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Effects of Glycerin in Steam Flaked Corn Feedlot Diets

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Summary

Glycerin was fed at 0%, 3%, 6%, and 9% (DM basis) in a steam-flaked, corn-based (SFC) diet to determine the effects on performance and carcass characteristics. Glycerin linearly increased (P = 0.02) final BW, ADG linearly increased (P = 0.02), and F:G linearly decreased (P < 0.01) by 7.1%. The data suggests glycerin can be added up to 9% inclusion to improve performance.

Introduction

Biodiesel is derived from vegetable oils and animal fats. The primary byproduct from biodiesel production is glycerin, which accounts for approximately 10% of the initial oil. Glycerin is gluconeogenic and has been used as an energy source in the poultry and swine industries, as well as dairy cattle industry; however, there are limited data in beef cattle. We hypothesized that glycerin would be comparable to SFC in feedlot diets. The objective of this study was to evaluate the effects of different levels of glycerin on the performance and carcass characteristics of feedlot steers fed a steam-flaked, corn-based diet.

Procedure

British x Continental cross steers (n = 515; BW = 939 ± 81 lb) were used in a complete randomized block design. Upon arrival, individual BW were collected, steers were stratified by BW, assigned to 10 blocks, and assigned randomly to one of 40 pens (12 – 13 steers/pen). Treatment diets (n = 4; Table 1) were assigned randomly to pens. Treatments were glycerin inclusions of 0%, 3%, 6%, and 9% (DM basis; Table 1). The initial processing consisted of vaccinations and de-worming. Adaptation diets, which consisted of three periods of seven days each, had the roughage level decreased while the concentrate level increased. Corn silage was decreased (30%, 23%, and 17% [DM basis], respectively) and alfalfa hay was decreased (15%, 12%, and 8.5% [DM basis], respectively) while corn (dry-rolled corn in step 1 and SFC for steps 2 and 3) was increased (41%, 51%, and 62.7% [DM basis], respectively). Cattle were limit fed during step 3 at 2% of BW. Supplemental glycerin was not used during the adaptation period. Glycerin contained less than 0.005% methanol and 7% (DM) sodium chloride. Finishing diets were balanced for sodium with decreasing sodium chloride with increasing glycerin inclusion. Soybean meal was included to make the finishing diets isonitrogenous (Table 2). The liquid supplement (6.18% diet DM) contained Rumensin (30 g/ton) and Tylan (9 g/ton). On day 0, which occurred after the 21-day adaptation period, cattle were individually weighed for initial trial BW, implanted with Component TE-200, and began the finisher diet. Diets were fed once daily throughout the trial.

Cattle were fed 85, 118, or 126 days by BW block and harvested at a commercial packing plant (Cargill Meat Solutions, Fort Morgan, Colo.). Carcass data were collected (Diamond T Livestock Services Inc., Gunnison, Colo.) and calculated yield grade. To account for any gut-fill, the final BW

Table 1. Finishing diet composition (% DM basis).

	Glycerin			
Ingredient	0%	3%	6%	9%
Steam-Flaked Corn	79.29	75.93	72.58	69.22
Soybean Meal	3.14	3.69	4.24	4.80
Alfalfa Hay	3.60	3.60	3.60	3.60
Corn Silage	7.20	7.20	7.20	7.20
Glycerin[1]	0.00	3.00	6.00	9.00
NaCl	0.59	0.40	0.20	0.00
Supplement[2]	6.18	6.18	6.18	6.18

[1]DM 85%; NaCl 7% (DM basis); methanol < 0.005%
[2]Liquid supplement formulated to supply: Rumensin 30 g/ton and Tylan 9 g/ton

Table 2. Finishing diet nutrient analysis (% DM basis)[1].

	Glycerin			
Nutrient	0%	3%	6%	9%
DM, %	72.1	72.5	74.0	71.4
TDN, %	91.1	90.4	91.4	90.4
NE_m, MCal/lb	1.03	1.02	1.04	1.02
NE_g, MCal/lb	0.72	0.71	0.72	0.71
CP, %	13.2	13.5	12.8	12.8
Ca, %	0.90	0.78	0.79	0.73
P, %	0.30	0.28	0.28	0.25
Ca:P	3.0:1	2.8:1	2.8:1	2.9:1

[1]Analyses conducted by Servi-Tech Laboratories, Hastings, Neb.

Table 3. Effects of glycerin on performance.

	Glycerin				*P*-value[1]	
Item	0%	3%	6%	9%	Linear	Quadratic
Initial BW, lb	939[ab]	942[ab]	946[b]	935[a]	0.84	0.06
Final BW, lb[2]	1331[d]	1340[de]	1349[e]	1349[e]	0.02	0.57
DMI, lb/day	23.8[b]	24.0[b]	24.0[b]	23.1[a]	0.04	0.05
ADG, lb	3.45[d]	3.52[de]	3.59[e]	3.59[e]	0.02	0.74
F:G	6.90[c]	6.80[bc]	6.67[b]	6.41[a]	< 0.01	0.25

[1]Orthogonal contrasts; no cubic response ($P > 0.18$).
[2]HCW / 63% average dressing percentage.
[a,b,c]Means within rows differ ($P < 0.05$).
[d,e]Means within rows differ ($P < 0.10$).

Table 4. Effects of glycerin on carcass characteristics.

	Glycerin				*P*-value[1]	
Item	0%	3%	6%	9%	Linear	Quadratic
HCW (lb)	836[a]	838[ab]	847[b]	845[b]	0.03	0.55
Dressing (%)	62.8	62.7	62.9	62.7	0.95	0.87
12th rib fat (in)	0.46	0.45	0.44	0.45	0.83	0.37
LM area (sq in)	12.3	12.4	12.5	12.4	0.09	0.12
USDA YG[2]	3.29	3.23	3.22	3.28	0.80	0.24
Marbling[3]	560	558	568	554	0.92	0.36
					Chi-Square	
Choice and above (%) [4]	86.1	83.1	85.7	82.5	0.82	
Prime (%) [4]	1.6	0.0	2.4	0.0	0.14	
Upper choice (%) [4]	7.8	3.9	5.6	2.4	0.22	
Mid choice (%) [4]	22.4	30.0	33.3	23.0	0.14	
Lower choice (%) [4]	54.2	49.2	44.4	57.1	0.19	
Select (%) [4]	14.0	16.9	14.3	17.5	0.82	

[1]Orthogonal contrasts; no cubic response ($P > 0.18$).
[2]Calculated Yield Grade = 2.5 + (2.5*12th rib fat, in) + (0.0038*HCW, lb) – (0.32*LM area, in^2) + (0.2*KPH, %).
[3]400 = slight 0; 500 = small 0.
[4]Analyzed by chi-square.
[a,b]Means within rows differ ($P < 0.10$).

was adjusted to a common dressing percentage of 63% and calculated from HCW. The carcass adjusted final BW was used to calculate ADG and F:G.

Data were analyzed using the MIXED procedure of SAS (Version 9.1, SAS Inc., Cary, N.C.). The factors included in the model were glycerin inclusion and block, where the weight block was a fixed variable and initial BW was used as a co-variate. Orthogonal contrasts were used for linear, quadratic, and cubic relationships for glycerin inclusion. Chi-square was used for USDA quality grade distribution. Pen was the experimental unit.

Results

When glycerin inclusion increased, final BW increased linearly ($P = 0.02$); Table 3. A quadratic response ($P = 0.05$) was observed for DMI as glycerin increased with the 3% and 6% inclusion being greater than the 0% or 9%. Gain increased linearly ($P = 0.02$) with increased glycerin and F:G decreased linearly ($P < 0.01$). The only carcass difference was a linear ($P = 0.03$) increase in HCW, where 6% inclusion had the heaviest carcasses (Table 4). There tended to be a linear ($P = 0.09$) increase in LM area with increased glycerin inclusion.

In summary, when replacing SFC with glycerin up to a 9% inclusion (DM basis), no adverse effects were observed for carcass characteristics, while ADG was improved up to 4.1%, and F:G was improved up to 7.1%. These data suggest glycerin is a suitable energy replacement in finishing diets containing steam-flaked corn.

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