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Supplemental chromium and revaccination effects on performance and health of newly weaned calves

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SUPPLEMENTAL CHROMIUM AND REVACCINATION EFFECTS ON PERFORMANCE AND HEALTH OF NEWLY WEANED CALVES

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Summary

Two trials were conducted to evaluate the effects of chromium (Cr) supplementation (4 mg/hd/day in a yeast form) or no supplementation, with or without revaccination with a modified live viral vaccine at 9 days postweaning on performance, health, and ability to withstand an IBR challenge infection. In Trial 1, Cr supplementation had no effect on performance of newly weaned calves in a 28-day receiving study, but reduced the incidence of respiratory disease by 37%. Revaccination depressed dry matter intake and had no effect on animal health. In trial 2, blood plasma levels of cortisol and ACTH (stress hormones) were measured at 6 and 26 days postweaning. Cortisol levels were unaffected by treatment or by time after weaning. Plasma ACTH concentrations were lower at 26 vs 6 days postweaning, and were reduced at 26 days by revaccination. Despite some slight differences in rectal temperature, treatment did not appear to affect the animals' ability to withstand a live IBR challenge. We concluded that supplemental Cr was beneficial in reducing the incidence of bovine respiratory disease, although mediation of stress hormones was not involved. Revaccination of newly weaned calves with a modified live viral vaccine showed no performance or health benefit.

(Key Words: Chromium, Weaned Calves, Respiratory Disease.)

Introduction

Minimizing losses from bovine respiratory disease continues to pose a major challenge to the beef cattle industry. Benefits from supplementing a variety of nutrients that stimulate the immune response in cattle and that may become deficient in an acute stress-disease complex have been documented. Most recently, Canadian research has shown that chromium (Cr) supplementation can reduce the incidence of morbidity and improve performance of stressed beef cattle. Whether Cr supplementation can have the same effects in newly weaned calves has not been tested. Vaccination programs for newly received calves also deserve research attention. Therefore, we studied the effects of supplemental Cr and revaccination on performance, health, and blood parameters of newly weaned calves.

Experimental Procedures

Trial 1. Two hundred and four British crossbred steer and heifer calves (492 lb) were separated from their dams at the KSU Range Unit and delivered to the Beef Research Unit. Calves were individually weighed and held on concrete without access to feed or water for 24 hours to impose additional stress. Calves then were weighed again; treated for parasites; and vaccinated against IBR, PI₃, BVD, BRSV (Bovishield-4®); and seven clostridial organisms (Ultrabac-7®). Calves were blocked by weight and allotted to one of 12 pens in a 2×2 factorially arranged experiment. An

¹College of Veterinary Medicine. Provision of IBR virus by Harish Minocha, Dept. of Pathology and Microbiology, is gratefully acknowledged.

equal ratio of steers:heifers was maintained in each pen. Main effect factors were Cr supplementation (0 or 4 mg/head/day) and vaccination schedule (– or + revaccination with Bovishield-4® on day 9). Chromium was supplied in a dried yeast form that was 960 ppm Cr (Alltech, Inc., Nicholasville, KY). Diets were formulated to contain 14% crude protein and were composed of (dry basis): 44.45% corn, 36.0% chopped prairie hay, 3.75% molasses, and 15.8% supplement. Performance and health parameters were measured over a 28-day period.

Trial 2. This trial was conducted to measure plasma cortisol and ACTH levels during the weaning period. Twenty steer mates (393 lb) to the calves used in Trial 1 were individually housed and fed in an open-front barn. Processing procedures, treatments, and starting date were identical to those for Trial 1 and resulted in five steers per treatment combination. Steers were halter-trained, and blood samples were collected on days 6 and 26 (trial termination). On collection days, steers were fitted with indwelling jugular catheters, and blood samples were collected every 30 minutes for 4 hours (nine samples) beginning 5 hours after catheter placement. Samples were analyzed subsequently for cortisol and ACTH.

Following the 26-day trial, all steers were challenged with 300 million plaque-forming units (PFU) of IBR virus (200 million PFU intranasally, 100 million via the conjunctiva) to assess previous treatment effects on the ability of animals to withstand an infectious challenge. Rectal temperatures and clinical signs of illness were recorded over a 7-day period.

Results and Discussion

Trial 1. Feed and water deprivation for 24 hours resulted in a 5.6% weight loss (shrink) which took at least 9 days to recover (Table 1). No interactions occurred between Cr level and vaccination schedule; therefore, data are pooled by main effects. In contrast to other research, Cr supple-

mentation had no effect on calf performance. However, 4 mg/head daily of Cr reduced ($P=.04$; Chi-square) the percentage of calves treated for respiratory disease by 37%. The fact that performance was not affected in the presence of large differences in morbidity may be related to a good response rate to antibiotic treatment and low number of retreatments ($n=2$ and 1 for 0 and 4 mg Cr treatments, respectively).

Revaccination depressed dry matter intake for the receiving period by more than .5 lb per day ($P<.05$). Revaccination had no effect on daily gain, feed efficiency, or reduction in incidence of respiratory disease.

Trial 2. Neither Cr supplementation nor revaccination had an effect on plasma cortisol levels (Table 2). Further, no differences occurred in cortisol concentrations between day 6 and day 26 of the study. We anticipated that cortisol concentration at day 6 would be elevated, because calves were still undergoing the stress of weaning at that time. Plasma ACTH concentrations were higher ($P<.10$) on day 6 than day 26, indicating a higher stress level at the earlier date. Revaccination reduced ($P<.02$) serum ACTH levels at day 26, with no change in plasma cortisol. The importance of this finding is unclear, because revaccination had no beneficial effect on performance or health of calves in Trial 1.

Rectal temperatures of calves during the IBR challenge period are shown in Figure 1. Two calves each in the (+) Cr, (–) Revac and (–) Cr, (+) Revac groups and one each in the other two groups showed no sign of infection (measured as temperature $\geq 103.5^{\circ}\text{F}$). Peak morbidity occurred within 2 days after infection and lasted approximately 3 days. A Cr supplementation by revaccination interaction ($P<.03$) showed that Cr supplementation or revaccination alone reduced average rectal temperature by .5°F during the challenge period, compared to control. However, the combination of revaccination and Cr supplementation had no effect on mean rectal temperature. Although slight differences were noted, treatment did

not appear to have a physiologically significant effect on the calves' ability to withstand an IBR viral challenge.

Results of these studies indicate that supplemental Cr can reduce morbidity of weaned calves. However, mediation of stress hormones was not involved, suggesting that supplementation corrected a Cr deficiency. Fermentation products or yeast preparations similar to that used in this study contain other

nutrients and growth factors that reportedly stimulate ruminal diet digestion and(or) animal performance. Lack of a performance response in Trial 1 for the yeast treatment suggests that no response was directly attributable to the yeast. Revaccination of newly weaned calves showed no performance or health benefit.

Table 1. Effect of Chromium Supplementation (as Yeast) and Revaccination on Performance and Health of Newly Weaned Calves (Trial 1)

Item	Supplemental Cr, mg/hd/d			Revaccination ^a		
	0	4	Probability	–	+	Probability
No. pens	6	6		6	6	
No. head	102	102		102	102	
Weaning wt, lb	492	491		494	489	
Processing wt, lb ^b	463	465		466	461	
Shrink, % ^b	5.93	5.23		5.6	5.6	
Day 9 wt, lb	490	492		495	489	
Day 30 wt, lb	547	546		547	545	
Daily feed, lb dry matter	13.45	13.28	NS ^f	13.63	13.09	.05
Daily gain, lb ^c	1.96	1.97	NS	1.92	2.00	NS
Feed/gain	6.90	6.76	NS	7.09	6.54	NS
Treated, % ^d	34.3	21.6	.04	28.4	27.5	NS
Retreated, % ^e	5.7	4.5	NS	3.4	7.1	NS
Death loss, %	0	0		0	0	

^aRevaccinated (+) or not (–) on day 9 with modified live IBR, P I₃, BVD, and BRSV.

^bFollowing 24 hours of feed and water deprivation.

^cFrom weaning weight.

^dTreated for respiratory disease.

^ePercentage of treated cattle treated twice or more.

^fNot significant.

Table 2. Serum Cortisol and ACTH Concentrations in Calves at 6 and 26 Days Postweaning (Trial B)

Item	0 mg/hd/d Cr		4 mg/hd/d Cr		S E M
	– Revac	+ Revac	– Revac	+ Revac	
Cortisol, ng/ml					
Day 6	11.8	9.8	11.5	12.4	2.19
Day 26	13.3	13.3	13.2	12.3	
ACTH, pg/ml ^a					
Day 6	138.8	120.5	129.0	132.7	7.17
Day 26 ^b	133.5	108.3	129.0	114.8	

^aDay 6 vs day 26 (P<.10).

^bEffect of revaccination (P<.02).

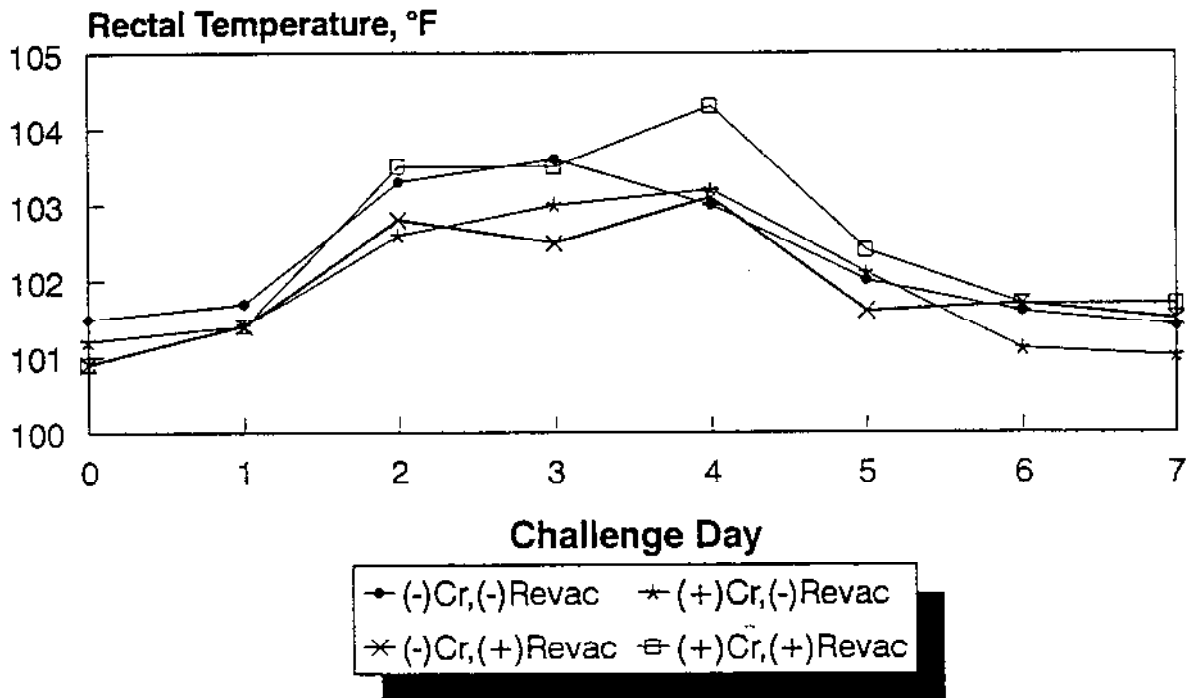


Figure 1. Rectal Temperatures of Steers Challenged With IBR Virus