.05 was declared significant.

Results and Discussion

Interactions between zinc and Zilmax were observed for changes in plasma glucose and lactate concentrations from day 1 through 21 ($P < 0.05$; Figure 1). No interaction between zinc and Zilmax was observed for plasma urea nitrogen concentration, but plasma urea nitrogen decreased over time with Zilmax supplementation ($P < 0.05$; Figure 2). Feedlot performance and carcass traits are presented in Table 2. There were no effects of Zilmax or zinc on average daily gain; dry matter intake; final body weight; feed efficiency; hot carcass weight; ribeye area; backfat; kidney, pelvic, and heart fat; quality grade; or incidence of liver abscesses ($P > 0.05$), although zinc numerically improved marbling scores, tended ($P = 0.08$) to improve proportion of carcasses grading USDA choice, and tended to decrease carcass weight ($P = 0.11$). As expected, feeding Zilmax decreased yield grade ($P < 0.05$) and tended to increase ribeye area ($P = 0.07$); however, marbling score ($P > 0.05$) was not altered appreciably.

Implications

Increasing dietary concentrations of zinc did not affect response to Zilmax, but feeding Zilmax altered the circulating concentrations of blood components associated with muscle accretion.

Table 1. Diet composition, dry matter basis

	No Zilmax[1]		Zilmax	
Ingredients, %	60 zinc (Zn)	300 Zn	60 Zn	300 Zn
Steam-flaked corn	53.55	53.52	53.55	53.52
Wet corn gluten feed	35.00	35.00	35.00	35.00
Wheat straw	7.00	7.00	7.00	7.00
Feed additive premix[2]	2.16	2.16	2.16	2.16
Vitamin/mineral premix[3]	0.17	0.17	0.17	0.17
Limestone	1.82	1.82	1.82	1.82
Salt	0.30	0.30	0.30	0.30
Zinc oxide[4]	-	0.03	-	0.03
Calculated composition				
Crude protein, %	14.01	14.00	14.01	14.00
Calcium, %	0.75	0.75	0.75	0.75
Phosphorus, %	0.51	0.51	0.51	0.51
Potassium, %	0.70	0.70	0.70	0.70
Zinc, ppm	93.41	333.40	93.41	333.41

[1] Merck Animal Health, Summit, NJ.
[2] Formulated to provide 300 mg/day Rumensin and 90 mg/day Tylan (Elanco Animal Health, Greenfield, IN) in a ground corn carrier. Zilmax was fed 22 days at 7.56 g/ton of diet dry matter followed by a 3-day withdrawal prior to harvest.
[3] Formulated to provide (as a proportion of total diet dry matter) the following added nutrient levels: 1,000 IU/lb vitamin A, 10 IU/lb vitamin E, 0.10 ppm added cobalt, 10 ppm added copper, 0.6 ppm added iodine, 60 ppm added manganese, 0.25 ppm added selenium, 60 ppm added zinc, and 0.3% salt.
[4] Formulated to provided 240 ppm added zinc.

Table 2. Feedlot performance and carcass traits of steers fed 0 or 7.56 g/ton Zilmax and 60 or 300 ppm added zinc (Zn)[1]

	No Zilmax		Zilmax			*P*-values		
Item	60 Zn	300 Zn	60 Zn	300 Zn	SEM	Zinc	Zilmax	Zinc × Zilmax
Initial weight, lb[2]	1,441	1,433	1,435	1,435	30.79	0.34	0.41	0.34
Final weight, lb[2]	1,477	1,446	1,488	1,466	33.32	0.11	0.36	0.83
Average daily gain, lb	2.36	1.56	3.33	2.89	0.73	0.39	0.12	0.80
Dry matter intake, lb/day	23.14	23.23	23.91	22.61	1.08	0.53	0.94	0.48
Feed:gain	10.417	19.608	7.143	8.000	3.29	0.34	0.07	0.63
Hot carcass weight, lb	963	952	979	968	22.33	0.37	0.21	0.96
Dressed yield, %	65.2	65.8	65.7	65.9	0.01	0.37	0.55	0.71
Liver abscess, %	30.0	20.0	30.0	30.0	14.81	0.72	0.72	0.72
Ribeye area, sq. in.	15.06	14.55	15.40	15.59	0.39	0.46	0.07	0.37
12th-rib fat, in.	0.52	0.54	0.48	0.53	0.04	0.37	0.48	0.76
USDA yield grade	2.7	3.0	2.4	2.4	0.22	0.50	0.05	0.50
Marbling score[3]	481	492	503	523	23.8	0.52	0.27	0.85
Kidney, pelvic and heart fat, %	1.6	1.7	1.45	1.75	0.17	0.09	0.66	0.39
Choice, %	80.0	100.0	90.0	100.0	8.33	0.08	0.55	0.55

[1]Zilmax (Merck Animal Health, Summit, NJ) was fed for 22 days followed by a 3-day withdrawal prior to harvest.
[2] Calculated as: gross body weight × 0.96.
[3] Marbling scores were determined by a USDA grader; slight = 300 to 399; small = 400 to 499; modest = 500 to 599.

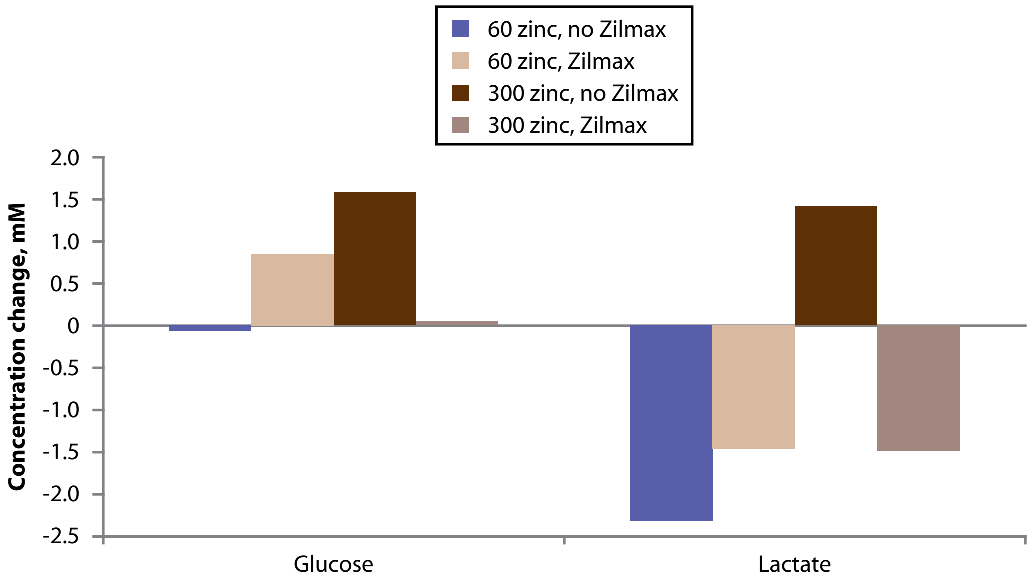

Figure 1. Change in plasma glucose and lactate concentrations of steers fed 0 or 7.56 g/ton Zilmax and 60 or 300 ppm added zinc (Zn). Zilmax was fed for 22 days followed by a 3-day withdrawal prior to harvest. Change in glucose zinc × Zilmax interaction, $P = 0.01$; no effect of zinc or Zilmax, $P > 0.10$; SEM = 0.46. Change in lactate zinc × Zilmax interaction, $P = 0.047$; effect of zinc, $P = 0.052$; effect of Zilmax, $P = 0.27$; SEM = 0.91.

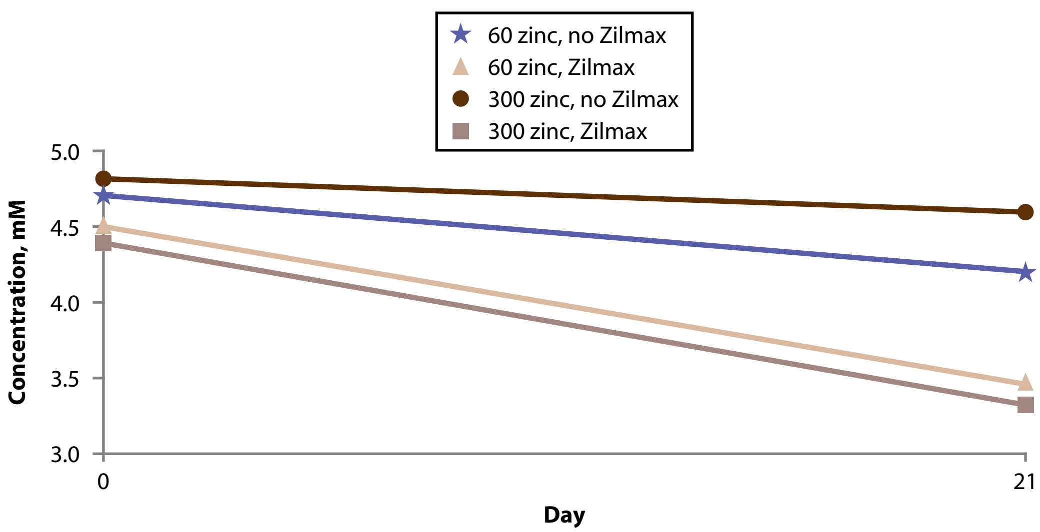

Figure 2. Plasma urea nitrogen concentrations from steers fed 0 or 7.56 g/ton Zilmax and 60 or 300 ppm added Zn. Zilmax was fed for 22 days followed by a 3-day withdrawal prior to harvest. Zilmax × day interaction, $P = 0.03$; effect of Zilmax, $P < 0.001$; effect of zinc, $P = 0.70$; SEM = 0.22.