Effect of Energy Level and a Fibrolytic Enzyme on Performance and Health of Newly Received Shipping Stressed Calves

R.E. Peterson, C.R. Krehbiel, D.R. Gill, and C.E. Markham

Story in Brief

The objective of this experiment was to determine the effect of increasing dietary energy with or without a fibrolytic enzyme on health and performance of sale-barn origin calves. Dietary treatments included: 1) low energy; 2) low energy + enzyme (475 mg/lb of DM); 3) high energy; and 4) high energy + enzyme (475 mg of enzyme/lb of DM). Low- and high-energy diets were formulated for 400 lb medium-framed calves to gain 1.80 and 2.80 lb/d, respectively. The fibrolytic enzyme had no effect on gain, feed intake, or feed efficiency, although gain and feed efficiency tended to be greater for calves consuming the high-energy diet. Increasing dietary energy improved feed efficiency by 14.6%. Morbidity was not influenced by energy level or by the addition of the fibrolytic enzyme. Because increasing energy did not negatively affect the health of calves in this experiment, we conclude that economics should dictate the receiving strategy.

Key Words: Stressed calves, Energy, Fibrolytic enzyme, Feedlot performance, Morbidity

Introduction

Maintaining health of newly received calves in the feedlot continues to be problematic for feedlot managers. Light weight newly received cattle face two primary problems that contribute to a high incidence of morbidity (Galyean et al., 1999). First, stress associated with weaning and transportation has a negative effect on the immune system; and second, this stress occurs when the animal is exposed to a variety of infectious agents as a result of sale barn and shipping management procedures. Although nutritional practices during the first few weeks in the feedlot can have a major influence on subsequent performance and health of newly received feedlot calves (Hutcheson et al., 1984), feed intake by stressed calves is low, averaging approximately 1.5% of BW during the first two weeks after arrival (Cole, 1996). This low feed intake makes correction of nutritional deficiencies difficult, which could further compromise immune function and increase susceptibility to infection. Management practices that decrease the incidence and(or) severity of morbidity in the feedlot are needed. Feed additives that can improve digestibility of the diet and(or) boost the immune system are important for the overall health and performance of stressed beef cattle. Increased digestibility of diets for newly received stressed calves may improve health and performance. Therefore, the objective of this study was to determine the effect of increasing dietary energy level with or without a fibrolytic enzyme on health and performance of sale-barn origin calves during a 56-d receiving study.

Materials and Methods

Four truckloads (100 calves/load; Table 1) of sale barn-origin calves (470 ± 36 lb) were received at the Willard Sparks Beef Research Center during the months of January, February, and March 2002. Calves were purchased from several auction barns in South Central Oklahoma and northern Texas. Day one (d 1) processing, at approximately 0730 h before feeding, included individual weight, vaccination for infectious bovine rhinotracheitis/parainfluenza-3 virus/bovine viral diarrhea/bovine respiratory syncytial virus (Frontier 4 Plus [Intervet, Millsboro, DE], 2 mL s.c.); vaccination for Clostridial organisms (Covexin 8 [Schering-Plough, Omaha, NE], 5 mL s.c.), treatment with anthelmintics to control internal and external parasites (Ivomec-Plus [Merial Animal Health, Duluth, GA], 1.0 mL/45.4 Kg of BW s.c.), an antibiotic treatment (Micotil [Elanco Animal Health, Indianapolis, IN], 1.5 mL/100 lb of BW), and all bulls were banded with the Callicrate Easy Bander (No-Bull Enterprises LLC., St. Francis, KS). The calves received a booster vaccination for the respiratory viruses on d 14.

Table 1. Description of cattle at arrival

Load	Arrival Date	Weight, lb	Bulls	Steers	Total
1	1/25/2002	467 $\pm$ 39	45	53	98
2	2/1/2002	466 $\pm$ 33	54	44	98
3	2/8/2002	473 $\pm$ 31	67	32	99
4	3/22/2002	477 $\pm$ 39	43	57	100

Treatments. Dietary treatments included: 1) low energy; 2) low energy + enzyme (475 mg of enzyme/lb of DM); 3) high energy; and 4) high energy + enzyme (475 mg/lb of DM). A corn-based premix was included in the diet at 2 percent of ration DM. In enzyme diets the corn-based premix contained the appropriate level of enzyme. In diets without enzyme supplementation the premix was all corn. Low-and high-energy diets were formulated based on 400 lb medium-framed calves to gain 1.80 and 2.80 lb/d, respectively (Table 2; NRC, 1996). After processing on d 1, calves were immediately taken to their assigned pens and fed 1.0% BW prairie hay and .5% BW of their respective treatment rations. Prairie hay was decreased .2% BW every two days for ten days, and rations were increased to provide ad libitum intakes. Feed was delivered twice daily at approximately 0800 and 1400 h. Cattle were weighed on d 0, 14, 28, 42, and 56 of the study. Calves received only one-half of the previous days ration on d 55 and were not permitted access to water from 1700 h until after the final weight on d 56.

Health Management. Cattle were observed each morning at approximately 0730 h by experienced personnel (supervised by OSU College of Veterinary Medicine) for signs of respiratory and other diseases. Two or more clinical signs of disease (depression, lack of fill, occasional soft cough, physical weakness or altered gait, and ocular or nasal discharge) were required to designate a calf as sick and eligible for further clinical review and therapeutic antibiotic treatment. Calves that were pulled were returned to the processing area, weighed, and rectal temperature taken. All information was recorded on an individual sick card and filed by pen. If an animal's rectal temperature reached 104ºF or higher an antibiotic treatment was administered. Calves were treated as follows: a) first time treatment were administered Baytril (4.5 mL/100 lb of BW s.c.; Bayer Corporation, Shawnee Mission, KS); b) second time treatment were administered Nuflor (6.0 mL/100 lb of BW s.c.; Schering-Plough Animal Health Corp., Union, NJ) and ; c) third time treatment were administered Excenel (1.0 mL/100 lb of BW s.c.; Pharmacia & Upjohn Animal Health, Kalamazoo, MI). If cattle received more than three antibiotic treatments due to sickness, the third treatment protocol was followed for all subsequent sicknesses.

Statistical Analysis. Feedlot performance and health data were analyzed using the MIXED procedure of SAS (SAS, 1998). The model included terms for load, block, and treatment. Pen was used as the experimental unit for performance data variables such as daily gain, feed intake, and feed conversion. The experiment was designed as a randomized complete block, blocked by initial body weight, with a 2 x 2 factorial treatment structure. Main effects were the two levels of energy with or without enzyme supplementation. Two-way interactions between main effects and block were tested. Block x energy, and block x enzyme interaction terms were not significant ($P>.10$), and therefore left out of the analysis. Load, load x energy, and load x enzyme served as the random variables in the statistical analysis for this experiment. For variables related to health, such as first and second pull rates and DOF until first and second pull, individual calves were used as the experimental unit.

Results and Discussion

Feedlot performance of the calves is shown in Table 3. Initial and final weights were similar for both the energy and enzyme treatments. There were no differences in ADG between fibrolytic enzyme treatments overall. Average daily gain was not different for energy treatment overall, however, from d 15 to 28, cattle fed the high-energy diet had greater ADG compared with cattle fed the low-energy diet. Although initial period ADG was not different for the energy treatment, we believe numerical differences in d 1 to 14 ADG can be attributed to rumen fill because of the increased bulk of the low energy diet. Lofgreen et al. (1980) noted differences in feedlot performance between newly received calves supplemented with free choice alfalfa hay compared with calves that had not received free choice alfalfa hay in the first 28 d of the experiment. Dietary effects seen in the first 28 d upon arrival can be attributed to comparing dietary concentrate level, however, much of the effect can be due to differences in fill (Lofgreen et al., 1980). Dry matter intake was not different for either the energy or enzyme treatments overall or within period. Although there were no differences in feed intake for dietary energy level, decreased dry matter intake for the high-energy treatment is most likely a function of increased energy density of the diet. Feed efficiency was improved from d 15 to 28 and tended to be improved from d 42 to 56 and d 0 to 56 for cattle fed the high-energy diet compared with cattle fed the low-energy diet. However, supplementation with a fibrolytic enzyme had no effect. The tendency for improved feed efficiency for the high-energy diet can be attributed to the increased dietary energy density of the diet. Lofgreen et al. (1980) reported improved conversion of feed to gain as concentrate level increased because of the greater energy density of diets. In another study, Lofgreen et al. (1983) reported performance by newly received calves is typically optimized with higher-concentrate diets. Fluharty and Loerch (1996) reported similar trends. Daily gain and feed efficiency for newly received, transit stressed calves, increased with increasing concentrate during a 28 d arrival period (Fluharty and Loerch, 1996).

The influence of a fibrolytic enzyme on health and morbidity is summarized in Table 4. Number of animals treated once was not different for either energy or enzyme treatments. In addition, the mean day for which the first antibiotic treatment occurred was not different for either energy or enzyme treatments. Mean day treated for first treatment was significantly extended for cattle on the low-energy no fibrolytic enzyme (11.5) and the high-energy fibrolytic enzyme (11.3) diets compared with the low-energy fibrolytic enzyme (9.6) and the high energy no fibrolytic enzyme (9.8) diets. Fibrolytic enzyme supplementation did not significantly affect the number of animals treated a second or third time for either energy or enzyme treatments. Similarly, dietary treatments did not affect the number of days on feed the second or third antibiotic treatment occurred for either energy or enzyme.

Although increases in dietary energy level had no affect (P>.10) on health and morbidity in this experiment, other researchers (Lofgreen et al. 1975; Galyean et al., 1999) have found mixed results. Lofgreen et al. (1975) reported no effect of concentrate level (20, 55, and 72%) on morbidity rate in one experiment. However, in a second experiment with concentrate levels of 55, 72, and 90%, there was a trend for increased rate and severity of morbidity in newly received lightweight cattle. More recently, Galyean et al. (1999) reported that one possible negative aspect of higher-concentrate receiving diets is an increased morbidity rate, and/or severity of morbidity with increasing dietary concentrate level. Conversely, Fluharty and Loerch (1996) did not report any negative effects on incidence or severity of morbidity due to increasing concentrate level (70, 75, 80, and 85) of receiving rations fed to newly received shipping stressed calves. Differences in source of cattle, time of year, nature of diet, management, and other unknown factors likely confound the relationship between dietary concentrate level and health and morbidity (Galyean et al., 1999).

The trends in feedlot performance and health and morbidity data suggest that fibrolytic enzyme supplementation was ineffective for use with newly received shipping stressed calves. However, this data does suggest that increasing dietary energy level may have benefits when receiving shipping stressed calves. Although feed intake and gain were not different (P>.10) for the overall feeding period between energy level treatments, feed efficiency tended (P=.06) to be improved for the high-energy diet (.175 and .171, respectively) compared with the low energy diet (.154 and .148, respectively) overall. The important finding is that even when suffering from stress, calves were able to utilize a higher energy diet (Lofgreen et al., 1980). In addition to improving feed efficiency, the high-energy dietary treatment showed no negative affects on health or morbidity.

Implications

In the present experiment, direct fibrolytic enzyme supplementation to a total mixed ration for newly received shipping stressed calves was generally ineffective. Although newly-received shipping stressed calves were not affected by the addition of a fibrolytic enzyme, increasing dietary energy level improved feed efficiency by 14.6%, with no negative impacts on health or morbidity. Because increasing dietary energy level did not negatively affect health of calves in this experiment, we conclude that economics should dictate the receiving strategy.

Table 2. Composition of experimental diets (DM basis)

Ingredient	Low Energy	High Energy
Alfalfa Hay Fair	60.0	25.0
Cottonseed Hulls	10.0	10.0
Rolled Corn	24.0	49.5
Cane Molasses	5.0	5.0
Soybean Meal, 47.7%	.50	6.0
Cottonseed Meal	.25	3.0
Salt	.24	.24

Limestone, 38%	0	1.2
Rumensin	.016	.016
Vitamin A, 30,000 U/lb	.019	.019
Vitamin E, 50%	.004	.004
Selenium 600	.001	.001
Nutrient		
ME, Mcal/cwt	107.3	123.7
NEm, Mcal/cwt	67.6	81.9
NEg, Mcal/cwt	38.4	50.0
NDF	32.5	21.7
eNDF, %	79.8	65.3
CP, %	14.3	14.5
DIP, %CP	70.5	58.5
Potassium, %	1.61	1.17
Calcium, %	.97	.94
Phosphorus, %	.25	.30

Table 3. Feedlot performance of newly received shipping stressed calves fed high and low energy diets with and without a fibrolytic enzyme

	Low Energy		High Energy			Probability > F		
Item	No Enzyme	Enzyme	No Enzyme	Enzyme	SEM[a]	Energy	Enzyme	Energy x Enzyme
Steers	99	99	99	98	---	---	---	---
Pens	8	8	8	2	---	---	---	---
Weight, lb								
d 0	470	470	470	470	10.94	.98	1.00	.99
d 56	582	577	593	592	11.41	.27	.80	.86
Daily Gain, lbs								
d 0-14	1.10	.84	.61	.54	.30	.12	.65	.70
d 15-28	1.85	1.99	2.67	2.89	.40	.01	.72	.90
d 29-42	2.41	2.21	2.47	2.36	.40	.82	.68	.88
d 43-56	2.64	2.61	3.02	2.94	.38	.18	.84	.92
d 0-56	2.00	1.91	2.19	2.18	.14	.21	.53	.52
DM intake, lb/d								
d 0-14	7.07	7.21	7.11	6.96	.25	.71	.99	.53
d 15-28	12.52	12.75	12.80	12.84	.44	.69	.67	.77
d 29-42	16.50	16.32	15.78	16.47	.44	.53	.57	.33
d 43-56	19.18	18.46	17.50	17.91	.67	.20	.78	.32
d 0-56	23.95	12.88	12.54	12.81	.34	.50	.74	.57
Gain/feed, lb/lb								
d 0-14	.152	.119	.084	.078	.042	.13	.70	.70
d 15-28	.152	.155	.208	.225	.031	.01	.79	.76
d 29-42	.146	.133	.158	.142	.023	.68	.49	.95
d 43-56	.137	.142	.172	.167	.019	.07	1.00	.76

d 0-56	.154	.148	.175	.171	.008	.06	.39	.83
[a]Standard error of the mean								

Table 4. Feedlot performance of newly received shipping stressed calves fed high and low energy diets with and without a fibrolytic enzyme								
	Low Energy		High Energy			Probability > F		
Item	No Enzyme	Enzyme	No Enzyme	Enzyme	SEM[a]	Energy	Enzyme	Energy x Enzyme
Steers	99	99	99	98	---	---	---	---
Pens	8	8	8	2	---	---	---	---
Pulls, #	.64	.77	.71	.70	.08	.29	.89	.36
Treated once, %	37.3	44.7	41.9	40.2	.59	.23	.75	.72
Day treated	11.5	9.6	9.8	.11.3	1.2	0.17	0.2	<.01
Treated twice, %	14.6	19.3	18.2	15.7	3.1	.31	.62	.7
Day treated	17.9	17.1	18.2	16.9	2.3	.79	.67	.52
Threated thrice, %	6.6	7.6	6.6	7.6	1.8	.71	.71	.44
Day treated	22..9	22.3	18.9	26.3	3.2	.91	.18	.82
[a]Standard error of the mean								

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