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Effect of supplemental Vitamin E on the performance, metabolic profiles, and immune responses of dairy calves.

Abstract

Forty-six Holstein heifer calves were used from birth to 3 mo to study the effect of supplemental vitamin E at 1400 or 2800 mg dl- α -tocopherol acetate given orally at weekly intervals or 1400 mg dl- α -tocopherol by intramuscular injection. Weekly starter consumption was 10 to 27 % more ($P=0.12$) and weekly weight gains were 9 to 25% more ($P=0.13$) in supplemented calves. Creatine phosphokinase activity was negatively correlated with serum tocopherol concentrations, indicating a subclinical muscular dystrophy in unsupplemented calves. Lymphocyte stimulation indices were positively correlated with serum tocopherol concentration. Calves given high level of oral supplementation had higher IgM antibody concentration. It was concluded that supplemental vitamin E is beneficial for calves reared on conventional complete starters to increase disease resistance and to obtain optimum performance.; Dairy Day, 1984, Kansas State University, Manhattan, KS, 1984;

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K EFFECT OF SUPPLEMENTAL VITAMIN E ON THE PERFORMANCE,
S METABOLIC PROFILES, AND IMMUNE RESPONSES OF DAIRY CALVES.

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Summary

Forty-six Holstein heifer calves were used from birth to 3 mo to study the effect of supplemental vitamin E at 1400 or 2800 mg dl- α -tocopherol acetate given orally at weekly intervals or 1400 mg dl- α -tocopherol by intramuscular injection. Weekly starter consumption was 10 to 27% more ($P=.12$) and weekly weight gains were 9 to 25% more ($P=.13$) in supplemented calves. Creatine phosphokinase activity was negatively correlated with serum tocopherol concentrations, indicating a subclinical muscular dystrophy in unsupplemented calves. Lymphocyte stimulation indices were positively correlated with serum tocopherol concentration. Calves given high level of oral supplementation had higher IgM antibody concentration. It was concluded that supplemental vitamin E is beneficial for calves reared on conventional complete starters to increase disease resistance and to obtain optimum performance.

Introduction

Modern calf management systems have shown a trend toward confined feeding of complete rations containing both grain and forage and less access to pastures. Under such conditions, several factors affect vitamin E requirements, including inadequate vitamin E in feedstuffs, stress conditions, and interrelationships with certain other nutrients in the diet. In calf rations, feedstuffs alone may not provide a sufficient amount of alpha-tocopherol, which is the most biologically active form of vitamin E.

Recent studies with laboratory animals and other animals have shown that vitamin E at levels much higher than those presently recommended enhances immune responses.

The objective of the present research was to study the effect of supplemental vitamin E on the general performance, metabolic profiles, and immune responses of dairy calves from birth to 3 mo under normal herd management conditions.

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Experimental Procedures

Forty-six Holstein heifer calves were used in the experiment. Calves were allotted to one of 3 treatments: (1) 0 mg 2) 1400 mg and 3) 2800 mg of dl- α -tocopherol acetate fed orally at weekly intervals with a nipple bottle. Later calves were also allotted to a 4th treatment, which was 1400 mg of dl- α -tocopherol given by intra-muscular injection at weekly intervals.

Calves were fed colostrum for the first 3 days and then milk at 8% of birth weight until weaning at 6 wk. Water and a complete calf starter (Tables 1 and 2) were always available to the calves. Calves were housed in fiberglass hutches throughout the experiment. Weight gains were recorded weekly. Fecal consistencies were scored twice daily.

Results and Discussion

Data on the performance and immune responses are in Table 3.

Although statistically not significant, weekly weight gains were 9 to 25% greater and weekly starter consumption was 10 to 27% more in supplemented calves. Fecal scores were the same for all calves.

Lymphocyte stimulation indices, considered to be the laboratory correlates for cell-mediated immune responses, were positively correlated with serum-tocopherol concentrations. This indicated that supplemented calves possibly had developed a better immunocompetency during their first weeks of life and thus were relatively more protected against diseases. Calves given a higher level of oral supplementation had higher IgM antibodies, suggesting capability for a better primary immune response.

Table 1. Ingredient composition of calf starter¹

Ingredient	%
Corn, rolled	30.0
Oats, rolled	20.0
Sorghum grain, rolled	7.5
Alfalfa hay, ground	25.0
Soybean meal	10.0
Molasses, dry	5.0
Dical	0.7
Limestone	0.3
Salt, plain	0.25
Salt, trace mineral	0.25
Vitamin and Selenium premix ²	1.00

¹ 3/16" pellets.

² 220264 IU of vitamin A, 33039 IU of vitamin D, 0.2159 g Na₂SeO₃/kg.

Table 2. Chemical composition of the calf starter
(dry matter basis)

Crude protein %	15.61
Ether extract %	3.36
Acid detergent fiber %	19.95
Vitamin E, IU/kg	21.6
Selenium, PPM	0.44

Table 3. Performance, metabolic profiles and immune responses of calves
(least square means averaged across weeks)

Variable	Oral Treatment			Injection 1400 mg	Probability
	0 mg	1400 mg	2800 mg		
Weekly starter consumption, kg	8.9	11.3	11.1	10.7	0.124
Weekly weight gains, kg	4.0	5.0	4.8	4.7	0.134
Fecal scores	1.2	1.2	1.3	1.2	0.247
Ig G ₁ , mg/100 ml	1240.1	1455.6	1460.6	1450.6	0.305
Ig G ₂ , mg/100 ml	134.1	169.8	152.4	180.2	0.226
Ig M ₂ , mg/100 ml	67.9	67.4	75.0	54.2	0.037
Lymphocyte stimulation index	44.9	64.1	77.2	132.7	0.0001