Ammonium Salts of Volatile Fatty Acids for Feedlot Steers

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Story in Brief

Seven levels (0 to .99 percent) of ammonium salts of volatile fatty acids (AS-VFA) were added to 77 to 82 percent concentrate diets for 192 yearling feedlot steers of mixed breeding. Steers weighed 797 lb initially and were fed for 131 days. Rate and efficiency of gain were not significantly altered by AS-VFA, although on a liveweight basis, AS-VFA on the average increased rate of gain by 2.4 percent and efficiency of feed use by 0.6 percent. Carcass cutability was increased with the middle levels of AS-VFA due to decreased kidney-heart-pelvic fat percentage and less fat over the ribeye. The mechanism for and repeatability of this effect on fat deposition need further examination since such a change may economically justify use of this new feed supplement.

Introduction

Ammonium salts of volatile fatty acids (AS-VFA) are a new feed supplement produced by Eastman Kodak which may become available for feeding to ruminants in the future. With dairy cows fed diets consisting primarily of corn silage, AS-VFA has increased production of milk protein and milk solids (Cook and others, 1981). The optimal dose level for cows was 61 g ammonium caproate and 28 g ammonium isobutyrate per day (Papas and others, 1981). Intake of grain dry matter was increased slightly with added AS-VFA (Sniffen and others, 1981). With forages low in protein, supplementation with low levels of volatile fatty acids has sometimes increased fiber digestion and feed intake. With higher concentrate diets, ammonium salts of certain volatile fatty acids are useful sources of ammonia. This trial was conducted to determine the effects of various levels of AS-VFA on performance and carcass characteristics of feedlot steers fed a moderately high energy diet.

Materials and Methods

One hundred ninety-two steers, primarily Hereford, Angus and Charolais crossbreds, with a mean initial weight of 797 lb received routine feedlot vaccinations and ear tags at Hitch Feedlot, Guymon, OK and were trucked to Goodwell, OK on April 4, 1982. Steers were weighed on arrival and subdivided by weight into two groups of 14 pens each with 8 steers per pen. Dietary treatments were randomly assigned to pens within weight groups with 2

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liveweight and two heavier weight pens receiving each of the 7 diets. Steers were weighed following a period of 16 hrs without feed and water at the start and on day 128 of the feeding trial. At other weighings, feed was not withheld. Following 131 days on feed, steers were trucked to Booker, TX and slaughter and carcass data were obtained.

The diet (Table 1) contained levels of AS-VFA from 0 to .99 percent. Urea was added to equalize protein levels in all diets. Due to low rates of gain of the steers, the level of corn grain in the diet was increased to 71 percent, cottonseed hulls were increased to 18 percent, and prairie hay was deleted from the diet on day 84 of the trial. The AS-VFA levels were dropped by 20 percent at this time, as well. One steer fed .12 percent AS-VFA died on day 118 of the trial. Feed intake of this steer to subtract from intake of this pen of steers was calculated using initial and final weights of this steer plus net energy values for the diet calculated from intake and performance of steers in all other pens receiving this level of AS-VFA. Effects of AS-VFA were calculated by comparing each level with each other level of material and by examining the linear and quadratic effects of level of AS-VFA.

Table 1. Diet composition

Ingredient	Percent
Corn, Ground	66.0
Prairie hay, ground	8.0
Cottonseed hulls	15.0
Supplement	11.0
Ground corn	5.8-4.9
Soybean meal	2.0
Limestone	1.15
Urea	.70-.58
KC1	.52
AS-VFA[a]	0-.99
Dicalcium phosphate	.44
Salt	.3
Ammonium sulfate	.086
Trace minerals	.013
Vitamin A-30	.011

[a]To provide AS-VFA levels of 0, .17, .34, .50, .66, .83 and .99% of the diet dry matter.

Results and Discussion

Supplemental AS-VFA had no effect on weight gain, feed or metabolizable energy intake, feed efficiency or energy content of the diet. The potent, pungent, persistent and penetrating odor of the material and supplements containing the material appeared to be much more objectionable to humans mixing and feeding it than to steers consuming it. Rate of gain and feed intakes were slightly greater for steers receiving diets with .12 and .67 percent AS-VFA than for steers receiving other levels of the material, especially during the early portion

Table 2. Performance of Steers fed AS-VFA.

	Initial AS-VFA Level, %						
	0	.17	.34	.50	.66	.83	.99
Weights, lbs							
Initial	791	810	810	796	794	815	800
28 days	889	933	927	904	907	934	915
56 days	986	1032	1007	989	985	1039	995
85 days	1037	1081	1049	1048	1038	1088	1054
112 days	1101	1136	1116	1119	1104	1144	1116
128 days	1126	1161	1139	1135	1129	1184	1136
131 days	1141	1175	1150	1150	1129	1186	1150
Total gain	350	365	340	354	335	371	350
Daily gain, lbs/day							
0-56 day	2.79	3.22	2.79	2.77	2.71	3.26	2.78
57-128 day	2.5	2.37	2.4	2.57	2.54	2.59	2.51
0-128 day	2.62	2.74	2.57	2.65	2.61	2.89	2.63
0-131 day	2.67	2.78	2.59	2.7	2.55	2.83	2.67
Daily feed, lbs/day							
0-56 day	24.23	25.29	24.84	24.34	24.36	25.93	24.66
57-128 day	22.47	22.83	22.44	21.99	22.36	23.46	22.1
0-128 day	23.24	23.9	23.49	23.02	23.24	24.54	23.22
0-131 day	23.13	23.78	23.38	22.91	23.14	24.42	23.1
Feed/Gain							
0-56	8.72	7.95	8.95	8.82	9.03	8.07	8.91
57-128 day	9.05	9.65	9.35	8.55	8.87	9.51	8.8
0-128 day	8.87	8.74	9.14	8.69	8.92	8.55	8.84
0-131 day	8.66	8.56	9.05	8.50	9.09	8.63	8.67
Met Energy content of feed							
Mcal/kg	2.61	2.64	2.58	2.65	2.56	2.63	2.63
ME Intake							
Mcal/day	27.4	28.6	27.4	27.6	26.9	29.2	27.6

of the trial. Averaged across AS-VFA levels, the material increased rate of gain on a liveweight basis by 2.4 percent and on a carcass basis by 0.6 percent. Feed intake was increased a mean of 1.4 percent. This calculates to an improvement in feed efficiency on a liveweight basis (0.6 percent) and a loss in efficiency (1 percent) based on carcass weights. Metabolizable energy (ME) content of the diet, calculated from mean weights and feed intakes, was increased a mean of 0.2 percent by the production while ME intake was increased a mean of 1.8 percent. If the product has its greatest benefit on fiber digestion, failure to find an intake and performance response to this material with the moderately high concentrate diet in this trial is not surprising. Further tests of this material for cows wintered on low protein range grass and for growing calves maintained on high roughage diets are needed.

Carcass weights, dressing percentage and liver abscess incidence and severity were not influenced by AS-VFA level (Table 3). Lung abnormalities including hardened and reddened areas were noted in some of the steers. Incidence was least with intermediate levels of the material. Rib eye area tended to be least with AS-VFA at 0.67 percent of the diet. Marbling score and Federal grade were not influenced by AS-VFA, but fat deposition internally (KHP) and externally (fat over the rib) were reduced with intermediate levels of AS-VFA. This change was reflected in the cutability or yield grade estimate. An increase in cutability of 1.2 percent with a 700 lb carcass will increase marketable product by 9.4 lb. This change was attained with 52 g per day of AS-VFA or a total of 15 lb of AS-VFA. Though this change would not benefit cattlemen selling cattle on a liveweight or grade-and-yield basis, it should be of interest to meatpackers. Mechanism for and repeatability of this effect deserves further testing.

Effects of initial weight grouping on performance and carcass traits are presented in Tables 4 and 5. Heavier cattle gained slightly more rapidly on a carcass basis due to an increased dressing percentage. Increased dressing percent is consistent with most earlier studies as summarized in Table 6.

Feed intake in this trial was increased by 2.5 lb (13 percent) for every 100 lb difference in initial weight. This is greater than in three previous studies (Table 6). Lighter weight cattle had a superior feed efficiency on a live weight basis similar to two of the three earlier trials. Net energy values of the feed, similar to all previous trials, favored the heavier cattle in previous trials. This suggests that the net energy question is consistently underestimating the gains of heavier cattle adjusted for carcass weight.

Dressing percent, rib eye area, fat thickness and marbling score were all greater for heavier cattle as in earlier studies. Rib eye area was increased by .6 square inches per hundred lb of carcass (5 percent, compared to 6 to 14 percent in other studies). Fat thickness per hundred lb of carcass increased by 12.9 percent vs 4 to 30 percent in our other studies. Cutability declined by .6 percentage units (1.3 percent) per hundred lb difference in carcass weight compared with 0 to 1.1 percentage points in other trials. How time on feed and initial weight interact and influence carcass composition need to be examined. Currently, most management and marketing decisions are based on efficiency of gain of live weight. In the future decisions should be based on efficiency of production of retail beef.

Table 3. Carcass characteristics of steers fed AS-VFA.

	Initial AS-VFA Level, %						
	0	.17	.34	.50	.66	.83	.99
Carcass #	707	728	713	713	700	735	713
Dress %	62.8	62.7	62.6	62.8	62	62.1	62.8
Liver abscesses							
Percent	15.6	28.6	12.5	31.2	25	12.5	31.2
Severity	1.78	2.38	1.67	1.25	2.17	1.75	1.5
Lung abnr	.22	.19	.06	.06	0	.09	.44
Rib eye area							
Sq inches	12.4	12.8	12.5	12.9	12.6	12.4	12.6
In/cwt	1.76	1.76	1.75	1.81	1.81	1.69	1.78
KHP %	2.27	2.03	2.14	1.97	1.88	2.23	1.92
Rib fat	.43	.34	.35	.34	.38	.44	.39
Marbling	13.9	13.3	14	12.8	13.7	13.6	13.4
Fed grade	12.9	12.7	12.9	12.2	12.6	12.8	12.6
% choice	75	75	62	53	66	78	69
Cutability, %	49.7	50.6	50.3	50.9	50.7	49.5	50.4

Table 4. Influence of initial weight on performance.

Weight	Light	Heavy
Initial weight	784[a]	840[b]
56 days	967[a]	1052[b]
128 days	1106[a]	1183[b]
131 days	1104[a]	1204[b]
Daily gain, lbs		
0-56 days	2.76	3.04
57-128 days	2.59	2.40
0-128 days	2.66	2.68
0-131 days	2.59	2.78
Daily feed, lbs		
0-56 days	23.9[a]	25.8[b]
57-128 days	21.9[a]	23.1[b]
0-128 days	22.8[a]	24.3[b]
0-131 days	22.7[a]	24.1[b]
Feed/gain		
0-56 days	8.56	8.71
57-128 days	8.52[a]	9.71[b]
0-128 days	8.58[a]	9.06[b]
0-131 days	8.79	8.69
ME content of the diet, based on performance mcal/kg	2.57[a]	2.66[b]
ME Intake, mcal/day	26.5[a]	29.1[b]

Table 5. Carcass data by initial weight group.

Weight group	Light	Heavy
Carcass weight, lb	685	748
Dressing percent	61.9[a]	63.1[b]
Abscesses, percent	21.4	23.3
severity	1.86	1.73
Ribeye area		
Square inches	12.4[a]	12.8[b]
Sq in/cwt carcass	1.82[a]	1.71[b]
KHP, %	2.01	2.11
Fat over rib eye, in.	.37	.40
Marbling score	13.2	13.9
Federal grade	12.5	12.8
Percent choice	62	75
Cutability, %	50.5[a]	50.1[b]

Table 6. Effects of initial steer weights and carcass weights on performance and carcass characteristics

	Source[a]				
	Current	MP-112:141	MP-112:141	MP-108:131	MP-104:008
	Percent change/100 lb increase in initial weight				
Measurement					
Gain	+13.1	– .4	+1.5	+ 8	----
F/G ratio	+11.0	+4.3	+5.6	+10	----
ME, mcal/kg	+ 6.3	+2.2	+1.3	+ 3.4	----
	Percent change/100 lb increase in carcass weight				
Dressing %	+ 3.1	+ 1.3	+ 4.0	+ 0.2	+ 2.2
Rib eye, sq. in.	+ 5.1	+ 6.6	+10.0	+14.1	+ 6.1
In^2/cwt	– 9.6	– 7.5	– 3.0	– 3.6	----
Fat thickness, in.	+12.9	+27.2	+13.0	+ 4.0	+30.0
Marbling score	+ 8.4	+11.1	+13.7	+11.0	+ 5.5
Cutability, %	– 1.3	– 1.9	– .7	0	– 2.28

[a]From this trial or other OSU-Miscellaneous publications on pages listed.

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