Influence of a Methane Inhibitor on the Performance of Beef Steers

N. A. Cole and J. E. McCroskey

Story in Brief

Two studies were conducted to investigate the influence of the methane inhibitor HCS on the energetic efficiency and performance of beef steers fed an 80 percent concentrate ration. Twelve beef steers were used in study 1 in two total energy balance trials to determine the effect of methane inhibition on energy utilization. In the second study, the influence of HCS at a constant level (0.2 percent) and at an increasing level (0.1, 0.2 and 0.3 percent) in the ration on feedlot performance was investigated using 27 beef steers.

Steers fed HCS had significantly lower energy digestibilities (DE) than the control group after 30 days on feed. The lowered DE values of the HCS steers resulted in lower values for metabolizable energy (ME) and net energy (NE_{m+g}) despite a significant reduction in ruminal methane production. After 120 days on feed the HCS steers had apparently adapted to the methane inhibitor. DE, ME and NE_{m+g} values were similar for both groups at 120 days on feed although the HCS group tended to have higher values for ME.

In the feedlot, average daily gains (ADG) were 3.08, 2.97 and 2.42 pounds for the control, constant HCS (CHCS) and increasing HCS (IHCS) groups, respectively. When compared to controls, CHCS steers had a 6 percent improvement in feed efficiency but a 9 percent decrease in feed intake.

Introduction

Methane production due to microbial fermentation in the rumen accounts for as much as 6-10 percent of the gross energy intake of ruminants. Since this is essentially a complete loss of energy to the animal, recent studies have been attempted to improve the energy utilization and performance of ruminants by reducing the production of methane in the rumen.

A number of methane inhibiting compounds have been studied but the most satisfactory results have been obtained with the compound

hemiacetal of chloral and starch (HCS). Most studies with HCS, however, have been with rations containing less than 60 percent concentrate. The purpose of this study was to investigate the influence of HCS on the energetic efficiency and performance of beef steers fed a high (80 percent) concentrate ration.

Methods and Materials

Twelve steers of Hereford and Angus breeding weighing approximately 575 pounds were divided into two equal groups. One group was fed a basal ration (Table 1) and the second group was fed the same ration with HCS added to the ration at a level of 6 lbs. per ton (0.3 percent). Two total energy balance trials were conducted, one at 30 days and a second at 120 days on test. Each energy balance trial consisted of a 7 day feces and urine collection period and a 3 day heat production phase. Heat production was determined while the animals were in respiration chambers by measuring oxygen consumption, carbon dioxide and methane production and urinary nitrogen excretion. Between the energy balance trials the steers were fed twice daily in individual feeding stalls.

Feed, feces and urine samples were analyzed for dry matter, nitrogen, carbon and gross energy by standard laboratory procedures.

In a performance trial, 27 beef steers averaging 700 lbs. were randomly divided into 3 groups of 9 steers. Group 1 (control) received the basal ration shown in Table 1. Group 2 (CHCS) received the same basal ration with HCS added at a level of 4 lb. per ton (0.2 percent) throughout the entire feeding period. Group III (IHCS) received the basal ration with the level of HCS in the ration increased at 28 day intervals.

Table 1. Composition of Basal Ration[1]

Ingredient	Energy Balance Trials	Growth Trial
Rolled milo	63.0	63.0
Dehydrated alfalfa pellets	8.0	7.5
Cottonseed hulls	12.0	11.5
Soybean meal	11.0	11.0
Dried cane molasses	5.0	5.0
Minerals and antibiotics	1.0	2.0
	100.0	100.0

[1] Percent on an as-is basis.

The levels of HCS in the IHCS group for periods 1, 2 and 3 were 2 lb/ton, 4 lb/ton and 6 lb/ton, respectively. The steers were group fed in pens of 3 with 3 pens per treatment and were allowed to eat *ad libitum*. Weights were taken following a 14 hour shrink. Feed consumption was measured at monthly intervals. Due to a 30 day withdrawal period, the feeding trial was terminated at 84 days.

Results and Discussion

Results of the energy balance trial are shown in Table 2. At 30 days on feed digestible energy (DE) values were significantly higher for the control group. This resulted in significantly higher values for metabolizable energy (ME) for the control group despite a significant decrease in methane production by the HCS group. Net energy (NE_{m+g}) values tended to be higher for the control group indicating that the control group used their gross energy (GE) intake more efficiently.

The similar DE values for both treatment groups at 120 days suggests that the HCS steers were able to adapt to the methane inhibitor. Due to their lower methane productions, HCS steers had significantly higher ME values but NE_{m+g} values were similar for both groups.

The performance of steers in the feedlot is shown in Table 3. HCS additions to the ration tended to reduce feed and dry matter (DM) intakes. The IHCS group tended to have poorer daily gains and feed efficiencies than the control and CHCS groups. The CHCS group had a slight advantage (6 percent) in feed efficiency over the control group but a reduced feed intake resulted in similar daily gains for both groups.

It was thought that a gradual increase in the level of HCS in the ration would allow the steers to adapt to the inhibitor, thereby preventing a reduced feed intake. Steers in the IHCS group, however, had re-

Table 2. Effects of HCS on Energetic Efficiency.

Item	30 Days		120 Days	
	Control	HCS	Control	HCS
Avg. steer wt. (lb)	647	660	737	722
D.M. intake (lb)	10.0	10.0	10.0	9.8
GE intake (Mcal/day)	20.6	21.3	21.2	21.4
DE (%)	73.7	69.6	70.8	71.2
ME (%)	64.7	62.0[1]	62.8	64.2
ME (Mcal/100 lb. D.M.	133.6	125.9[1]	128.2	133.6[1]
NE_{m+g} (Mcal/100 lb. D.M.	80.0	69.5	94.5	95.4

[1] Significantly different from control in same trial ($P<.05$).

duced feed intakes (Table 4) each month of the trial corresponding with the increased level of HCS in the ration. Steers in the control and CHCS treatment groups tended to increase their average daily DM intakes each month of the trial. The CHCS steers were unable, however, to adapt to the HCS sufficiently to obtain feed intakes equal to those of the control group.

Results of this study appear to indicate that HCS may improve feed efficiency of steers fed an 80 percent concentrate ration but may also reduce feed intake. HCS had no apparent benefit in improving energy utilization in the total energy balance trials suggesting the level in the ration (0.3 percent) may have been too high. Most of the current research appears to indicate that HCS may have its most beneficial effects in rations containing less than 60 percent concentrate.

Table 3. Feedlot Performance of Steers Fed HCS.

Item	Control	CHCS	IHCS
No. of steers	9	9	9
Initial wt. (lb)	686	697	698
Final wt. (lb)	950	953	906
Daily Feed Intake (lb)	27.1	24.8	24.0
Daily D.M. Intake (lb)	23.9	21.7	21.0
Daily Gain (lb)	3.08	2.97	2.42
Feed/lb. Gain (lb)	8.84	8.31	9.86

Table 4. Average Daily Feed Intake by Period.

Item	Control	CHCS	IHCS
Days 1-28			
Feed intake[1]	25.4	23.4	24.7
D.M. intake	22.6	20.6	21.8
Days 29-56			
Feed intake	27.8	25.2	22.5
D.M. intake	24.6	22.0	21.6
Days 57-84			
Feed intake	28.3	25.7	22.6
D.M. intake	24.5	22.6	19.6

[1] Pounds/head/day.