THE EFFECTS OF FLAXLIC[1] BLOCK SUPPLEMENTATION ON FINISHING FEEDLOT HEIFERS

M. J. Quinn, J. S. Drouillard, E. R. Loe, B. E. Depenbusch, A. S. Webb, and M. E. Corrigan

Summary

An experiment was conducted to determine the effects of FlaxLic supplement blocks, fed free-choice during feedlot finishing, on heifer performance, carcass quality, and fatty acid profiles of loin steaks. Heifers (n=302, 1059±7 lb initial bodyweight) were fed diets based on steam-flaked corn. Cattle were assigned to dirt surfaced pens (12 to 13 heifers/pen, 12 pens/treatment). Treatments consisted of control (no block) or FlaxLic free-choice block supplements. Loins were obtained from three animals randomly selected from each pen for measurement of fatty acid profiles. Average daily gain and feed:gain were not different over the 75-day feeding trial. Dry matter intake was less for heifers supplemented with FlaxLic blocks. There were no differences between treatments for carcass characteristics. Heifers supplemented with FlaxLic blocks had greater concentrations of 18:3n3 (alpha-linolenic acid) fatty acids in loin steaks, compared with controls. The ratio of omega-6:omega-3 fatty acids was also reduced by supplementation with FlaxLic blocks.

Introduction

Flaxseed contains high concentrations of alpha-linolenic acid, an important omega-3 fatty acid. American diets historically have been largely deficient in omega-3 fatty acids. Consumption of omega-3 fatty acids has been linked to reductions in coronary heart disease, chronic inflammatory conditions, and tumor malignancy. Compounds such as fish oil, which are rich in omega-3 fatty acids, have been recommended as sources of omega-3 fatty acids for human diets. Past studies have demonstrated that the fatty acid composition of beef tissues may be altered by the incorporation of flaxseed into the diets of finishing beef cattle. Addition of flaxseed to diets of beef steers resulted in greater concentrations of alpha-linolenic acid in the longissimus muscle (ribeye), indicating that a proportion of dietary omega-3 fatty acids escape rumen biohydrogenation and subsequently are deposited into tissues, thus creating a product enriched with alpha-linolenic acid.

Availability of processed flax for use as cattle feed has been a limitation to its use by cattle producers with small to moderate size operations. An alternative mechanism to incorporate these omega-3 fatty acids into diets is to supply FlaxLic, a low-moisture block supplement containing ground flaxseed and flaxseed oil. The objective of our experiment was to determine if FlaxLic, when administered as a free-choice supplement to finishing beef heifers, results in higher concentrations of omega-3 fatty acids in tissues.

[1]FlaxLic is a trademark of New Generation Feeds, Belle Fourche, SD.

Experimental Procedures

Crossbred heifers (n=302) were purchased from salebarns and transported to Kansas State University Beef Cattle Research Center in Manhattan, Kansas. All cattle were offered *ad libitum* access to hay and water before processing. Within 24 hours after arrival, cattle were processed through the working facility. Heifers were weighed and treated with internal/external parasiticides. Cattle that were lame or sick at initial processing were not included in the experiment. Cattle were implanted with Revalor®-H, gradually adapted to a diet composed of 94% concentrate and 6% alfalfa hay (Table 1), blocked by initial weight into three weight blocks, and allotted to dirt-surfaced feeding pens containing 12 to 13 animals each. Within each weight block, four pens received FlaxLic and four pens did not receive FlaxLic block supplementation (control). Pens of cattle were weighed by using a platform scale on day 0 and immediately before being transported to a commercial abattoir for slaughter.

The daily ration was delivered at approximately 3 p.m. each day. Unconsumed feed was weighed and accounted for in calculations of feed consumption. Each of the FlaxLic blocks were weighed before supplementation and after removal from the pens. Samples were obtained from each supplement block, and moisture content was measured.

Slaughter data, including hot carcass weight, incidence and severity of liver abscess, and dressing yield were obtained on the day of slaughter. After a 24-hour chill period, carcasses were evaluated for subcutaneous fat thickness; kidney, pelvic, and heart fat; longissimus muscle area; marbling score; and USDA yield and quality grades. After fabrication, loins were obtained from three animals randomly selected from each pen. The loins were allowed to age for 14 days in Cryovac bags at 32 ± 2˚F. After aging, loin steaks were removed and vacuum packaged for sampling. Steaks were cooked, being turned at an internal temperature of 104˚F and removed from the oven at an internal temperature of 158˚F, and then were refrigerated at 38˚F for 24 hours. After refrigeration, six to eight half-inch cores were removed parallel to the fiber orientation of the steaks for fatty acid analysis by gas chromatography.

Table 1. Diet composition

Ingredient	% of Dry Matter
Steam-flaked corn	79.6
Ground alfalfa hay	6.0
Corn steep	6.2
Soybean meal	2.8
Limestone	1.6
Urea	1.0
KCl	0.3
Salt	0.3
Trace mineral premix[a]	0.04
Drug premix[b]	2.2
Nutrient	
Dry matter, % as is	80
Crude protein	14
Fat	3.7
Calcium	0.75
Phosphorus	0.39

[a]Supplement formulated to provide to final diet: 0.3 ppm selenium, 10 ppm copper, 60 ppm zinc, and 60 ppm manganese, 2.1 KIU/lb vitamin A, and 15 IU/lb vitamin E.

[b]Diets formulated to provide 300 mg monensin, 90 mg tylosin, and 0.5 mg melengesterol acetate per heifer daily.

Results and Discussion

Average daily gain was not affected by block supplementation (Table 2), but average daily dry matter intake for the FlaxLic-supplemented heifers was significantly less than for the control heifers ($P<0.05$). The heifers provided FlaxLic supplement were slightly more efficient than control animals,

although the difference was not significant. Carcass weight, ribeye area, and fat thickness measured at the 12th rib were similar for the two treatments (Table 3). Yield grades and quality grades also were not different between treatments.

Cattle provided access to FlaxLic blocks yielded loin steaks with greater concentrations ($P<0.001$) of alpha-linolenic acid (18:3n3) (Table 4). The concentration of total fatty acids (a measure of total fat content) was similar between the two treatments. Proportions of alpha-linolenic acid, when calculated as percentage of total fatty acids, were higher for cattle in the FlaxLic treatment. Also, concentrations of total omega-3 fatty acids were significantly higher for cattle fed FlaxLic ($P<0.01$), and the ratio of total omega-6 fatty acids to omega-3 fatty acids was significantly less in heifers fed FlaxLic, compared with that in heifers receiving no block supplementation.

Feeding FlaxLic blocks to finishing heifers for 75 days before slaughter resulted in comparable rates of gain, but with less total feed consumption. FlaxLic blocks increased concentrations of omega-3 fatty acids in cooked ribeye steaks.

Table 2. Performance of finishing heifers

Item	Control	FlaxLic	SEM	*P*-value
Number of heifers	152	150	-	-
Number of pens	12	12	-	-
Days on feed	75	75	-	-
Initial weight, lb	855	853	3.2	0.78
Final weight, lb	1162	1161	7.3	0.97
Dry matter intake, lb/day	22.2	21.3	0.24	0.02
Average daily gain, lb	4.10	4.09	0.10	0.99
Gain:feed, lb:lb	0.184	0.192	0.004	0.18

Table 3. Carcass characteristics of finishing heifers

Characteristic	Control	FlaxLic	SEM	*P*-value
Carcass weight, lb	738	737	5	0.97
Ribeye area, square inches	13.60	13.45	0.20	0.61
Fat thickness (12th rib), inches	0.30	0.31	0.01	0.62
Kidney, pelvic, heart fat, %	2.25	2.22	0.03	0.55
Marbling score[1]	384	369	7	0.16
Average USDA yield grade	2.00	2.00	0.06	0.99
USDA Choice, %	41.8	35.1	5.1	0.37
USDA Select, %	54.9	58.9	5.4	0.61
USDA Standard, %	3.3	6.0	2.0	0.35
USDA Yield Grade 1, %	23.9	23.8	4.4	0.99
USDA Yield Grade 2, %	55.7	54.2	4.2	0.80
USDA Yield Grade 3, %	17.0	19.4	3.1	0.60
USDA Yield Grade 4, %	3.4	2.0	1.5	0.52

[1]Traces=200-299, slight=300-399, small=400-499, modest=500-599, moderate=600-699, slightly abundant=700-799, moderately abundant=800-899, and abundant=900-999.

Table 4. Fatty acid concentrations of cooked loin steaks from control and heifers provided FlaxLic supplement

Fatty Acid	Control	FlaxLic	SEM	*P*-value
	---------- % of sample ----------			
C16:0	1.096	1.069	0.045	0.67
C18:0	0.566	0.572	0.024	0.86
C18:2n6t	0.006	0.007	0.0003	0.22
C18:2n6c	0.200	0.198	0.006	0.80
C18:2cis9trans11	0.018	0.018	0.001	0.92
C18:2trans10cis11	0.002	0.002	0.0002	0.63
C18:2cis9cis11	0.0004	0.0005	0.0001	0.57
C18:2trans9trans11	0.003	0.003	0.0002	0.87
C18:3n6	0.005	0.006	0.0005	0.52
C18:3n3	0.020	0.023	0.0007	<0.001
Total fatty acids	4.49	4.40	0.171	0.72
Total omega-3 fatty acids	0.068	0.074	0.001	<0.01
Omega-6/Omega-3	3.84	3.53	0.090	0.02