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LIMITING INTAKE OF FINISHING DIETS BY RESTRICTING ACCESS TIME TO FEED AND THE INTERACTION WITH MONENSIN

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Summary

One hundred seventy-six yearling steers were randomly allotted to 16 pens and fed ad libitum or restricted amounts of finishing diets with or without monensin. Intake of the restricted cattle was limited by allowing only 6 to 7 hours access time to feed per day. All cattle were fed once daily. Monensin and restricting access time reduced feed intake by 5.6% and 7.9% ($P<.01$), respectively. Intake tended to be lowest for restricted cattle fed monensin ($P=.13$). Intake of restricted cattle as a percent of ad libitum intake varied greatly during the study. This may have contributed to the 7% reduction in daily gain of the restricted-monensin fed cattle and the fact that only nonsignificant trends toward improved feed efficiency due to intake restriction were found ($P=.13$). Factors affecting rate of feed intake must be considered if limited access time is to be used successfully to improve feed efficiency.

(Key Words: Yearling Steers, Limit-Feeding, Access Time, Monensin.)

Introduction

Although high grain diets are usually fed ad libitum to finishing cattle, a 5 to 10% restriction of feed intake below ad libitum has been shown in some studies to improve feed efficiency without affecting daily gain. Such a restriction offers additional advantages of improved bunk management, reduced day to day fluctuation of intake, and improved feed inventory control.

Despite potential benefits, limit-feeding of finishing diets has not been adopted for two reasons. First, results among studies have been variable. An understanding of the biological mechanisms involved will be needed before consistency can be achieved across a variety of feeding situations. Second, there is as yet no practical method for determining the appropriate intake. The response appears to be dependent on a narrow range of restriction between 5 and 10%. This has generally been achieved by pair-feeding with ad libitum controls, which is impractical in commercial feedlots.

The objective of this study was to determine if limiting access time to a high concentrate finishing diet was an effective way to achieve a small restriction of intake (7% below ad libitum) and, as a result, improve feed efficiency. The role of an ionophore, monensin, in the limit feeding response was also evaluated.

Materials and Methods

One hundred seventy-six yearling, crossbred steers were randomly allotted to 16 pens and fed ad libitum or restricted amounts of feed daily with or without monensin. Ad libitum cattle had unlimited access to feed throughout the study. Finishing diet intake of the restricted group was limited by afternoon bunk checking such that the last of the day's feed was consumed between 4 and 5 p.m. This provided 6 to 7 hours of access to feed and was considered appropriate to achieve an approximate 7% reduction in intake based on previous studies at this facility. The finishing diets were formulated such that absolute intakes of protein, calcium, phosphorus, potassium, supplemental trace minerals, vitamin A, tylosin and monensin (depending on treatment) would be the same across treatments (Table 1), assuming 7% lower intake

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Table 1. Experimental diet composition (dry matter basis)

	Diets[a]						
		Step up				Finishing	
Ingredient	Receiving	1	2	3	4	Ad lib	Restr
	Percent						
Rolled corn	32.5	54.9	62.8	70.3	77.8	84.8	82.7
Alfalfa hay	24.0	37.9	30.0	22.5	7.5	-	-
Brome hay	39.0	-	-	-	-	-	-
OMB[b]	-	-	-	-	7.5	8.0	8.0
Molasses	2.0	4.0	4.0	4.0	4.0	4.0	4.0
Soybean meal	-	-	-	-	-	-	1.8
Dicalcium phosphate	.3	.2	.2	.2	.2	.2	.3
Limestone	1.1	1.2	1.2	1.2	1.2	1.2	1.2
Potassium chloride	.6	.5	.5	.5	.5	.5	.6
Trace mineral salt[c]	.5	.5	.5	.5	.5	.5	.5
Urea	-	.8	.8	.8	.8	.8	.9

[a] Vitamin A fed at 50,000 IU/day. Cattle on ionophore treatments were fed monensin at 295 mg/day and tylosin at 90 mg/day. Other cattle were fed tylosin only.

[b] Oat mill by-product. Approximately 80% oat hulls.

[c] Trace mineral salt contained 97% NaCl, .007% I, .24% Mn, .24% Fe, .05% Mg, .032% Cu, .11% Co, .032% Zn, and .5% Ca.

for restricted cattle (desired level of restriction). The diets were fed once per day.

The cattle were vaccinated (IBR, BVD, BRSV, Lepto, 7-way clostridial), treated with Ivermectin, implanted with Synovex-S, and ear tagged upon arrival at the feedlot. They were weighed on and off test after a 16-hour removal of feed and water. Interim 28-day weights were taken after a 16-hour removal of water only.

The data were analyzed as a 2 x 2 factorial design with intake and ionophore levels as main effects. Daily gain, carcass weight, and dressing percentage were analyzed with the individual animal as the experimental unit and initial and slaughter weights as covariates for gain and carcass data, respectively. Intake and feed efficiency analyses were based on pen observations.

Results and Discussion

Feedlot performance is presented in Table 2. As expected, restricting the access time to feed reduced dry matter intake ($P<.01$). The reduction amounted to 7.9% from day 29 through day 126. Ad libitum feeding of the step-up diets during period 1 resulted in a smaller overall reduction for the entire study of 6.5%. The main effect of feeding monensin also reduced intake of the finishing diets by 5.6% ($P<.01$). The interaction of access time and monensin approached significance ($P=.13$) as the effect of restricted access time tended to be greater when monensin was fed (11.2% vs 4.7%). However, degree of restriction was not consistent throughout the study (Table 3). It ranged from 86 to 92% and 91 to 101% of ad libitum for monensin and nonmonensin fed cattle, respectively.

Table 2. Feedlot performance of yearling steers fed finishing diets ad libitum or restricted with or without monensin

	Monensin		No monensin		
Item	Ad libitum	Restricted	Ad libitum	Restricted	SE
No. steers	43	44	44	44	
Initial weight, lb	797	800	797	803	6.8
Final weight, lb[ce]	1232	1201	1227	1231	7.9
Dry matter intake, lb/day					
1-28 days	16.6	16.4	16.5	16.5	.09
29-126 days[ac]	20.6	18.3	21.1	20.1	.38
1-126 days[ac]	19.7	17.9	20.1	19.3	.31
Weight gain, lb/day					
1-28 days	2.83	2.74	2.79	2.68	.11
29-126 days[df]	3.65	3.31	3.59	3.61	.07
1-126 days[ce]	3.47	3.18	3.41	3.40	.06
Feed:gain					
1-28 days	5.86	6.02	5.99	6.17	.260
29-126 days	5.65	5.54	5.91	5.57	.138
1-126 days	5.69	5.63	5.91	5.67	.123

[a] Monensin ($P<.01$).
[b] Monensin ($P<.05$).
[c] Restriction ($P<.01$).
[d] Restriction ($P<.05$).
[e] Monensin x restriction ($P<.05$).
[f] Monensin x restriction ($P<.01$).

Table 3. Dry matter intake of restricted cattle as a percent of ad libitum[a]

Period	Monensin +	Monensin -
	%	
1-28 days	99	100
29-56 days	86	91
57-84 days	91	92
85-112 days	88	98
113-126 days	92	101
1-126 days	91	96

[a] Restriction begun with initial feeding of the finishing diet on day 26.

An interaction between access time and monensin was found for daily gain between day 29 and day 126 ($P<.01$) as well as overall ($P<.05$). This resulted from 8.5% lower daily gain for cattle fed the restricted diet containing monensin compared to the other treatments. Feed efficiency, on the other hand, only approached significance for the same period ($P=.13$). Dressing percentage of the cattle at slaughter did not differ due to treatment ($P>.10$), indicating that adjustments of daily gain to compensate for level of intake effects on gut fill were unnecessary in this study.

It is obvious from the data in Table 3 that achieving a specific degree of daily intake restriction by limiting access time to feed was, at best, only partially successful. Monensin tended to increase the effect of access time restriction. It is well known that monensin can reduce palatability of feeds and rate of consumption. It appears that this results in greater access time needed to achieve the same degree of restriction as in cattle not fed monensin. Although the overall restriction for the monensin-fed cattle was within the desired range of 5 to 10%, it was substantially greater during the second and fourth weigh periods. This likely contributed to the lower daily gain for this treatment. The greater restriction coincided with daily high temperatures that averaged 4 to 7 °F above those of the other periods. When exposed to hot weather, cattle tend to eat less during the day and more in early morning and late evening. The feeding pattern imposed on the restricted cattle in this study did not permit such a behavioral change and factors that decrease eating rate would have accentuated heat stress effects on performance.

While feed efficiency tended to improve with restricted intake, the differences were small and inconclusive. This may have been due to the variability in degree of restriction imposed during the study. However, even a conservative interpretation of the data, that feed efficiency did not differ, would suggest that either maintenance requirements were reduced or energy was more efficiently used for growth by restricted, monensin-fed cattle, since feed efficiency did not suffer in spite of lower daily gain. In other words, improved energy utilization offset the "dilution of maintenance" advantage of the other treatments with greater daily gains.

In conclusion, in order to be an effective means of restricting high concentrate finishing diet intake, access time should be determined for specific feeding situations. Factors that affect rate of intake, such as the feeding of monensin, will affect the degree of restriction and, therefore, the response to limit feeding. Other factors that should, perhaps, be taken into account would include the occurrence of high ambient temperatures (heat stress), ionophore type, and grain content of the diet.