EFFECTS OF A DIETARY SWEETENER ON PERFORMANCE AND HEALTH OF STRESSED CALVES

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Summary

Two-hundred twenty newly received male calves were used to evaluate the time-course of efficacy of a commercial sodium-saccharin containing additive during a 56-day receiving period. Treatments included 0, 88, 176, and 264 g of Sucram (97% sodium saccharin)/ton of dry matter. The effects of treatment and time did not interact ($P > 0.98$) for any response variable tested. Overall total weight gain, ADG, and feed efficiency ($P > 0.10$) were similar among treatments. Overall dry matter intake was 17% greater ($P < 0.05$) for steers receiving 176 g of Sucram/ton compared to steers fed the control diet. The proportion of water disappearing per unit of DMI was less ($P< 0.10$) for steers receiving 264 g of Sucram, but the incidence of animals receiving antibiotic for respiratory disease did not differ among treatments.

Introduction

Cole (1996) indicated that low feed intake during first 14 days is a significant impediment to improving health and performance of stressed calves. Stressed calves are an important component of the stocker cattle industry; these calves are characterized by displaying between 30 and 70% morbidity from undifferentiated bovine respiratory disease complex (BRD). Continued research efforts to identify management practices and/or compounds that may improve the health and performance of stressed calves are needed. Previous data suggest that energy intake of rats can be increased by saccharin supplementation in drinking water (Tordoff, 1988; Ramirez, 1990). Our objective was to evaluate the time-course of efficacy of a commercial saccharin-containing sweetener.

Experimental Procedures

Two-hundred twenty male calves were delivered from Camden, AR to the study site in Canyon, TX in two separate loads on 01 July 2002 and 11 July 2002 (75% intact males). Animals were processed on arrival, and processing included tagging, weighing, vaccination (Titanium 3, Nasalgren IP, and Covexin 8), treatment with Cydectin, implanting with Ralgro, castration by banding, horn tipping, and treatment with Micotil as needed. Cattle were revaccinated against IBR on day 8. Following individual processing, animals within a load were sorted into four groups based on castration and horn tipping (castrated bulls with tipped horns, castrated bulls without tipped horns, steers with tipped horns, steers without tipped horns). Animals within load were allocated randomly to pens by removing one to two animals from each group until each pen contained eleven animals.

The experimental additive was incorporated into meal-form supplements, and supplements were formulated to deliver 0 (S01), 88 (S02), 176 (S03), or 264 grams (S04) of Sucram C-150 (Pancosma SA, Le Grand-Saconnex, Switzerland)/ ton of diet dry matter. Calves were fed a 50% concentrate diet (based on steam-flaked corn) for 14 days, a 75% concentrate diet for 14 days, and a 90% concentrate diet for the remainder of the 56-day study. Calves were also allowed ad libitum access to prairie hay for the first week.

Individual weight was determined before feeding after 7, 14, 21, and 28 days on test. After 56 days, cattle were weighed after feed and water had been removed for 24 and 12 hours, respectively. Cattle health was visually evaluated twice daily for approximately the first two weeks and once daily thereafter. Cattle deemed unhealthy were pulled for further examination. Antibiotic treatment was given if rectal temperature exceeded approximately 39.9°C, and cattle were returned to home pen. The initial antibiotic course of therapy was Baytril 100 and Banamine, the second course of therapy was Nuflor, and the third and final course of therapy was Biomycin 200. Cattle determined to be noncompetitive (marked weight loss in the absence of BRD) or experiencing chronic non-BRD health problems were removed from study.

Feedlot performance data were analyzed as a randomized complete block using Mixed procedures (SAS Inst., Cary, NC) with pen as the experimental unit. Responses across time were evaluated as repeated measures. When the treatment x time effect was not significant ($P > 0.10$), overall performance data were evaluated and the model included the fixed effect of treatment and load served as a random effect. Means were initially separated using contrasts of control vs the average of Sucram, and linear and quadratic effects of Sucram. A linear or quadratic response for DMI or ADG was not evident ($P > 0.24$) from initial analysis.

Thus, means were then separated using contrasts of control vs each concentration of Sucram. Health data were evaluated by Chi-square analysis (Freq procedure; SAS Inst., Cary, NC). Fisher's exact test was used to accommodate the small numbers of observations/cell.

Results and Discussion

Commercial sweeteners have been used successfully in the food and beverage industries as non-caloric 'sensory replacements' for certain sugars. The product used in the present experiment (Sucram C-150) contains sodium saccharin, and has been used commercially in Europe in diets of newly weaned pigs. The study is the first evaluation of Sucram C-150 for cattle in the US.

One animal died during the course of the study, and seven animals were determined to be noncompetitive or chronic and were removed from the study. Feed intake for these animals was deducted from the feed DM consumed by the pen. The effects of treatment and time did not interact ($P > 0.98$) for any response variable tested, suggesting that the pattern of the response across time was similar across treatments. Overall total weight gain ($P > 0.18$), ADG ($P > 0.18$), and feed efficiency ($P > 0.46$) were similar among treatments (Table 1). Overall DMI was 17% greater ($P = 0.04$) for steers receiving 176 g of Sucram/ton compared to steers fed the control diet, and this response was particularly evident after 14 days on feed. The proportion of water disappearing per unit of DMI was less ($P= 0.06$) for steers receiving 264 g of Sucram. The experimental feed additives tested did not influence ($P > 0.36$) the incidence of first pulls or repulls.

A previous study with this product at the University of Leeds reported increased feed intake (additive concentration not specified) and body weight gain by heifer calves (averaging 14 days of age) through three and six weeks, respectively (J. M. Forbes, unpublished observations). The majority of data describing feed/food intake responses to saccharin supplementation has been derived from rat preference tests. A common model employed involves offering unsupplemented drinking water simultaneously with saccharin-supplemented water. Ramirez (1990) reported that rats fed 'slurried' food supplemented with saccharin consumed approximately 12% more energy than rats not receiving saccharin, whereas the response to saccharin was not evident if rats were previously exposed to the same slurried diet without saccharin or if rats were allowed to consume saccharin-supplemented water before the saccharin-supplemented, slurried diet was offered. Tordoff (1988) indicated that rats consumed more food when drinking water was fortified with saccharin than when tap water served as the drinking water source.

Implications

Sucram included at 176 g /ton of dry matter increasing dry matter intake (17%) by stressed beef calves, and numerically increased average daily gain by a similar magnitude (23%). The incidence of morbidity during the receiving period was not altered by Sucram supplementation.

Literature Cited

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Table 1. Effect of dietary concentration of Sucram (g of additive /ton of DM) on overall feedlot performance and morbidity by calves[a]

Item	Sucram dose 0	88	176	264	SE[b]
Pens	4	4	4	4	-
Animals	44	42	43	44	-
Initial body weight, lb	421.5	423.1	422.2	420.2	4.8
Final body weight, lb	515.6	513.9	538.1	515.8	18.2
Total weight gain, lb	94.1	90.8	115.9	95.6	17.5
DMI, lb/day[c]	8.13	8.20	9.53	8.51	0.87
Water disappearance, gal/d	5.11	4.96	5.73	4.48	0.32
Water:DMI, gallons/lb[d]	0.64	0.61	0.60	0.54	0.05
ADG, lb/day	1.68	1.62	2.07	1.70	0.31
DMI:ADG	5.05	5.30	4.61	5.32	0.50
Day 1 through 28					
First treatment	45.4	38.1	41.9	47.7	
Repulls, % of first treatment	15.0	18.8	22.2	28.6	
Day 1 through 56					
First treatment	50.0	52.4	46.5	52.3	
Repulls, % of first treatment	43.5	36.4	35.0	56.5	

[a]Treatment x time was not significant ($P > 0.98$) for any response variable.
[b]Standard error of the least squares mean, n = 4.
[c]Control vs 176 g/ton ($P = 0.04$).
[d]Control vs 264 g/ton ($P = 0.06$).