Impacts of Bunk Management on Animal Performance and Hydrogen Sulfide Concentrations of Steers Fed 25% Modified Distillers Grains with Solubles

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Introduction

The focus of this project was to examine the impact of bunk management strategy on animal performance, carcass characteristics, and hydrogen sulfide gas concentration in beef steers fed 25% modified distillers grains with solubles. Distillers grains are a main component of feedlot diets, with over 70% of surveyed nutritionists indicating that they include some form of distillers grains in rations at ranges of 10-30% (Samuelson et al., 2016). The amount of sulfur present in ethanol by-products has led to concern over the occurrence of polioenchephalomalacia (also known as polio or PEM), a neurological condition resulting from either thiamine deficiency or sulfur toxicity.

There seems to be a general consensus that the greatest risk to cattle for developing PEM is during the time of dietary adaptation to finishing rations, although it could occur at any time. During dietary adaption to high-grain finishing rations, roughage steadily decreases and concentrates (corn, byproduct feeds, or other grains) increase. This adaptation period presents challenges for other metabolic disorders as well, including acidosis and bloat. One of the hypotheses proposed for the onset of sulfur induced-PEM in feedlot cattle is through the production of hydrogen sulfide gas in the rumen.

The impacts of bunk management on feeding behavior and ruminal pH have been evaluated (Schwartzkopf-Genswein et al., 2003). However, continued research into the link between bunk management, animal feeding behavior, ruminal pH, and incidence of PEM, especially during dietary adaptation, is still needed.

Methods

The objective of this study was to evaluate the impacts of bunk management on animal performance, carcass characteristic, and hydrogen sulfide gas concentrations in beef steers fed modified distillers grains with solubles. One hundred thirty-nine steers (average weight = 970 ± 16.6 lb) were allocated to 16 pens and assigned to one of two treatments: 1) Control – (i.e. slick bunk management) bunks managed to be devoid of feed 1 hour prior to feeding, and 2) Long – bunks managed to still have greater than 1 inch of feed remaining at the time of feeding. Treatments were applied during a 28-day adaptation period, during which time steers were adapted to a common finishing ration containing 25% modified distillers grains with solubles (DM basis). Animal performance data including body weight, average daily gain, dry matter intake, and feed-to-gain ratio were collected throughout the study. Upon reaching market readiness, steers were shipped to a commercial abattoir for harvest and subsequent carcass characteristic data collection.

Ruminal hydrogen sulfide gas was collected by rumenocentesis from two steers from each of three pens per treatment on days 0, 7, 14, and 28, which correspond to days of diet transition. Ruminal hydrogen sulfide collections occurred 4 hours after feeding. Procedures for sampling rumen hydrogen sulfide gas were previously outlined by Gould et al. (1997) and modified by Neville et al. (2010, 2012). Two 120 ml samples of rumen gas were withdrawn from the rumen gas cap with 100 ml of each sample subsequently drawn through colorimetric detector tubes (Gastec, Kanawaga, Japan) by use of a volumetric gas sampling pump to acquire a measurement of ruminal gas cap hydrogen sulfide; for each steer at each sampling point, duplicate measurements were taken and the average value used for any calculations.

Results

We found that steers fed under long-bunk management ate 2.4 pounds more feed per day compared to steers on the slick-bunk treatment (27.5 vs 25.1 pounds/day; Table 1). However, daily gain and feed efficiency were similar across treatment during the 28 days of adaptation. No differences in performance or carcass characteristics were observed over the entire feeding period between the treatments. This outcome was not unexpected as for the majority of the feeding period cattle were, in fact, treated the same.

Table 1. Impacts of bunk management on feedlot performance of steers fed 25% MDGS (DM Basis).

	Control	Long	SE	*P* -value
Adaptation, d 0-28				
Initial BW (d 0), lbs	973.9	966.1	16.6	0.75
BW (d 28), lbs	1120.4	1122.9	18.1	0.92
ADG, lbs/d	5.23	5.6	0.16	0.13
DMI, lbs/d	25.07	27.51	0.42	0.001
Feed:Gain, lbs	4.8	4.95	0.14	0.47
Overall, d 0-97				
Final BW, lbs	1395.9	1389.8	18.6	0.82
ADG, lbs/d	4.35	4.37	0.07	0.89
DMI, lbs/d	28.07	29.09	0.47	0.14
Feed:Gain, lbs	6.46	6.67	0.11	0.18
Carcass Characteristics				
HCW, lbs	834.3	833.9	12.6	0.98
Marbling	517	515	13.9	0.91
Yeild Grade	3.29	3.37	0.09	0.53
Back Fat, in	0.52	0.55	0.04	0.55
Ribeye area, in^2	13.59	13.54	0.12	0.78

The resulting hydrogen sulfide concentrations over this dietary transition period (Figure 1) indicate that bunk management may play a role in hydrogen sulfide production. Peak concentrations of hydrogen sulfide gas were found on day 14. At that time, hydrogen sulfide concentrations in cattle managed with long bunks were approximately 1000 ppm greater than slick-bunk managed cattle.   If we consider that hydrogen sulfide being inhaled following eructation is the mechanism by which PEM occurs, then increased concentrations of hydrogen sulfide would ‘in theory’ increase the potential risk of PEM. However, much more research is needed to fully understand this mechanism. Interestingly, following adaptation, cattle were transitioned back to control or slick-bunks resulting in hydrogen sulfide concentrations again being similar between the two groups (data not shown). While maybe not an expected outcome of our research, these preliminary results call into question whether hydrogen sulfide (and risk of PEM) may in fact be manipulated through bunk management.

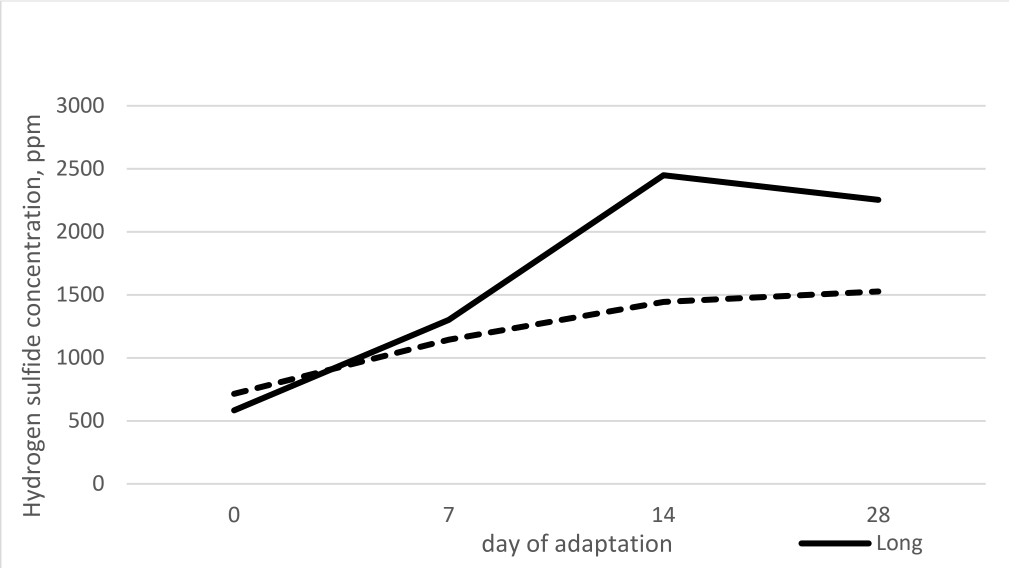

Figure 1. Hydrogen sulfide gas concentrations of steers fed 25% mDGS under different bunk management strategies.

To truly be able to make broader recommendations about bunk management during adaptation to finishing diets further research is needed. Specifically, research determining how bunk management impacts hydrogen sulfide gas production in the rumen and subsequently if hydrogen sulfide concentration alters rates of PEM. Our next step will be a study that uses greater concentrations of MDGS to see if greater sulfur concentrations in the ration amplify the magnitude of hydrogen sulfide differences observed in different bunk management scenarios.

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