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The effect of vitamin E, selenium, and copper supplementation preweaning on the performance and immune response of beef calves

Abstract

Two experiments were conducted to determine the effect of vitamin E, selenium, and copper supplementation on the pre- and postweaning performance, immune responses, and serum metabolites of crossbred beef calves. In experiment 1, 71 calves were blocked by weight and allotted to one of four individually fed treatments: 1) control supplement (2 lb grain creep) (CS), 2) CS + .27 mg selenium + 500 IU vitamin E, 3) CS + 9.1 mg copper, and 4) combination of treatments 2 and 3. In experiment 2, 80 crossbred beef calves were blocked by weight and allotted to 5 individually fed treatments: 1) control supplement (2 lb grain creep) (CS), 2) CS + .27 mg selenium, 3) CS + .27 mg selenium + 500 IU vitamin E, 4) CS + .27 mg selenium + 1000 IU vitamin E, and 5) CS + .27mg selenium + 1500 IU vitamin E. Supplements were fed daily on an individual basis. In experiment 1, vitamin E supplementation reduced plasma haptoglobin levels by the end of the study and tended ($P=.11$) to improve postweaning gain. However, no other effect was noted on calf performance or immune parameters in either experiment.

Keywords

Cattlemen's Day, 1997; Kansas Agricultural Experiment Station contribution; no. 97-309-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 783; Beef; Vitamin E; Selenium; Copper; Suckling calves; Growth; Health; Immune system

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**THE EFFECT OF VITAMIN E, SELENIUM, AND COPPER
SUPPLEMENTATION PREWEANING ON THE PERFORMANCE
AND IMMUNE RESPONSE OF BEEF CALVES**

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Summary

Two experiments were conducted to determine the effect of vitamin E, selenium, and copper supplementation on the pre- and postweaning performance, immune responses, and serum metabolites of crossbred beef calves. In experiment 1, 71 calves were blocked by weight and allotted to one of four individually fed treatments: 1) control supplement (2 lb grain creep) (CS), 2) CS + .27 mg selenium + 500 IU vitamin E, 3) CS + 9.1 mg copper, and 4) combination of treatments 2 and 3. In experiment 2, 80 crossbred beef calves were blocked by weight and allotted to 5 individually fed treatments: 1) control supplement (2 lb grain creep) (CS), 2) CS + .27 mg selenium, 3) CS + .27 mg selenium + 500 IU vitamin E, 4) CS + .27 mg selenium + 1000 IU vitamin E, and 5) CS + .27 mg selenium + 1500 IU vitamin E. Supplements were fed daily on an individual basis. In experiment 1, vitamin E supplementation reduced plasma haptoglobin levels by the end of the study and tended ($P=.11$) to improve postweaning gain. However, no other effect was noted on calf performance or immune parameters in either experiment.

(Key Words: Vitamin E, Selenium, Copper, Suckling Calves, Growth, Health, Immune System.)

Introduction

Environmental and management stresses have been shown to compromise the immune system and lower disease resistance of newly

weaned beef calves. Because stress caused by weaning and transportation are nearly inevitable, any management practices that reduce immunosuppressive consequences of physical or pathological stress could be beneficial.

The effects of vitamin E, selenium, and copper supplementation on immune system function has received a great deal of research attention. Studies have shown that deficiencies in vitamin E and selenium can depress immune function and that, when supplemented postweaning, these nutrients can improve calf performance. Preweaning supplementation of vitamin E, selenium, and copper has not been studied previously and merits attention. Thus, our goal was to evaluate the effects of preweaning vitamin E, selenium and copper supplementation on performance and immune function in beef calves.

Experimental Procedures

Experiment 1. Seventy-one Hereford-Angus calves (mean age = 163 days) were blocked by weight and allotted to one of four treatment groups; 1) control supplement (2 lb grain creep) (CS), 2) CS + .27 mg selenium + 500 IU vitamin E, 3) CS + 9.1 mg copper, and 4) combination of treatments 2 and 3. CS was 60% dry rolled corn, 25% rolled oats, 10% soybean meal, and 5% wet midds, fed at the rate of 2 lb/daily. Because additional copper was provided only in the creep supplements, the copper content of the total diet (supplement, forage, and milk) was below the recommended level of 8 to 10 ppm. For 49 days prior to weaning, calves were separated from their dams

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daily, sorted into treatment groups, and individually fed their respective diets.

At weaning, calves were separated from their dams; vaccinated (CattleMaster 4® and Ultrabac 7®, Pfizer Animal Health, Lincoln, NE); and shipped 150 miles where they were unloaded, bled, and provided water and grass hay. On the following day, calves were returned to the Kansas State University Beef Cattle Research Center, where they were re-vaccinated; dewormed (Safe Guard®, Hoechst Roussel, Somerville, NJ); and fed a standard feedlot receiving ration for 28 days.

Blood samples were collected at the start of the trial, at weaning, postshipping, and after the growing period. These samples were analyzed for erythrocytes and total leukocyte counts, whole blood hematocrit, hemoglobin, haptoglobin, lymphocyte blastogenic response, and IBR/BVD antibody titers. Haptoglobin, which is an acute phase protein, is gaining acceptance as an indicator of health problems in cattle. Elevated levels serve as an early warning of infection or inflammation.

Experiment 2. Eighty Hereford-Angus calves (mean age = 167 days) were blocked by weight and allotted to one of five treatment groups; 1) control supplement (2 lb grain creep) (CS), 2) CS + .27 mg selenium, 3) CS + .27 mg selenium + 500 IU vitamin E, 4) CS + .27 mg selenium + 1000 IU

vitamin E, and 5) CS + .27 mg selenium + 1500 IU vitamin E. The control supplement was the same as in experiment 1. For the last 53 days prior to weaning, calves were separated from their dams daily, sorted into treatment groups, and individually fed 2 lbs of their respective diet.

At weaning, calves were separated from their dams and shipped 250 miles to a commercial feedlot, where they were unloaded, weighed, and bled. All calves were re-vaccinated (CattleMaster 4 and Ultrabac 7, Lincoln, NE) and dewormed (Safe Guard, Hoechst Roussel, Somerville, NJ). Cattle were fed a series of step-up diets for the first 5 days then placed on a growing diet. Calf weights were taken at the start of the trial; at weaning; and 7, 18, and 45 days postweaning. All weights were taken full except on day 53 (postshipping) and day 98 (postshipping) when cattle were shrunk following transportation. As in experiment 1, blood samples were collected for immune parameter analysis.

Results and Discussion

Pre- and postweaning calf performances are shown in Tables 1 and 2. In experiment 1, feeding supplemental vitamin E and selenium tended to improve ($P=.11$) the postweaning gain of the calves. In both experiments, dietary treatment had no other effect on calf performance or immune response, and in experiment 2, postweaning performance was not influenced by experimental dietary treatment.

Table 1. Effect of Copper and Vitamin E Supplementation on Calf Performance in Experiment 1

Treatment	Prewaning ADG ^a		Postweaning ADG ^b	
	lb	SE	lb	SE
Control supplement	2.31	.043	1.87	.075
Vitamin E, 500 IU/day	2.29	.042	2.16	.073
Copper 9.1 mg/day	2.22	.042	2.09	.073
Vitamin E and copper added	2.33	.042	2.35	.073
<u>Contrast analyses:</u>				
Vitamin E	2.31	.03	2.24	.05
No vitamin E	2.24	.03	1.98	.05
Probability	.39		.11	
Copper	2.29	.03	2.20	.05
No Copper	2.27	.03	2.02	.05
Probability	.90		.26	

^aMeasured days 0 to 49 (preship).

^bMeasured days 49 to 78.

Table 2. Effect of Vitamin E and Selenium on Pre- and Postweaning Calf Performance in Experiment 2^a

Item	Treatment					S
	Control	Selenium ^c	Low E ^d Selenium	Med E ^d Selenium	High E ^d Selenium	
Prewaning ADG (lb) ^a	2.02	2.11	1.94	2.09	2.02	.10
Postweaning ADG (lb) ^b	2.18	2.13	1.99	2.38	1.66	.28

^aMeasured from the initiation of the feeding period until weaning.

^bMeasured for 45 day post-weaning growing period.

^c.27 mg added selenium daily.

^dLow, medium, and high levels of added vitamin E are 500, 1000, and 1500 IU daily, respectively.