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Nutritional Influence on Reproductive Efficiency in Beef Cows

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CHAPTER 1

EFFECT OF MONENSIN UPON RUMEN METABOLISM, METABOLIC HORMONES, AND PRODUCTIVE TRAILS OF BEEF COWS

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Early in 1976 monensin was cleared for use in the diets of feedlot cattle. Monensin has been shown to increase feed efficiency of cattle on growing and finishing rations. If monensin increases feed efficiency in cows, the amount of conserved forage per cow unit may be decreased, and increased stocking rates could be utilized under grazing conditions. An experiment was conducted to determine whether monensin may be profitably included in the ration of the beef breeding herd.

Experimental Procedure

Sixty-eight mature Brahman X Hereford F-1 cows were equally allotted to receive either 200 mg (milligrams) monensin per head per day or no monensin in 4 pounds of 20 percent protein range cubes. All cows received Coastal bermudagrass hay ad libitum throughout the trial. The experimental period began at 256 days of pregnancy and ended on the 12th week of lactation. The cows were weighed and their condition scored at 256 and 279-280 days of pregnancy and at 4, 8, and 12 weeks of lactation. Blood samples were collected at each weighing time. Calves were weighed at birth, 4, 8 and 12 weeks of age. Sixteen cows from each group, matched by age and previous production record, were milked at 4, 8, and 12 weeks of lactation. Rumen samples were collected from the milked cows also at 4, 8 and 12 weeks of lactation. Blood samples were assayed for growth hormone and insulin. Rumen samples were assayed for content of acetic, propionic, and butyric volatile fatty acids. Milk samples were assayed for butterfat, total solids, and total protein as well as weight of milk produced.

Results and Discussion

Monensin increased feed efficiency of hay consumed by 12.4 percent over controls. Monensin cows ate 23.2 pounds of Coastal bermudagrass hay per head per day whereas the controls consumed 26.3 pounds daily. Body weights and condition scores did not differ between treatment groups (Table 1).

Calves at birth from monensin fed cows weighed 81.5 ± 3.3 pounds compared to 77.7 ± 2.7 pounds in controls. Calf vigor was not affected by monensin. Growth of calves through 12 weeks of age was essentially identical, with monensin calves weighing 259.3 ± 6.9 pounds and control calves weighing 254.4 ± 5.3 pounds at 12 weeks of age.

Growth patterns of the calves indicate that lactation was not critically affected by monensin. Milk weights, butterfat, total milk solids, and total protein levels are shown in Table 2. Monensin decreased butterfat levels ($P<.0.01$); however, nonsignificant increases in total milk production made up for the losses in percent butterfat.

Rumen fluid volatile fatty acid concentrations were affected by monensin (Table 3). Monensin increased propionic acid concentrations ($P<0.01$) but did not change total volatile fatty acids, acetic acid, or butyric acid. Propionic acid is the most efficient source of energy of the volatile fatty acids produced in the rumen. The increased propionate to acetate ratio is indicative of higher energy rations. Increased levels of propionate are linked to decreased percent butterfat. The changes in total volatile fatty acids with sampling period ($P<0.01$) are related to diet. By 8 weeks of lactation the cows were receiving 4 hours' daily access to wheat-oats-ryegrass pastures (Table 3).

Blood levels of growth hormone were increased ($P<0.10$) in monensin as compared to control cows (Table 4). Insulin levels were similar at all periods. The increased levels of propionate production may be responsible for increased serum growth hormone in the monensin-fed cows.

Addition of monensin to the diet of mature cows increased feed efficiency without decreasing any productive trait measured by cow or calf performance. Decreased percent butterfat seemed to be masked by increased milk production when monensin was in the diet. Monensin did not affect birth weight, calving difficulty or calf vigor. It is concluded that monensin may be profitably included in the ration of the beef breeding herd with no ill effects.

TABLE 1. BODY WEIGHT AND CONDITION SCORE

Period	Monensin Body Weight	Monensin Condition Score	Control Body Weight	Control Condition Score
279-280 days pregnant	1202.4±57.1[a]	6.9±0.3[b]	1207.0±38.2	7.1±0.3
4th week of lactation	1115.1±46.4	6.4±0.4	1116.0±36.0	6.7±0.4
8th week of lactation	1086.2±47.5	5.9±0.4	1089±41.5	5.9±0.4
12th week of lactation	1064.3±46.8	5.2±0.4	1079.6±39.1	5.9±0.3

[a]Average body weight in pounds ± standard error.

[b]Average condition score ± standard error

TABLE 2. MILK PRODUCTION AND COMPOSITION

	Monensin 4 weeks	Monensin 8 weeks	Monensin 12 weeks	Control 4 weeks	Control 8 weeks	Control 12 weeks
Milk weight (lb)	3.272±.233[a]	3.370±.255	3.112±.113	3.026±.220	3.203±.164	2.837±.162
Butterfat (%)	5.37 ±.27	5.13 ±.27	5.66 ±.26	5.98 ±.37	5.71 ±.34	6.17 ±.37
Total solids (mg%)	14.24 ±.38	13.60 ±.28	14.32 ±.30	14.77 ±.44	14.46 ±.37	14.83 ±.38
Total protein (mg%)	3.18 ±.11	3.01 ±.14	3.16 ±.10	3.08 ±.08	3.24 ±.08	3.20 ±.11

[a]Average ± standard error.

TABLE 3. RUMEN VOLATILE FATTY ACIDS

	Monensin			Control		
	4 weeks	8 weeks	12 weeks	4 weeks	8 weeks	12 weeks
Acetic (molar%)	.7040±.0127[a]	.7394±.0097	.7463±.0122	.7133±.0042	.7675±.0122	.7489±.0151
Propionic (molar%)	.2089±.0079	.1990±.0068	.1941±.0110	.1892±.0036	.1731±.0096	.1788±.0096
Butyric (molar%)	.0870±.0061	.0617±.0043	.0875±.0273	.0975±.0036	.0594±.0034	.0722±.0067
Total (mMoles)	60.3±8.7	35.9±3.9	35.6±3.8	78.3±11.9	36.8±3.8	35.9±4.7

[a]Average ± standard error.

TABLE 4. SERUM GROWTH HORMONE AND INSULIN

	Monensin		Control	
Period	Growth Hormone[a]	Insulin[b]	Growth Hormone	Insulin
256 days of pregnancy	31.0±1.6	7.2±0.5	31.5±2.2	5.9±1.0
279-28 days of pregnancy	28.4±2.0	8.3±0.6	27.4±2.3	7.9±0.9
4 weeks of lactation	31.3±3.1	9.4±0.8	27.9±1.9	8.7±0.8
8 weeks of lactation	28.6±1.9	12.3±1.1	25.0±2.1	10.1±0.9
12 weeks of lactation	28.0±1.9	10.0±0.7	25.8±1.5	10.2±0.9

[a]Average growth hormone in ng/ml ± standard error.

[b]Average insulin in μ units/ml ± standard error.