2000 Animal Science Research Report

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The Effects of Feeding Vitamin E to Sale Barn-Origin Calves During the Receiving Period: Animal Performance and Medical Costs

J.N. Carter, D.R. Gill, A.W. Confer, R.A. Smith and R.L. Ball

Story in Brief

Six hundred ninety-four shipping stressed calves (mostly British crosses) from southern Oklahoma and northern Texas auction barns were received at the Willard Sparks Beef Research Center (WSBRC) in Stillwater, OK, from July to December 1999, and used to study the effects of adding supplemental vitamin E during the receiving period. Rather than feeding different levels of vitamin E for the full 42-d receiving period, 2000 I.U. of supplemental vitamin E was fed for 0, 7, 14, or 28 d. The basal diet consisted of soybean hulls, corn, wheat middlings, a lasalocid-containing protein supplement, and cottonseed hulls; feed intake was not restricted. A regimen of anti-microbial drugs prescribed by veterinary personnel was used when animals met specific criteria for morbidity. Detailed records of all incidences of disease and costs associated with anti-microbial drug treatment were maintained and analyzed by dietary treatment levels. Regardless of dietary vitamin E treatment, daily gains (2.1 lb/d), or feed conversion (F/G = 5.3) were not improved. Morbidity averaged 64.5% among all cattle; most symptoms occurred within the first 7 to 14 d. Anti-microbial treatment costs were reduced by 22.4% when cattle were fed 2000 I.U. of vitamin E for 28 d, compared to controls. In this study, medical costs minus the cost of providing vitamin E in the diet at this level for 28 d provided a $0.38/hd direct advantage.

Key Words: Vitamin E, Stress, Shipping Fever, Antibiotics, Feedlot

Introduction

The nebulous mechanisms of stress in cattle caused by marketing, transit, weaning, and other management practices and its interaction with infectious diseases, like the bovine respiratory disease (BRD) complex, has long been recognized (Breazile, 1988). Vitamin E (α-tocopherol) is a potent lipid-soluble antioxidant that functions in the prevention of chronic diseases associated with oxidative stress. It remains unclear whether the free-radicals produced as part of normal metabolism are injurious by themselves, or if they are formed as a result of disease (deZwart et al., 1998). Growing cattle require between 33 and 132 IU/lb body weight of vitamin E (NRC, 1996). Previous studies (Gill et al., 1986; Hays et al., 1987) evaluating the effects of vitamin E supplemented cattle revealed improvements in animal performance and improved immune system function. Fortunately, the cost of vitamin E is now at affordable levels. Stovall et al. (2000), studied the effects of dietary antioxidants on animal performance, health response and carcass traits. Their results indicate significant effects on carcass traits, particularly carcass value, for cattle requiring one or fewer anti-microbial treatments.

Our objective in this study was to determine the influence of 2000 I.U. of supplemental dietary vitamin E over time (0, 7, 14, or 28 d), rather than seeking an optimum feeding level over the entire pre-conditioning period (42 d). We intend to show animal performance effects in terms of daily gain and feed conversion; costs associated with anti-microbial drug therapy will be used as one parameter to describe the immune response.

Materials and Methods

Seven truckloads of sale barn-origin calves (568 heifers, 434 lb initially; 126 bulls and steers, 333 lb initially) were received at the WSBRC in Stillwater, OK, from July to mid-December, 1999. Calves were purchased from numerous auction barns in south central Oklahoma and northern Texas, transported to a facility near Purcell, OK, and sorted into truckload lots. They were then transported approximately 90 miles to the WSBRC. On arrival, calves were allowed to co-mingle and rest for at least 1h in a return alley prior to pre-processing. This procedure included assessment of overall health, individual weight (INWT) of each calf, and application of a sequentially numbered identification tag. Calves were then evenly distributed to six holding pens for no more than 36 h before inception of the study. While in these holding pens, 2 lb of prairie hay and 3 lb of the control diet (Table 1) were fed per head. On d 0, calves were processed at approximately 6:00 a.m., prior to feeding. Processing included: individual weight, vaccination for viral respiratory diseases (BRSV-Vac 4™, 2 mL IM); clostridial diseases (Vision-7™, 2 mL Sub-Q (heifers), or Covexin 8™, 5 mL Sub-Q (bulls and steers)), and a treatment for internal and external parasites (Ivomec-Plus™, 1.0 ml/110 lb SubQ); BRSV-Vac 4™ was boostered on d 14.

Calves were blocked by weight using INWT into two weight blocks (light=L, heavy=H) and randomly, and evenly as possible, assigned to one of four dietary treatments. Treatments were randomly assigned to eight pens. Dietary treatments are represented by the number of days that the control diet was supplemented with 2000 I.U. of vitamin E: 0 d=Control (CON), 7 d=E7, 14 d=E14, or 28 d=E28. After d-0 processing, calves were immediately taken to their assigned pens and 5 lb of the control or experimental diet (Table 2) were delivered into concrete feed bunks (40' of linear bunk space per pen). Prairie hay was fed for the first 7 d only (1.6 lb/d). As the amount of hay in the diet was reduced and as calves became acclimated to the new environment and diets, feed was increased on an ad libitum basis. Pen size was uniform across all treatments (40' x 100') and alternating pens shared automatic water basins. Feed was delivered once daily at approximately 7:00 a.m. Feed was delivered twice daily during inclement weather to provide clean, dry feed for a majority of each day. Cattle were weighed on d 0, 14, 28, and 42 of the study. On d 41 cattle received only one-half of the previous day's ration and were not permitted access to water from 5:00 p.m. until after final processing on d 42.

Cattle were closely observed each morning at approximately 6:30 a.m. by experienced veterinary personnel for signs of respiratory (BRD) and other diseases. Two or more clinical signs of disease (depression, lack of fill, occasional soft cough, physical weakness (stumbling, or altered gait), and ocular or nasal discharge) were required to designate a calf as "sick", or morbid. All morbid animals were evaluated further, once restrained, and subject to therapeutic anti-microbial treatment. Once pulled, a calf would be taken to the processing area and restrained in a squeeze chute; individual weight was recorded, and rectal temperature assessed. If rectal temperature was greater than 104°F, a prescribed regimen of anti-microbial drug treatment therapy (Table 3) followed. Regardless of status, all information was recorded on an individual "sick card" and filed by pen for future reference.

Statistical Analysis. Data were analyzed by ANOVA in a split-plot with whole units in a randomized block design (RBD) for daily gain and feed conversion (pen=experimental unit). Variables related to medical treatment costs were analyzed by ANOVA as a split-plot with whole units in a RBD with sub-sampling. All models were analyzed using the GLM and MIXED procedures of SAS® (1996).

Results and Discussion

Recovery time, or the number of days from first antibiotic treatment to last (Table 4), shows a more rapid trend in response to anti-microbial drug therapy from CON to E28. Morbid cattle in both CON and E28 received the first drug therapy on about d 3. The percentage of cattle in each treatment group that required the second drug therapy was reduced by slightly more than forty percent from CON to E28 (20.2 vs 12.1). No statistical differences were detected (P>.05) in the number of cattle requiring more than one drug treatment; however, a case for an economic advantage, as well as an implicit nutritional advantage, could be argued when calves respond to anti-microbial treatments sooner and return to positive levels of performance more rapidly. Performance data and health response data, including medical costs, are included in Table 5. Regardless of dietary treatment, average daily gain and feed conversion was not different (P>.05). The percentage of calves identified as "sick", and thus requiring treatment with anti-microbial drugs was 67.8, 68.3, 61.8, and 60.3% for the CON, E7, E14, and E28, respectively. Medical costs decreased (P>.05) from CON by 9.4, 17.2, and 22.4% for E7, E14, and E28, respectively. Other procedures are in progress and will be reported in subsequent research reports. Laboratory analyses to quantify serum lipid values and vitamin E concentrations which may help describe the effects that our experimental diet had on the animal physiologically are among these. Plasma and serum samples are also being analyzed to determine acute phase protein concentrations in response to stress and disease. These values, along with serum antibody titers to respiratory viruses, will be examined as possible predictors of disease status and subsequent response to anti-microbial drug treatment. Carcass data will also be collected as each load reaches appropriate slaughter weight and compared to disease status data.

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Acknowledgements

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Supplement[a]	13.6
Cottonseed hulls	10.0

[a]Supplement composition: Cottonseed meal 55.5%, soybean meal (47.5%) 31.5%, limestone 8.75%, pellet partner 5.0, salt 1.75%, vitamin A (30,000 IU/gm) .14%, vitamin E-50 adsorbate .02% (provides 125 I.U. vitamin E when included in the diet as described above), Bovatec 68™ .17% (formulated to contain 30 g/ton), selenium (0.02%) .08%.

Table 2. Composition of experimental diet on a dry matter basis when daily intake was equal to 10 lb/hd.

Ingredient	%DM
Soybean hulls	33.0
Corn, whole shelled	26.5
Wheat middlings	12.9
Supplement[a]	13.6
Cottonseed hulls	10.0
Vitamin E supplement[b]	4.0

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[b]Wheat middlings used as a carrier, and therefore, substituted when daily intake increased and the percentage inclusion of vitamin E decreased; vitamin E inclusion rate adjusted to provide 2000 IU vitamin E in 5 lb (6%), 10 lb (4%), or 15 lb (2%) of final ration depending on average daily ration intake.

Table 3. Therapeutic treatment and anti-microbial drug protocol[a].

Pull	Score[b]	Rectal temp	Drug therapy[c]
First	Mild or >	>104° F	Micotil™
No further treatment for at least 48 h			
Second	Mild or >	>104° F	NuFlor™
No further treatment for at least 72 h			
Third	Mild or >	>104° F	Excenel™
Repeat in 48 h regardless of severity score or rectal temperature			

[a]All anti-microbial drugs given under the supervision of a veterinarian.

[b]Subjective scores indicating severity of disease.

[c]All anti-microbial drugs given at recommended label dosages and routes of administration.

Table 4. Recovery time of morbid calves.

Dietary treatment	Rx1[a]	Rx2[a]	Rx3[a]
CON (n=183)	2.9 (124)[b]	9.7 (37)	24.4 (5)
E7 (n=180)	3.5 (122)	9.8 (25)	19.2 (6)
E14 (n=178)	3.3 (110)	8.7 (26)	21.3 (4)
E28 (n=174)	3.0 (103)	6.9 (21)	13.2 (6)

[a]Indicates day of experiment (0 to 42) on which the first (Rx1), second (Rx2), or third (Rx3) anti-microbial drug treatment was administered.

[b]Numbers in parenthesis represent cattle in each dietary treatment group that received either the first, second, or third anti-microbial drug treatment; some cattle could have received all three stages of drug therapy.

Table 5. Results of animal performance and health response by treatment.

Parameter	Control (n=177)	E7 (n=178)	E14 (n=171)	E28 (n=168)	S.E.	Pr > F
Daily gain, lb	2.1	2.2	2.2	2.2	.09	.6
F/G[a]	5.3	5.2	5.3	5.3	.30	.9
Total gain, lb	88.8	92.4	91.3	93.3	3.9	.6
Morbidity, %	67.8	68.3	61.8	60.3	-	-
AMT[b]	1.3	1.2	1.2	1.2	.2	.6
Rx costs[c], $/hd	6.17	5.59	5.11	4.79	.58	.11

[a]Feed to gain ratio calculated as total dry matter intake per pen divided by total lb gained per pen.

[b]Anti-microbial treatments required per sick animal according to protocol described in Table 3.

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