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Summary with Implications

The effect of increasing crude glycerin concentration was evaluated in a 91-d growing trial utilizing 60 steers. Crude glycerin was included at 0, 4, 8, and 12% of dietary DM in diets consisting of 50% wheat straw; 22.9-37.0% wet corn bran, and 8.0-10.1% soybean meal. Crude glycerin replaced wet corn bran and soybean meal was added to maintain dietary CP. Steer ending BW was not different among treatments. There was a quadratic increase in DMI from 0 to 8% crude glycerin and subsequent decrease at 12%. There was no difference in ADG or feed efficiency among crude glycerin concentrations. Therefore, crude glycerin appears to have an energy value slightly less than wet corn bran in a forage-based diet.

Introduction

During the transesterification process of biodiesel, fatty acids are cleaved from a triacylglyceride and bound to methanol, which is the biodiesel product. The remaining byproduct from the reaction is glycerol, also known as crude glycerin (GLY). The use of GLY has been evaluated in beef diets with mixed results depending on dietary ingredients being displaced. When evaluating 0, 4, 8, and 12% GLY in forage-based diets, GLY did not impact NDF digestibility and decreased acetate to propionate ratio as GLY inclusion increased (*2016 Nebraska Beef Cattle Report, pp 40-41*). However, data comparing GLY in forage-based growing diets are limited. Therefore, the purpose of this experiment was to determine the effect of GLY concentration on steer performance in forage-based growing diets.

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Procedure

The experiment utilized 60 crossbred steers (initial BW = 795 lb; ± 92 lb) in a randomized complete block design to evaluate the effects of increasing concentrations of GLY in a 91-d growing trial. Steers were individually fed using the Calan gate system. Treatments included the inclusion of 0, 4, 8, and 12% dietary DM of GLY in forage-based diets (Table 1). The control diet consisted of 50% wheat straw, 37% wet corn bran (Cargill; Blair, NE), 8% soybean meal, and 5% supplement. Wheat straw was ground through a 3-inch screen while wet corn bran was utilized to increase palatability and reduce sorting of dietary ingredients. The GLY replaced wet corn bran while the soybean meal and urea increased with increasing GLY to maintain equal dietary CP across treatments. Supplements were formulated to provide 200 mg per day monensin and equilibrate Na concentrations across treatment diets to minimize intake variances due to GLY inclusion.

Steers were limit-fed a diet containing 50% alfalfa and 50% Sweet Bran (Cargill; Blair, NE) at 2% BW for 5 d at the beginning and end of the trial with a 3-d BW collection to serve as initial and ending BW. Ending BW was calculated as the average of the 3-d weight minus 1 lb for each day steers were fed the limit diet to correct for weight gain during those 7 d. The adjustment of 1 lb per d is based on previous steer performance data when limit-feeding 50% alfalfa hay and 50% Sweet Bran diet at 2% BW. Steers were implanted with Ralgro® (Merck Animal Health; Summit, NJ) on day 1 of the trial.

Dietary energy values for treatment diets were calculated using the 1996 NRC. Using performance equations, individual steer BW, intake, and gain were used to

Table 1. Dietary composition of forage-based growing diets

	Crude Glycerin Concentration			
	0%	4%	8%	12%
Dietary Ingredient, % DM				
Wheat Straw	50.0	50.0	50.0	50.0
Wet Corn Bran	37.0	32.3	27.6	22.9
Soybean Meal	8.0	8.7	9.4	10.1
Crude Glycerin	0.0	4.0	8.0	12.0
Supplement[1]	5.0	5.0	5.0	5.0
Supplement Ingredient,				
Urea	0.79	0.87	0.94	1.01
NaCl	0.78	0.52	0.26	0.00
Limestone	0.76	0.76	0.76	0.76
Dicalcium Phosphate	0.39	0.38	0.38	0.37
Dietary Inclusion[2]				
CP, %	12.9	13.0	13.0	13.0
MP balance, g/d	334	327	321	316
RDP balance, g/d	249	280	311	342

[1] Supplements formulated to provide 200 mg monensin per day.
[2] Dietary inclusion calculated utilizing 2000 Beef NRC model.

Table 2. Effect of crude glycerin concentration on steer performance in forage-based growing diets

	Glycerin Concentration (Diet DM)					*P*-value	
	0%	4%	8%	12%	SEM	Linear	Quadratic
Initial BW, lb	796	794	793	797	3	0.83	0.23
Ending BW, lb	1060	1048	1053	1047	9	0.40	0.74
DMI, lb/d	20.6[ab]	21.6[ab]	22.0[a]	20.4[b]	0.6	0.93	0.03
ADG, lb	2.90	2.79	2.86	2.75	0.1	0.37	0.99
F:G[1]	7.06	7.62	7.62	7.34	-	0.50	0.14
NEm, Mcal/lb[2]	0.79	0.74	0.74	0.77	0.02	0.61	0.08
NEg, Mcal/lb[2]	0.50	0.47	0.46	0.49	0.02	0.61	0.08

[1] Analyzed as gain:feed, the reciprocal of F:G.
[2] Dietary NEm and NEg calculated based on animal performance using 1996 Beef NRC model equations.
[ab] Means within rows differ $P < 0.05$.

calculate dietary NEm and NEg for each GLY concentration.

Data were analyzed using the GLIMMIX procedure of SAS (SAS Institute, Inc., Cary, N.C.). Steer was the experimental unit. Block was included as a fixed effect. Orthogonal contrasts were used to test linear and quadratic effects of GLY concentration.

Results

Steer ending BW was not different ($P = 0.40$) among GLY concentrations (Table 2). There was a quadratic increase ($P = 0.03$) in DMI from 0% GLY (20.6 lb/d) to 8% GLY (22.0 lb/d) and subsequent decrease at 12% GLY (20.4 lb/d). There was no difference in ADG ($P = 0.37$) or feed efficiency ($P = 0.14$) among GLY concentrations. Dietary NEm and NEg had a tendency for a quadratic decrease ($P = 0.08$) from 0% GLY to 8% GLY with an increase at 12% GLY concentration. The greatest NEm and NEg were noted for 0% GLY concentration at 0.79 and 0.50 Mcal/lb, respectively.

Conclusion

Feed conversion and dietary net energy tended to change quadratically, and were poorer at 4% and 8% GLY. Therefore, GLY appears to have an energy value slightly less than wet corn bran in a forage diet.

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