Lasalocid[1] or Rumensin[2] to Prevent Lactic Acidosis in Cattle

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Summary

Lasalocid or Rumensin (monensin) protected cattle gorged with grain from lactic acidosis. Both lasalocid and monensin prevented the decrease in rumen and blood pH and increase in rumen and blood lactic acid (D(-) isomer) usually associated with lactic acidosis. Lasalocid appears more effective in preventing acidosis than monensin.

Introduction

Acidosis, which results from eating too much grain, stems from increased lactic acid (particularly the D(-) isomer) in ruminal fluid and blood, which reduces the pH of the ruminal fluid, blood, and urine.

Acidosis may occur at any time. Cattle are particularly vulnerable when started on feedlot rations or when environmental or other stresses reduce their feed intake so they later eat too much. The economic loss due to acidosis is due to decreased feed consumption, reduced weight gain, poor feed efficiency, and occasionally death.

No effective prevention for lactic acidosis is yet known. The only available method is to switch to high-grain rations gradually and to prevent interruptions in feeding schedules.

The two major lactic acid-producing bacteria of the rumen, Streptococcus bovis and Lactobacillus species, are directly responsible for the disorder. Hence, a logical approach to control acidosis is to prevent their proliferation. We tested the effects of two polyether antibiotics, monensin and lasalocid, on the lactic acid bacteria of the rumen and as a way to prevent lactic acidosis in cattle.

Experimental Procedure

The sensitivities of the major lactic acid-producing and acid-using rumen bacteria to monensin and lasalocid were determined. Pure cultures were inoculated into culture media containing various concentrations of the antibiotics. Growth was observed by measuring turbidity. The minimum inhibitory concentration was the lowest concentration of the antibiotic in

[1]A product of Hoffman-LaRoche Inc., Nutley, N.J. Lasalocid is approved for poultry, but not for ruminants.

[2]A product of Elanco Products Co., Indianapolis, Ind.

which there was no measurable bacterial growth.

Next, we conducted an in vitro fermentation study to test the effects of lasalocid and monensin on lactic acid production from glucose. The antibiotics were added at 0 (control) and 6 ppm concentration. Six ppm in vitro is equivalent to 30 g of antibiotic per ton of feed. We anaerobically incubated 100 ml of strained rumen fluid from a cow adapted to an all-roughage ration with an equal amount of mineral buffer and 20 g glucose and took samples at 3, 6, 9, and 12 h of incubation to determine pH and lactic acid.

Four rumen-fistulated cattle (body weight from 650 to 950 lb) were used for acidosis studies. The animals were adapted to a hay ration, and monensin or lasalocid was fed at 600 mg/1000 lb weight per day[3] for 7 days before acidosis was induced. Four trials were conducted, each consisting of 3 treatments; control (no antibiotic), lasalocid, or monensin. The interval between trials ranged from 2 to 3 weeks.

Two samples (controls) of rumen fluid and blood were collected before inducing acidosis. Then 25 lb ground corn per 100 lb body weight was added via rumen fistula. Rumen fluid and blood samples were obtained at 8, 12, 16, 24, 30, 36, and 48 h after the rumens were gorged; samples were analyzed for pH and L(+) and D(-) lactic acid.

Results and Discussion

The two predominant lactic acid-producing bacteria in the rumen, Streptococcus bovis and Lactobacillus species, were inhibited by lasalocid (table 20.1). Monensin was effective against Lactobacillus but not against Streptococcus bovis. However, the three major lactic acid-using bacteria were not sensitive to the antibiotics. Minimum antibiotics required to inhibit the lactic acid-producing bacteria were 5 to 10 times less than found in rumens of cattle fed the antibiotics at 30 g/ton of feed.

Effects of lasalocid and of monensin on lactic acid during in vitro fermentation of glucose is shown in table 20.2. As expected, control samples (no antibiotic) showed a marked decrease in pH and an increase in both L(+) and D(-) lactic acid. Samples treated with either lasalocid or monensin had much less lactic acid. Lasalocid seemed to be more effective than monensin, probably because it inhibits lactic acid-producing bacteria more.

All control animals (without antibiotic) after being gorged showed typical signs of acute acidosis. Rumen pH decreased dramatically as soon as 12 hours (figure 20.1). Rumen pH in monensin-fed cattle decreased dramatically at 24 h and was lower than in lasalocid-fed cattle but higher than the control group. However, lactic acid concentration in monensin-fed cattle was not higher than in the lasalocid-fed group (figure 20.1), which suggests that another acid may be responsible for the decrease in rumen pH in monensin-fed cattle. We are investigating that possibility. Blood of lasalocid-fed and of monensin-fed cattle showed no change in pH, and lactic acid increased

[3] Not cleared by FDA at this dosage. FDA permits feedlot cattle to receive not more than 360 mg Rumensin per head per day.

only slightly (figure 20.2). Rumen contents of control cattle were emptied, usually withing 24 to 36 h after being gorged, when the pH reached 4.4 or below. Rumens of treated animals were emptied at the end of the experiment (48 h).

These experiments suggest that lasalocid or monensin might prevent lactic acidosis in feedlot cattle. Lasalocid appears to be more effective than monensin. Work is in progress to determine the fewest days the antibiotics need to be fed to effectively prevent acidosis.

Table 20.1. Sensitivity of rumen lactic acid-producing and acid-using bacteria to lasalocid or monensin.

Organism	Lasalocid	Rumensin
Lactic acid producers		
Streptococcus bovis	+ (0.75)	-
Lactobacillus ruminis	+ (1.50)	+ (3.0)
Lactobacillus vitulinus	+ (1.50)	+ (1.5)
Lactic acid users		
Megashpaera elsdenii	-	-
Selenomonas lactilytica	-	-
Veillonella alcalescens	-	-

+ = sensitive, - = resistant
Numbers in parentheses indicate minimum concentration in ppm of the antibiotics required for complete inhibition.

Table 20.2. Effect of lasalocid or monensin on pH and L(+) or D(-) lactic acid concentration in rumen fluid incubated <u>in vitro</u> with glucose.

Hours of incubation	pH			L(+) Lactic (mg/ml)			D(-) Lactic (mg/ml)		
	C	L	M	C	L	M	C	L	M
3	6.46	6.74	6.70	.43	.27	.26	.17	.06	.13
6	5.06	6.68	6.18	3.17	.41	.38	.31	.19	.71
9	4.60	6.53	5.50	3.17	.50	.99	.73	.25	.36
12	4.33	5.74	5.13	4.50	.36	1.53	1.24	.49	1.32

C = control (no antibiotic), L = Lasalocid, M = Monensin.

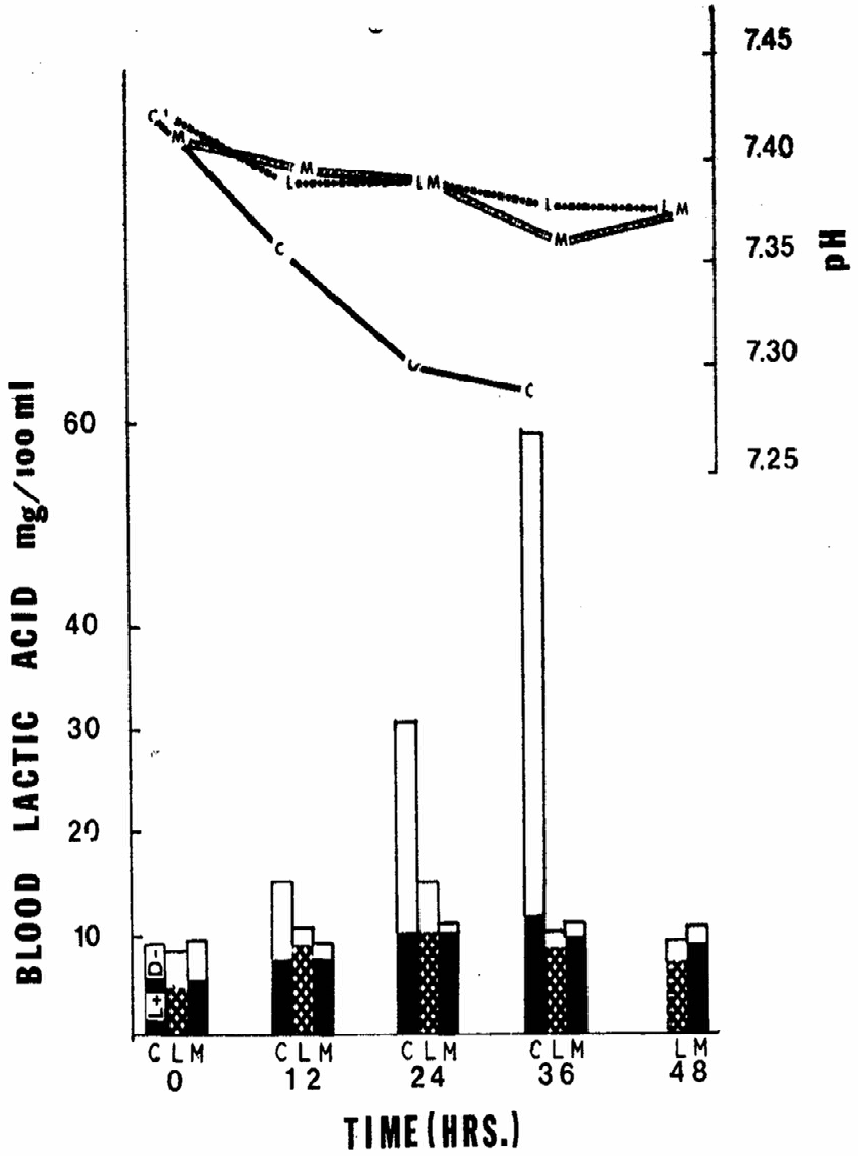

Figure 20.1. Effect of lasalocid or monensin on pH and total lactic acid (L(+) and D(-)) concentration of blood of cattle with induced lactic acidosis. C = control. L = Lasalocid. M = Monensin.

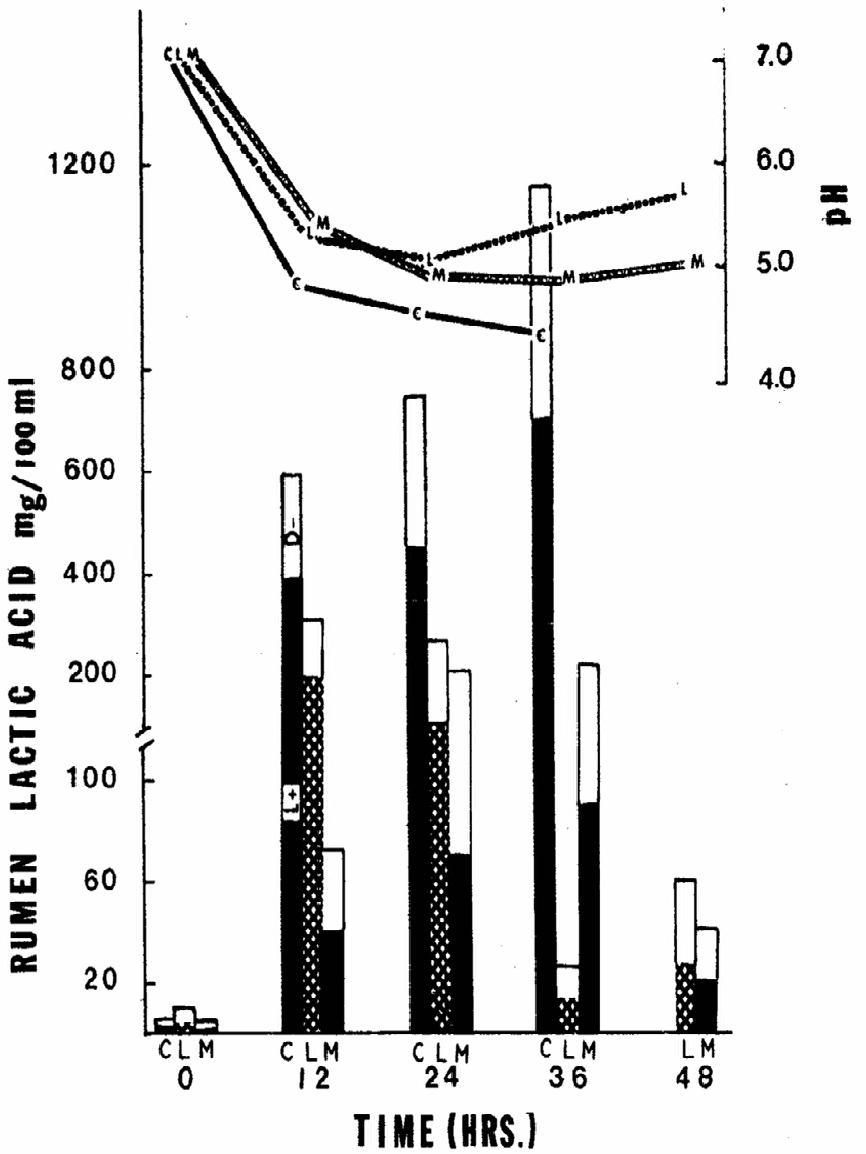

Figure 20.2. Effect of lasalocid or monensin on pH and total lactic acid (L(+) and D(-)) concentration of rumen fluid of cattle with induced lactic acidosis. C = control, L = Lasalocid, M = Monensin.