PEER REVIEWED

Effects of Concurrent Metaphylaxis with Chlortetracycline and Tulathromycin on the Health and Performance of High-risk Beef Calves

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Abstract

A total of 463 steer and bull calves (average body weight 447 lb or 203 kg) were used to determine the effect of feeding chlortetracycline (CTC) to calves metaphylactically treated with tulathromycin at arrival processing in a research feedlot. Experimental treatments consisted of three growing diets top-dressed with either no pellets (CON); pellets containing CTC (4 g/lb or 8.89 g/kg) administered at a rate of 10 mg/lb (22 mg/kg) body weight (BW) for two five-day intervals with a one-day break in between (CTC); or pellets containing no CTC fed in the same amount per unit of BW (1.12 lb or 2.46 kg/hd) and for the same time period as the CTC treatment (PP). Calves were enrolled in the study for 41 days. No difference in performance, morbidity or mortality was found among the three treatments.

Keywords: bovine, BRD, metaphylaxis, feedlot

Résumé

Un total de 463 bouvillons et veaux mâles (poids moyen 447 lb ou 203 kg) ont été utilisés afin de déterminer l'effet de l'administration de chlorotétracycline (CTC) à des veaux traités de façon métaphylactique avec de la tulathromycine à leur arrivée dans un parc d'engraissement de recherche. Il y avait trois traitements expérimentaux dans lesquels la diète de croissance n'était pas supplémentée de pastille (CON) ou supplémentée avec soit des pastilles contenant de la CTC (4 g/lb or 8.89 g/kg) administrée à un taux de 10 mg/lb (22 mg/kg) de poids corporel pendant deux intervalles de cinq jours avec une pause d'une journée entre les deux (CTC) ou soit des pastilles ne contenant pas de CTC mais administrée à la même quantité par unité de poids corporel (1.12 lb or 2.46 kg/tête) et sur la même période que dans le traitement CTC (PP). Les veaux participaient à l'étude pendant 41 jours. Il n'y avait pas de différence entre les trois traitements au niveau de la performance, de la morbidité ou de la mortalité.

Introduction

Beef calves experience many stressors when marketed, including weaning, commingling, transportation, processing, feed and water changes, and disease challenges.[8] Common outcomes of stress are decreased appetite, loss of body mass,[8] and decreased immunity, resulting in increased risk of disease, especially bovine respiratory disease (BRD). BRD is the most common and costly disease in the stocker and feedlot industries.[12,20] In addition to treatment cost and death loss, BRD can negatively affect feedlot performance and carcass characteristics, resulting in further economic losses.[2,7,23,25]

Vaccination, pre-conditioning, and backgrounding have been shown to reduce morbidity.[22,24,26] In one study, vaccination and pre-conditioning programs reduced respiratory disease during the first 28 days after arrival at the feedlot.[11] Pre-conditioning should increase on-farm gain, reduce transit shrink, and improve feedlot health and performance while improving potential profit.[3] Although beef producers could enhance immunity through preweaning/postweaning management and vaccination programs,[6] there is often no economic incentive to utilize these management practices. In such cases, calves are often at high risk for developing BRD. To reduce risk of BRD, calves are often treated with antimicrobials (metaphylaxis)[13] when they enter the feedyard.

Several injectable antimicrobials are approved by the Food and Drug Administration in the United States for metaphylaxis, including tilmicosin, florfenicol, ceftiofur crystalline free acid, and tulathromycin. Chlortetracycline (CTC) is also labeled for control of BRD caused by *Pasteurella* spp, and has been shown to improve performance[9,16] and decrease respiratory morbidity[5] of high-risk calves.

Administration of tulathromycin at arrival processing has been shown to increase average daily gain (ADG) and decrease respiratory morbidity and mortality caused by BRD compared to using florfenicol, oxytetracycline, tilmicosin phosphate, or ceftiofur crystalline free acid.[1,19,21] However, no studies have examined the concurrent use

of tulathromycin and CTC. The objective of this study was to determine the effect of concurrent metaphylaxis using tulathromycin and feed-grade CTC on health and performance of high-risk beef calves.

Materials and Methods

Two 41-day receiving studies were conducted at the Kansas State University Beef Stocker Unit during November 2007 and March 2008 to compare the use of tulathromycin alone to concurrent use of tulathromycin and CTC to control BRD in high-risk calves. Prior to each study, calves were received over a three-day period; all cattle were sourced from an order buyer in central Tennessee. Calves within a shipment day (block) were procured on a single day at the respective auction facility and were shipped to Manhattan, Kansas. Calves were hauled by truck, and time in transit was approximately 12 hours.

Upon arrival, all calves were weighed, ear tagged, administered tulathromycin[a] (1.14 mg/lb or 2.5 mg/kg) subcutaneously, and palpated for the presence of testicles. Calves were offered *ad libitum* access to long-stem grass hay and water overnight.

The following day, calves were vaccinated against clostridial[b] and respiratory diseases (infectious bovine rhinotracheitis virus, bovine viral diarrhea [types 1 and 2] virus, parainfluenza-3 virus, and bovine respiratory syncytial virus)[c], and were dewormed.[d] Bulls were surgically castrated. Calves that arrived in March were also treated for lice with a topical pour-on insecticide[e] for lice control.

Each load was blocked by arrival date and randomized to pens within one of three feed alleys (one alley per block; six pens per alley), and treatments were randomly assigned to the pens within a block (two pens per treatment within each feed alley), for a total of 18 pens/study. Castrated bulls were equally distributed among the six pens within each alley. Calves were individually weighed and re-vaccinated with the same respiratory vaccine used at initial processing 12 days following initial vaccination, and weighed again at the end of the 41-day study period.

Calves were stepped up on ration during the study using three growing diets ranging from 29 to 36.5% concentrate (Table 1). Diets were fed with the addition of the following experimental treatments: no top-dress pellets (CON); top-dressed with pellets containing chlortetracycline[f] (CTC); or top-dressed with the pellets, but without chlortetracycline (PP). The CTC treatment was top-dressed to provide cattle 10 mg CTC/lb of BW (22 mg/kg). The PP pellets were top-dressed at the same unit of BW (1.12 lb or 2.46 kg/head) as the CTC pellets. The CTC and PP treatments were top-dressed for two periods that lasted five days each (days 1 to 5 and days 7 to 11), with a one-day moratorium between the two treatment periods.

Cattle were observed daily for signs of illness and injury by trained personnel masked (blinded) to treatments; however, calves were not eligible for treatment for BRD until completion of the 5-day post-metaphylaxis evaluation period. A tentative diagnosis of BRD was made if a calf showed signs of depression, such as inappetance, lowered head, and dropped ears, and did not have clinical signs of disease related to other body systems. Cattle with clinical signs were removed from the pen and evaluated; those with a rectal temperature of 104°F (40°C) or higher were treated for BRD according to the Beef Stocker Unit standardized operating procedures, while animals with a rectal temperature less than 104°F were not treated and were returned to their home pen. Briefly, cattle treated the first time for BRD were administered enrofloxacin[g] (5 mg/lb or 11 mg/kg). Treated calves were re-evaluated 48 hours later, and those with clinical signs of BRD and a rectal temperature of 104°F or higher were given florfenicol[h] (18.2 mg/lb or 40 mg/kg) and returned to their home pen. Cattle were evaluated again 48 hours later, and those requiring a third treatment were administered long-acting oxytetracycline[i] (9 mg/lb or 19.8 mg/kg). No cattle were marketed prematurely. All calves that died were examined by trained veterinary personnel to determine the cause of death.

Feed bunks were checked at approximately 0630 and 1430 hours daily to determine the amount of feed to be delivered to each pen of calves; feed was delivered at approximately 0700 and 1500 hours daily during the study. Feed was delivered in amounts sufficient to result in slick bunks both morning and afternoon.

Cattle were weighed on days 0 and 41; the study was terminated on day 41. Daily dry matter intake (DMI), gain, and feed efficiency were determined for each pen of calves. Health records were used to calculate morbidity and mortality.

Table 1. Experimental diets and formulated nutrient content for calves receiving no pellets (CON), pellets containing chlortetracycline (CTC), or pellets without chlortetracycline (PP) during the 41-day receiving periods.

Item	Ration 1	Ration 2	Ration 3
Dry-rolled corn, %	30.00	30.67	36.76
Wet corn gluten feed, %	28.00	35.96	36.76
Alfalfa hay, %	23.00	15.49	15.01
Prairie hay, %	16.00	15.19	8.47
Mineral supplement,%	3.00	2.70	3.00
Nutrient composition			
Crude protein, %	16.07	16.54	16.21
Ether extract, %	3.87	4.46	4.58
Ca, %	1.06	0.83	0.84
P, %	0.46	0.51	0.51
K, %	1.18	1.03	1.07
NE_{M}, Mcal/lb	0.95	0.99	1.01
NE_{G}, Mcal/lb	0.62	0.68	0.71

Statistical Analysis

Pen was the experimental unit. Performance and health data were analyzed using the random effects MIXED model procedure of the Statistical Analysis Software (SAS Institute, Cary, NC). Treatment was included in the model as a fixed effect, and study and start date were included as random variables. Values were determined to be statistically different when $P \leq 0.10$.

Results

Performance data are presented in Table 2. Initial body weight (BW) differed ($P=0.07$) among the three treatment groups because animals within each load were blocked by alley and randomized to pens by BW and sex. Final BW also differed ($P=0.06$) among the three treatments; however, the difference reflected the variance in initial weights. Calves in the PP group had the highest BW at the end of the study; calves in the CTC group had the lowest final BW; and CON calves were intermediate. Daily DMI was affected by treatment ($P=0.09$) and followed the same pattern as initial and final BW; PP calves consumed the most feed, and CTC calves consumed the least. Average daily gain and feed efficiency were not affected by treatment ($P=0.39$ and 0.50, respectively).

Health data are presented in Table 3. Total ($P=0.80$) and respiratory ($P=0.80$) morbidity rates were similar across treatments. Likewise, total relapses and relapses due to BRD did not differ ($P>0.30$) among the three treatments (data not shown). There were no differences in death loss due to BRD ($P=0.25$). Necropsy examination of calves that died confirmed that BRD was the cause of death.

Table 2. Performance of calves receiving no pellets (CON), pellets containing chlortetracycline (CTC), or pellets without chlortetracycline (PP), during the 41-day receiving periods.

	Treatment[a,b]				
Item	CON	CTC	PP	SEM	*P*-value
Head, no.	154	155	154		
Pens, no.	12	12	12		
Initial wt, lb	447[c,d]	442[c]	452[d]	5.72	0.07
Final wt, lb	576[c,d]	569[c]	584[d]	5.67	0.06
Daily DMI, lb	13.63[c,d]	13.46[c]	14.13[d]	0.29	0.09
ADG, lb	3.15	3.11	3.22	0.14	0.39
G:F, lb	0.229	0.233	0.230	0.01	0.50

[a]CON = fed three growing diets only; CTC = three growing diets top-dressed with pellets containing chlortetracycline (4 g/lb CTC) to provide 10 mg CTC/ lb BW; PP = three growing diets top-dressed with pellets containing no CTC administered at the same amount per unit of BW as those in the CTC treatment (1.12 lb/hd).
[b]Pellets were top-dressed from days 1 to 5 and days 7 to 11.
[c,d]Within a row, numbers without a common superscript letter differ ($P \leq 0.10$).

Discussion

Under the conditions of this study, there were no performance or health benefits when feeding CTC to calves following arrival-metaphylaxis with tulathromycin. Results of feeding CTC to calves has been variable. Some studies reported that feeding CTC and sulfamethazine or CTC alone to calves[10] offered no benefits compared to feeding non-medicated feed.[10,17,18] In contrast, other studies showed that CTC improved daily gain and feed efficiency when fed alone or in combination with sulfamethazine.[9,16] Feeding CTC following metaphylaxis with both oxytetracycline and sulfadimethoxine or tilmicosin phosphate had little or no effect on calf performance.[4,10]

Some researchers reported no differences in calf health when feeding CTC alone or in combination with sulfamethazine.[10,15,17] No differences in morbidity or mortality of calves were observed when concurrent metaphylaxis with tilmicosin phosphate and CTC were used.[4] However, a significant reduction in the number of calves treated and treatment days per calf purchased were observed when feeding CTC following treatment with injectable oxytetracycline followed by sulfadimethoxine.[10]

It is possible that the lack of response to feeding CTC in this study was the result of the timing of administra-

Table 3. Health response of calves receiving no pellets (CON), pellets with chlortetracycline (CTC), or pellets without chlortetracycline (PP), during the 41-day receiving periods.

	Treatment[a,b]				
Item	CON	CTC	PP	SEM	*P*-value
Total morbidity, %[c]	25.7	25.7	22.7	0.06	0.80
BRD morbidity, %[d]	24.4	25.1	22.0	0.06	0.80
Mortality, %[e]	2.0	2.0	3.3	0.01	0.25

[a]CON = fed three growing diets only; CTC = three growing diets top-dressed with pellets containing chlortetracycline (4 g/lb CTC) to provide 10 mg CTC/lb BW; PP = three growing diets top-dressed with pellets containing no CTC administered at the same amount per unit of BW as those in the CTC treatment (1.12 lb/hd).
[b]Pellets were top-dressed from days 1 to 5 and days 7 to 11.
[c]All calves received tulathromycin at processing. Total morbidity rate is the number of calves treated for any cause divided by the number of animals in the experimental group x 100.
[d]Bovine respiratory disease (BRD) morbidity rate is the number of calves treated for BRD divided by the number of animals in the experimental group x 100.
[e]Mortality rate is the number of calves that died divided by the number of animals in the experimental group x 100. BRD was the cause of death in all calves that died, which was confirmed by necropsy.

tion of the CTC and tulathromycin. There is effective lung tissue concentration of tulathromycin for up to eight days following subcutaneous administration to calves at label dose,[14] therefore it may be beneficial to wait at least eight days after administering tulathromycin before feeding CTC to calves at risk of developing BRD. Further research is necessary to elucidate this practice.

Conclusions

This study showed no advantage to feeding CTC during two five-day periods to calves treated metaphylactically with tulathromycin at processing. These data may be beneficial to veterinarians and producers when designing health management protocols for newly received high-risk stocker or feeder calves.

Endnotes

[a]Draxxin®, Pfizer Animal Health, New York, NY
[b]Cavalry 9®, Schering Plough Animal Health, Summit, NJ
[c]Bovishield Gold 5®, Pfizer Animal Health, New York, NY
[d]Ivomec® Pour-On, Merial, Inc., Duluth, GA
[e]Cylence®, Bayer Animal Health, Shawnee Mission, KS
[f]Aureomycin®, Alpharma Animal Health, Bridgewater, NJ
[g]Baytril®, Bayer Animal Health, Shawnee Mission, KS
[h]Nuflor®, Schering-Plough Animal Health, Summit, NJ
[i]Bio-Mycin® 200, Boehringer Ingelheim Vetmedica, Inc., St. Joseph, MO

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