EXTENSION
BEEF CATTLE RESEARCH UPDATE
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Random Metaphylaxis Effects on Health Outcomes and Growth Performance of High-Risk Beef Steers

Shipping fever, or bovine respiratory disease complex (BRD), is the most common morbidity and mortality event among feedlot cattle in the United States.[1] BRD accounts for approximately 75% of morbidity[2] and 50 to 70% of mortality in feedlots.[3] Metaphylaxis is the on-arrival, preventative mass medication of antimicrobial therapy for the control of BRD. Conventional metaphylaxis is currently the only management tool that has consistently shown an improvement in clinical health outcomes of high-risk cattle.[4] Conventional metaphylaxis is imprecise and costly because antimicrobial drugs are administered to cattle that are healthy and would otherwise not qualify for antimicrobial therapy. Texas Tech University conducted an experiment to evaluate the effects of random metaphylaxis administered at feedlot arrival to 0, 33, 66, or 100% of high-risk beef cattle on clinical health, growth performance, and antimicrobial use during a 35-day receiving period.[5]

In this experiment, a total of 216 crossbred beef steers with an initial body weight (BW) of 434 lb were sourced from regional auction markets in West Plains, Missouri, and shipped approximately 733 miles to the Texas Tech University Burnett Center, arriving on December 7, 2022 (source block 1) and February 8, 2023 (source block 2). These steers were used in a generalized complete block design consisting of 2 source blocks, each with 4 BW blocks, and 4 treatments, yielding a total of 8 replications per treatment. Experimental treatments were assigned randomly to pen before cattle arrival. Experimental treatments consisted of (1) negative control, s.c. injections with 5 mL sterile saline (0M); (2) 33% of steers per pen given metaphylaxis at random with tildipirosin (33M), (3) 66% of steers per pen given metaphylaxis at random with tildipirosin (66M); and (4) positive control; conventional metaphylaxis given to 100% of steers with tildipirosin (100M). The steers in the metaphylaxis treatments were administered tildipirosin (Zuprevo, Merck Animal Health) at 1 mg/100 lb of BW.

The effects of the treatments on clinical health outcomes are shown in Table 1. The percentage of steers treated for BRD at least once (BRD1) was 48.5% greater on average for 0M and 33M than for 66M and 100M ($P < 0.01$). Similarly, the percentage of steers treated twice for BRD (BRD2) was 77% greater for 0M and 33M than for 66M and 100M ($P < 0.01$). The percentage of steers treated 3 times for BRD (BRD3) did not differ among treatments ($P = 0.28$), whereas the percentage of steers classified as chronic (treated for BRD >3 times) tended to be greater in 0M than in 66M ($P = 0.07$). Mortality did not differ among treatments during the 35-day receiving period ($P = 0.17$).

No difference between treatments was observed in days to first antimicrobial therapy treatment ($P \geq 0.61$). Whereas days to second antimicrobial therapy (days between first and second BRD treatment) tended to be greater for 33M and 0M ($P = 0.10$) than for the other 2 treatments. Furthermore, days to third therapeutic treatment was greater in 33M than for 0M and 66M ($P < 0.01$), with no steers in the 100M treatment being treated 3 times.

As was expected, the total metaphylactic cost per pen was greatest in 100M and least in 0M, and the total therapy cost per pen was greater in 0M and 33M than in 66M and 100M.

The authors noted that this resulted because there were a greater number of steers in 0M and 33M treated for BRD1 and BRD2, which led to a greater amount of therapeutic antimicrobial administered across a greater number of antimicrobial therapy treatments.

Table 1. Clinical health outcomes of high-risk beef steers administered 0, 33, 66, or 100% metaphylaxis at feedlot arrival.

	Treatment[1]				
Item	0M	33M	66M	100M	P-value
No. of steers	56	54	53	53	
No. of pens	8	8	8	8	
BRD1, %	57.1[a]	54.5[a]	27.9[b]	29.5[b]	<0.01
BRD2, %	17.9[a]	20.8[a]	7.1[b]	1.8[b]	0.01
BRD3, %	7.1	3.6	3.6	--	0.28
Chronic, %	5.4	--	1.8	--	0.07
Mortality during 35-day study, %	3.6	--	3.6	--	0.17
Mortality after study completion, %	10.7	1.9	7.6	1.9	0.09
Days to					
1st treatment	7.7	8.5	9.4	9.7	0.61
2nd treatment	12.6	17.6	15.2	14.1	0.10
3rd treatment	15.9[a]	23.5[b]	17.6[a]	--	<0.01
Total metaphylaxis cost, $/pen	0.00[a]	59.97[b]	104.50[c]	151.41[d]	<0.01
Total therapy cost, $/pen	95.81[a]	85.12[a]	42.90[b]	37.28[b]	<0.01

[a–d]Items within a row that do not have a common superscript differ, P ≤ 0.05.

[1] Experimental treatments were as follows: 0M = negative control, injection with sterile saline; 33M = 33% of the steers were administered metaphylaxis at random; 66M = 66% of the steers were administered metaphylaxis at random; 100M = positive control, conventional metaphylaxis administered to all steers.

[2] Percentage of steers treated for bovine respiratory disease (BRD) at least once (BRD1), twice (BRD2), 3 times (BRD3), or >3 times (chronic).

The effects of the treatments on the growth performance of the steers during the 35-day receiving period are shown in Table 2. No differences were observed among treatments for BW on day 14 or 35 of the receiving period (P ≥ 0.65). There were no differences in average daily gain (ADG) throughout the study. However, cattle in the 0M and 33M treatments lost weight between days 0 and 14. Dry matter intake (DMI) tended to be greater in 66M and 100M than 0M and 33M from days 0 to 14 and days 14 to 35 (P = 0.09). Similarly, overall DMI was greater (P = 0.03) for 66M and 100M than for 0M and 33M. DMI as a percentage of BW was greater in 66M and 100M than for 0M and 33M (P = 0.04) from days 0 to 14 and tended to be greater from days 14 to 35 (P = 0.09). DMI as a percentage of BW from d 0 to 35 was significantly greater (*P* ≤ 0.03) for 66M and 100M (2.24%) than for 0M and 33M (2.01%). Gain efficiency (Gain-to-feed ratio) did not differ among treatments throughout the study (P ≥ 0.20).

These researchers concluded that their data suggested that "metaphylaxis can be randomly administered to 66% of high-risk cattle at arrival without the increasing BRD morbidity, while concomitantly increasing DMI, similar to that observed when 100% of the cattle were administered metaphylaxis". As a result, "random metaphylaxis to 66% of steers at arrival decreased antimicrobial use for metaphylaxis while simultaneously maintaining health outcomes and growth performance of high-risk beef cattle".

Table 2. . Effects of high-risk beef steers being administered 0, 33, 66, or 100% metaphylaxis at feedlot arrival on the growth performance of beef steers during a 35-day receiving period.

	Treatment[1]				
Item	0M	33M	66M	100M	P-value
BW, lb[2]					
Day 0	439	432	434	434	0.90
Day 14	423	428	441	441	0.78
Day 35	494	490	509	516	0.65
ADG, lb					
Day 0 to14	-1.10	-0.24	0.40	0.40	0.16
Day 14 to 25	3.37	2.89	3.26	3.66	0.95
Day 14 to 35	1.59	1.63	2.12	2.34	0.73
DMI, lb/day					
Day 0 to14	5.91	5.69	6.48	6.66	0.09
Day 14 to 25	9.59	8.91	9.99	10.41	0.09
Day 14 to 35	9.61	9.06	10.34	10.87	0.03
DMI, % of BW[3]					
Day 0 to14	1.37	1.32	1.48	1.52	0.04
Day 14 to 25	2.08	1.91	2.10	2.19	0.09
Day 14 to 35	2.06	1.96	2.19	2.29	<0.01
Gain:Feed					
Day 0 to14	-0.201	-0.048	0.055	0.058	0.20
Day 14 to 25	0.384	0.329	0.326	0.344	0.96
Day 14 to 35	0.160	0.180	0.196	0.212	0.88

[a–d]Items within a row that do not have a common superscript differ, P ≤ 0.05.

[1] Experimental treatments were as follows: 0M = negative control, injection with sterile saline; 33M = 33% of the steers were administered metaphylaxis at random; 66M = 66% of the steers were administered metaphylaxis at random; 100M = positive control, conventional metaphylaxis administered to all steers.

[2] Shrink of 4% was applied to all BW except the day 0 BW. Reported day 0 BW is an average of day −1 and day 0 BW.

[3]Calculated using the average BW of the corresponding period.

[1] USDA-APHIS (2013). Pages 18 in Feedlot 2011 Part IV: Health and Health Management on U.S. Feedlots with a Capacity of 1,000 or More Head. USDA–APHIS–Veterinary Services, Fort Collins, CO.

[2] Edwards, A. J. 1996. Respiratory diseases of feedlot cattle in the central USA. Bovine Practitioner 30:5–7.

[3] Loneragan, G. H., D. A. Dargatz, P. S. Morley and M. A. Smith. 2001. Trends in mortality ratios among cattle in US feedlots. J. Am. Vet. Med. Assoc. 219: 1122-1127.

[4] Richeson, J. T., K. L. Samuelson, and D. J. Tomczak. 2019. Beef Species—Ruminant Nutrition Cactus Beef Symposium: Energy and roughage levels in cattle receiving diets and impacts on health, performance, and immune responses. J. Anim. Sci. 97:3596–3604.

[5] Hanratty, A. N., N.C. Burdick Sanchez, P.R. Broadway, J.A. Carroll, A.A. Hoffman, J.L. Manahan, Z.S. McDaniel, T.M. Smock, C.W. Dornbach, D.J. Line, M.E. Theurer, M.L. Galyean, and K.E. Hales. 2023. Random metaphylaxis effects on health outcomes, complete blood count, antimicrobial use, and growth performance of high-risk beef steer. Appl. Anim. Sci. 39:380-390. Available at: https://doi.org/10.15232/aas.2023-02458.