Effects of Injectable Vitamin Products on Serum Vitamin and Selenium Concentrations and Growth Performance in Beef Calves

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Introduction

The immune system benefits of vitamins A, D, and E as well as the antioxidant properties of selenium have the potential to significantly improve overall animal health and productivity. The purpose of this study was to determine the effectiveness of vitamin A-D-E or Bo-Se injection on raising serum fat-soluble vitamin and selenium concentrations of newborn calves in the first 48 hours after treatment. Additionally, blood samples from both cows and calves were analyzed for vitamin concentrations to determine the relationship among cow and calf serum vitamin status.

Materials and Methods

Forty crossbred beef calves were used to determine the effects of injectable vitamin products on serum vitamin and selenium concentrations and growth performance of young calves (3 to 20 days of age). Calves were blocked by age and sex, then randomly assigned to treatments in a 2×2 factorial design with factors being 1) administration or not of 4 mL Bo-Se [Intervet; selenium (1 mg/mL) and vitamin E (50 mg/mL)]; 2) administration or not of 5 mL of Vital EAD [Stuart Products; vitamin E (as d-alpha-tocopherol; 300 I.U.), vitamin A (as retinyl-palmitate; 100,000 I.U.), and vitamin D_3 (10,000 I.U.)]. Whole blood samples were obtained via jugular venipuncture from all calves just prior to treatment administration. In addition, blood samples from the dam of each calf were collected at this time. Calves were placed on a portable digital scale to determine body weight at the time of treatment administration. Forty-eight hours after treatment administration, a sample of whole blood was collected again. Calves were all born to primiparous cows that were maintained in a lot and fed once daily. The diet consisted of 20% alfalfa/grass hay, 70% corn silage, 6% barley, and 4% liquid supplement and was delivered once daily. In addition, cows had access to free-choice loose mineral. Twenty-three days after treatment administration calves were weighed and cow/calf pairs were moved to pasture. Body weight gain was calculated by subtracting the weight at the start of the trial from the pasture turnout weight. Blood samples were shipped to the Iowa State University Diagnostic Laboratory for analysis.

Results

Serum samples were analyzed for selenium, vitamin A, and vitamin E. In the dams, mean concentrations of selenium, vitamin A, and vitamin E were 112.8 ± 2.09 ng/mL, 0.21 ± 0.01 µg/mL, and 2.84 ± 0.11 µg/mL, respectively. No interactions ($P > 0.10$) were present among Bo-Se and Vital EAD factors for serum concentrations of

selenium, vitamin A, or vitamin E in calves on day two. However, calves treated with Bo-Se had greater concentrations of selenium on day two compared with calves not given Bo-Se (Table 1). Calves treated with Vital EAD had greater concentrations of vitamin A and vitamin E on day two compared with calves not given Vital EAD (Table 2). Concentrations of vitamin E in calves at the start were correlated with calf body weight, whereas concentrations of selenium in cows were correlated with days postpartum. Calf average daily gain was affected by an interaction among Bo-Se and Vital EAD (Table 3). Calves given either Bo-Se or Vital EAD had greater average daily gain compared with calves given both products, while untreated calves were intermediate.

Table 1. Serum concentrations of selenium, vitamin A, and vitamin E after administration of injectable Bo-Se in beef calves.

Item	No Bo-Se	Bo-Se	*P*-value
Selenium, ng/ml			
0 hours	71.7 ± 1.97	75.0 ± 2.13	0.25
48 hours	**56.3 ± 1.68^{x}**	**72.5 ± 1.73^{y}**	**< 0.01**
Vitamin A, µg /ml			
0 hours	0.11 ± 0.01	0.10 ± 0.01	0.88
48 hours	0.18 ± 0.01	0.19 ± 0.01	0.43
Vitamin E, µg /ml			
0 hours	1.37 ± 0.18	1.07 ± 0.19	0.26
48 hours	8.78 ± 1.31	10.75 ± 1.36	0.29

^{xy}Means within row lacking a common superscript differ ($P < 0.01$)

Table 2. Serum concentrations of selenium, vitamin A, and vitamin E after administration of injectable Vital EAD in beef calves.

Item	No Vital EAD	Vital EAD	*P*-value
Selenium, ng/ml			
0 hours	73.0 ± 2.10	72.7 ± 2.0	0.65
48 hours	64.2 ± 1.7	64.53 ± 1.7	0.90
Vitamin A, µg /ml			
0 hours	0.10 ± 0.01	0.11 ± 0.01	0.65
48 hours	**0.16± 0.01^{x}**	**0.22 ± 0.01^{y}**	**< 0.01**
Vitamin E, µg /ml			
0 hours	1.10 ± 0.18	1.34 ± 0.18	0.35
48 hours	**4.73 ± 1.33^{x}**	**14.80 ±1.33^{y}**	**< 0.01**

^{xy}Means within row lacking a common superscript differ ($P < 0.01$)

Table 3. Effect of injectable Bo-Se and Vital EAD on growth of beef calves (pounds).

Bo-SE	Vital EAD	BW 1	BW 2*	Gain	ADG
		P = 0.27	***P* = 0.03**	***P* = 0.02**	***P* = 0.02**
No	No	95.8 ± 4.8	128.5 ± 5.8^{ab}	32.6 ± 3.2^{xy}	1.42 ± 0.14^{xy}
No	Yes	103.2 ± 4.8	141.0 ± 5.8^{b}	37.6 ± 3.2^{y}	1.64 ± 0.14^{y}
Yes	No	101.1 ± 4.9	139.2 ± 5.9^{b}	38.2 ± 3.3^{y}	1.66 ± 0.14^{y}
Yes	Yes	97.7 ± 4.9	125.2 ± 5.8^{a}	26.8 ± 3.4^{x}	1.17 ± 0.15^{x}

* Body weight taken 23 days after treatment administration

^{xy} Means within column lacking a common superscript differ ($P < 0.01$)

^{ab} Means within column lacking a common superscript tend to differ ($P < 0.10$)

Conclusions

Administration of Vital EAD increased serum concentration of vitamin A and vitamin E in young beef calves whereas Bo-Se increased concentrations of selenium. Future research will explore duration of elevated serum vitamin status as well as potential health benefits.

CGREC Annual Report - December 2011