PEER REVIEWED

Feed Intake Response of Feedlot Cattle following Single-Dose Treatment of Ceftiofur Crystalline Free Acid Sterile Suspension or Florfenicol

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Abstract

Healthy feedlot cattle were injected with either ceftiofur crystalline free acid (CCFA-SS) or florfenicol at the label dosage in a replicated, three treatment, 21-day study. Daily dry matter intake (DDMI), average daily gain (ADG) and feed efficiency (F:G) were compared between untreated controls and calves injected with CCFA-SS or florfenicol. The study was conducted at Mississippi State University (MSU) and the Pfizer Animal Health Research Farm (PAH).

At MSU, 48 steers (630 lb; 286 kg) were individually fed in four pens with 12 Calan gates in each pen, while 192 steers and heifers (847 lb; 385 kg) were group fed in 24 pens, each holding eight head at PAH. Steers and heifers were fed separately during the trial. Treatments were randomly assigned to animals at MSU and to pens at PAH.

DDMI for cattle treated with CCFA-SS was similar to controls on all days at both locations. Dry matter intake for calves treated with florfenicol was lower ($P < 0.05$) than controls on days 2, 4, 5, 8 and 9 at MSU, and days 1-13 at PAH. ADG of calves treated with CCFA-SS at MSU was significantly greater than controls (4.37 and 3.45 lb; 1.99 and 1.57 kg, respectively) during the 21-day study, while ADG (2.04 lb; 0.93 kg) of calves treated with florfenicol was lower ($P < 0.01$). There were no differences in ADG between treatment groups at the PAH study location. Feed:gain (feed efficiency) of calves treated with CCFA-SS was similar to control calves at both study locations ($P = 0.77$). Feed:gain of cattle treated with florfenicol was similar ($P = 0.50$) to controls at PAH, but was higher (less efficient) than control cattle at MSU (F:G 8.57 vs 3.71, $P < 0.01$).

Résumé

Des bovins en santé dans des parcs d'engraissement ont reçu une injection contenant une suspension de ceftiofur sous forme cristalline libre d'acide (CCFA-SS) ou une injection de florfénicol à la dose recommandée dans une expérience s'étalant sur 21 jours et comportant trois groupes. Le groupe témoin ainsi que les deux groupes injectés ont été comparés au niveau de la prise alimentaire journalière de matière sèche (DDMI), du gain moyen quotidien et de la conversion alimentaire. L'étude a pris place à la *Mississippi State University* et au *Pfizer Animal Health Research Farm*.

Pour l'étude à l'université, 48 bouvillons (630 lb; 256 kg) ont été nourris individuellement dans quatre enclos comportant 12 compartiments chacun. Pour l'étude à la ferme, 192 bouvillons et taures (847 lb; 385 kg) ont été nourris en groupe dans 24 enclos comportant chacun huit animaux. Les bouvillons et les taures ont été nourris séparément. Le traitement a été alloué au hasard au niveau de l'animal pour l'étude à l'université et au niveau de l'enclos pour l'étude à la ferme.

La prise alimentaire de matière sèche des bovins traités avec la suspension de ceftiofur était similaire à celle des bovins du groupe témoin et ce à tous les jours lors des deux études. La prise alimentaire de matière sèche était moindre chez les bovins traités avec le florfénicol ($P < 0.05$) que chez les bovins du groupe témoin aux jours 2, 4, 5, 8, et 9 lors de l'étude à l'université et aux jours 1-13 lors de l'étude à la ferme. Durant l'étude universitaire de 21 jours, le gain moyen quotidien des veaux traités avec la suspension de ceftiofur était plus élevé que celui des veaux témoins (4.37 versus 3.45 lb; 1.99 versus 1.57 kg, respectivement)

alors que le gain moyen quotidien était moindre chez les veaux traités au florfénicol (2.04 lb; 0.92 kg, $P < 0.05$). Il n'y avait pas de différence pour cette variable entre les groupes lors de l'étude à la ferme. La conversion alimentaire des veaux traités avec la suspension de ceftiofur n'était pas différente de celle des veaux témoins lors des deux études ($P = 0.77$). La conversion alimentaire des veaux traités au florfénicol était similaire à celle des veaux du groupe témoin ($P = 0.50$) lors de l'étude à la ferme mais était plus élevée (moins d'efficacité) lors de l'étude à l'université (conversion alimentaire : 8.57 versus 3.71, $P < 0.01$).

Introduction

A common strategy for managing bovine respiratory disease (BRD) in high-risk feedlot cattle is to administer a single dose of antibiotic during arrival processing. The goal is to interrupt the logarithmic growth stage of potentially pathogenic respiratory bacteria in cattle made vulnerable by shipping, commingling, previous exposure to potential pathogens and stress, thus interrupting the infection process. Animals developing clinical signs of BRD during the feeding period require antimicrobial therapy. Ideally, treatment will have little negative effect on appetite or performance. However, studies[2,3,5] comparing use of tilmicosin phosphate[a] to florfenicol[b] showed that dry matter intake and average daily gain (ADG) were greater for tilmicosin-treated calves. Two of the studies[2,3] compared treatment of calves with naturally occurring BRD. Calves in the third study[5] were treated with tilmicosin at arrival, followed by treatment with either tilmicosin or florfenicol if BRD was diagnosed.

Factors other than antimicrobial treatment can affect dry matter intake or reduce overall animal performance. Freshness of feed, crowding of cattle, available bunkspace, water quality and pen conditions in the hospital can influence feed intake and performance as well.

This study measured daily dry matter intake (DDMI), average daily gain (ADG) and the feed:gain (F:G) ratio of healthy feedlot cattle treated with a single dose of either ceftiofur crystalline free acid sterile suspension[c] (CCFA-SS) or florfenicol, and compared the outcomes to untreated control cattle. Both drugs are approved and widely used for control and treatment of BRD caused by *Mannheimia haemolytica*, *Pasteurella multocida* and *Histophilus somni*. The effect of either of these drugs on feed intake and performance is important for the bovine practitioner to know when making recommendations for control and treatment of BRD.

Materials and Methods

This study was conducted at two locations: Mississippi State University in Starkville, MS (MSU), and the Pfizer Animal Health Research Farm in Richland, MI (PAH). Three treatment groups (replications) were used at each location. Yearling steers owned by the Mississippi Agricultural Experiment Station were used at MSU. Cattle utilized at PAH were purchased from outside sources several months earlier. Cattle were placed in the pens 28 days prior to the study for adjustment to the Calan Electronic Door System[d] (MSU) and to adapt to feed and pen mates (both locations).

The experimental unit at MSU was the individual animal, and each treatment was represented by sixteen steers. Forty-eight steers were ranked by weight, and based on ranked groups of four, they were individually assigned to one of four pens. Treatments were then randomly assigned to steers within a pen. Diet consisted of 85% whole shelled corn and 15% pelleted soybean hulls on an "as-fed" basis. Trace mineral blocks were placed in each pen.

At PAH cattle were fed on a pen basis. Forty-eight heifers were ranked by weight and sorted into eight groups of six heifers each, and 144 steers were ranked by weight and sorted into eight groups of eighteen steers each. Within each sex and group, animals were randomly assigned to treatment such that each treatment was represented by two groups of heifers and six groups of steers. Groups were then randomly assigned to pens within the feeding barn. Diet consisted of 26% corn silage, 70.3% rolled corn and 3.7% protein/vitamin/mineral supplement (dry matter basis).

To ensure that cattle were not underfed at either location, excess feed was offered. The initial amount fed was determined by intake during the adjustment period. Feed was weighed and fed twice daily, and orts were weighed each morning. A once-weekly composite sample of "as-fed" feed was collected for dry matter analysis. Dry matter intake was determined by averaging the two dry matter analyses taken before and after a week of feeding, and then multiplying by daily intake. Personnel feeding cattle at both locations were blinded to the assigned treatment groups.

Following the 28-day adaptation period, animals were injected on day 0, and weighed full on days 0 and 21. Cattle in the CCFA-SS group were injected subcutaneously with 3.0 mg/lb (6.6 mg/kg) BW in the middle third of the posterior aspect of the ear. If the dose volume exceeded 15 mL, the dose was divided in half and administered at two locations in the same ear. Cattle in the florfenicol group were injected with 18.2 mg/lb (40.0 mg/kg) BW subcutaneously in the neck, with no more than 10 mL administered at each injection site. Animals were removed from the trial if they became unhealthy or unfit. Response variables for the trial were DDMI, ADG and feed efficiency as measured by pounds of dry matter intake per pound of gain (F:G).

Locations were analyzed separately using repeated measures mixed model analyses with an autoregressive covariance structure (SAS 1999). The model for analysis of DDMI for the MSU location included the fixed effects of treatment, day, and treatment by day and the random effects of pen, pen by treatment, pen by day, pen by treatment by day, animal within pen and residual. The mixed model for analysis of ADG and F:G included the fixed effect of treatment and the random effects of pen, pen by treatment and residual. For DDMI at PAH, repeated measures mixed model for analysis included the fixed effects of treatment, day, and treatment by day and the random effects of pen within treatment and residual. The model for analysis of ADG and F:G included the fixed effects of treatment and the random effects of pen and residual.

Results

Initial weight of cattle did not differ by treatment group at either location. At PAH, cattle in the CCFA-SS, florfenicol and control groups weighed 889, 882 and 884 lb (404, 401 and 402 kg), respectively. Steers at MSU were lighter weight, averaging 595, 591 and 589 lb (270, 269 and 268 kg) for the same groups, respectively. Four steers injected with florfenicol were removed from the trial: three at MSU because of inappetence and one at PAH due to lameness. Two of the steers with inappetence were refaunated with rumen fluid, and one subsequently died. The third steer recovered without medical treatment. The steer that died was not examined postmortem.

Table 1. Daily dry matter intake least square means within day (DM lb/head) by treatment and location from day 0 to day 21.†

	Mississippi State University‡			Pfizer Animal Health§		
Day	Control	CCFA-SS	Florfenicol	Control	CCFA-SS	Florfenicol
1	9.3	9.6	9.1	16.2	14.9	13.6¶
2	11.0	11.6	7.8¶	19.1	18.5	13.5¶
3	12.5	12.0	11.4	19.6	21.3	12.9¶
4	14.4	16.0	9.7¶	20.0	21.5	12.0¶
5	15.0	15.4	11.4¶	20.0	19.4	13.5¶
6	10.9	14.1	10.0	18.9	19.5	14.8¶
7	15.6	15.7	14.5	18.8	19.6	15.2¶
8	13.3	13.4	9.9¶	18.8	20.6	15.7¶
9	16.2	15.7	10.7¶	19.4	20.2	16.0¶
10	15.3	16.5	12.9	19.3	19.7	15.2¶
11	16.2	17.0	13.4	19.2	20.0	14.8¶
12	14.6	17.3	12.5	19.7	21.1	15.3¶
13	13.3	17.5	13.4	18.6	20.6	15.9¶
14	15.8	18.0	14.4	17.9	19.6	15.8
15	16.9	18.1	14.6	18.0	19.6	17.3
16	15.4	18.5	13.6	17.6	19.0	17.6
17	18.0	20.1	19.1	17.7	19.0	17.1
18	17.5	19.1	19.5	18.0	19.4	17.3
19	16.6	18.6	18.8	18.2	19.5	17.8
20	18.4	19.8	20.5	17.5	19.6	18.1
21	18.6	19.8	18.9	17.8	19.5	16.3

† Daily dry matter intake was calculated as the amount of feed offered minus the amount of feed refused times the dry matter content for each pen (PAH) or animal (MSU) for each day.

‡ Repeated measures mixed model analysis was conducted utilizing PROC MIXED of SAS with an autoregressive covariance structure. The model included the fixed effects of treatment, day, and treatment by day interaction and the random effects of pen, pen by treatment, pen by day, pen by treatment by day, animal within pen, and residual. Standard error of least square means equal 1.3 for all least square means except the florfenicol means on days 9 thru 21 which was 1.4.

§ Repeated measures mixed model analysis was conducted utilizing PROC MIXED of SAS with an autoregressive covariance structure. The model included the fixed effects of treatment, day, and treatment by day interaction and the random effects of pen within treatment, and residual. Standard error of least square means equal 0.9 for all least square means.

¶ Within study site, significantly less than control ($P < 0.05$).

Table 2. Average daily gain least square means (LSM) and standard errors (SE) (lb/head/day) by treatment group and location from day 0 to day 21.

Treatment Group	Mississippi State University†		Pfizer Animal Health*	
	LSM (SE)	*P*-value‡	LSM (SE)	*P*-value‡
Control	3.45 (0.34)		1.76 (0.48)	
CCFA-SS	4.37 (0.34)	0.05	2.00 (0.48)	0.73
Florfenicol	2.04 (0.38)	<0.01	1.80 (0.48)	0.96

† Analysis utilized PROC MIXED of SAS. The model included the fixed effect of treatment and the random effects of pen, pen by treatment, and residual.
* Analysis utilized PROC MIXED of SAS. The model included the fixed effects of treatment and the random effects of pen and residual.
‡ *P*-value for comparison to control (2-sided).

Table 3. Feed efficiency least square means (LSM) and standard errors (SE) (lb dry matter/lb gain) by treatment group and location from day 0 to day 21.

Treatment Group	Mississippi State University†		Pfizer Animal Health*	
	LSM (SE)	*P*-value‡	LSM (SE)	*P*-value‡
Control	3.71 (1.01)		9.51 (2.32)	
CCFA-SS	4.13 (1.01)	0.77	8.59 (2.32)	0.78
Florfenicol	8.57 (1.12)	<0.01	11.71 (2.32)	0.50

† Analysis utilized PROC MIXED of SAS. The model included the fixed effects of treatment and the random effects of pen, pen by treatment, and residual.
* Analysis utilized PROC MIXED of SAS. The model included the fixed effects of treatment and the random residual effect.
‡ *P*-value for comparison to control (2-sided).

Mississippi State University – Lightweight Steers

Least square means and contrast of treatments within each day are shown in Table 1. Daily dry matter intake was similar between cattle treated with CCFA-SS and control cattle. DDMI of steers injected with florfenicol was significantly ($P < 0.05$) less than controls on days 2, 4, 5, 8 and 9. ADG (Table 2) of steers treated with CCFA-SS was significantly higher ($P = 0.05$) than control cattle (4.37 and 3.45 lb [1.99 and 1.57 kg], respectively). In contrast, florfenicol-treated steers gained significantly less (2.04 lb/day; 0.93 kg; $P < 0.01$) than controls (3.45 lb/day; 1.57 kg). F:G (Table 3) did not differ ($P = 0.77$) between CCFA-SS treated and control cattle, however F:G was significantly higher ($P < 0.01$) for florfenicol-treated cattle (8.57) than controls (3.71).

Pfizer Animal Health Research Farm – Heavyweight Steers and Heifers

During the 21-day study period, there were no significant ($P > 0.05$) differences in DDMI between control and CCFA-SS treatment groups (Table 1). DDMI of cattle injected with florfenicol was significantly less ($P < 0.05$) than control cattle on days 1 through 13. Overall ADG and F:G were similar ($P > 0.05$) between CCFA-SS treated cattle and controls, and between florfenicol treated calves and controls (Tables 2 and 3).

Discussion

Healthy calves treated with florfenicol consumed less feed than control calves on many of the days of the study, regardless of whether they were light (MSU) or heavyweight (PAH) at the beginning of the study. In contrast, feed intake by calves treated with CCFA-SS was similar to controls at both locations. Cattle treated with CCFA-SS did not have any performance setbacks at either study location. However, lightweight calves (MSU) treated with florfenicol and fed a high-concentrate ration had reduced ADG and less favorable F:G than control cattle. In contrast, heavyweight cattle at the PAH Research Farm treated with CCFA-SS or florfenicol had similar performance (ADG and F:G) to control cattle. Performance differences between light and heavyweight calves may have been due to ration differences rather than initial body weight, as ration and location/animal weight were confounded.

The weight of cattle at the two study locations typify those commonly entering feedlots; heavy feeder cattle and lighter weight, recently weaned and/or backgrounded calves. One of the most important clinical signs of BRD is depressed appetite.[4] Changes in body weight and rectal temperature following treatment for BRD are commonly used to evaluate response to therapy. Obviously appetite is related to changes in body weight, and loss of weight or lack of gain following treatment is associated with greater likelihood of retreatment for BRD. One study reported cattle that gained weight during a three day therapy program for BRD were 3.4 times less likely to require further therapy as compared to cattle losing weight during the same time period.[1]

It is unknown whether any of the performance differences in this 21-day study would persist until cattle reach harvest weight. Further studies to evaluate any long-term effects of depressed feed intake following treatment with florifenicol and studies to elucidate the reasons for the depressed feed intake would be beneficial to veterinarians and beef producers.

Conclusions

Compared to control cattle, there were no adverse effects during the 21-day observation period when cattle were injected with CCFA-SS at label dosage. In contrast, injection of lightweight feedlot cattle with florfenicol resulted in decreased DDMI on some days, decreased ADG and poorer F:G. Post-treatment performance of heavyweight cattle was similar to controls.

Endnotes

[a] Micotil 300, Elanco Animal Health, Indianapolis, IN 46240.
[b] Nuflor, Schering-Plough Animal Health, Union, NJ 07083.
[c] Excede, Pfizer Animal Health, Kalamazoo, MI 49001.
[d] American Calan Company, Northwood, NH 03261.

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Abstract

The Effectiveness of Drying off Individual Quarters as a Treatment for Mastitis

Blowey R., Deyes E.
Cattle Practice 13(2):99-102, 2005

Numerous therapies have been proposed in the treatment of mastitis but few reach more than 60% success rate. This paper describes the reported effectiveness of drying off individual quarters because of unresponsive recurrent mastitis or persistent high cell count. All quarters had been previously treated unsuccessfully. A total of 125 quarters were dried off, with an average of 66% returning to expected production in the next lactation. Milk samples were taken form 30 quarters that had returned to production in the next lactation. In these, 16 had cell counts of below 200,000 and only 3 cultured positive for major pathogens. The technique has several advantages as a treatment. The cow can be kept in milk, albeit on three quarters, there is a considerably reduced risk of the spread of infection to other cows, and the bulk milk presented for sale is not down graded due to increased cell count and Bactoscan.

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