The Effect of Linseed Supplementation on Growth, Carcass Traits, Fatty Acid Profile, Retail Shelf Life, & Sensory Attributes of Beef from Steers Finished on Grasslands of the Northern Great Plains

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Introduction

Supplementing grazing steers with linseed may:
1) Reduce days needed to grow and fatten them to an acceptable grade,
2) Improve profitability and sustainability of beef production,
3) Increase n-3 fatty acids concentrations and healthfulness of beef, and
4) Alter tenderness and sensory characteristics of beef.

Trial objectives were to determine if daily supplementation of linseed for 85 days to steers finished while grazing would influence growth rates, carcass traits, muscle fatty acid profile, tenderness, retail shelf life and sensory attributes.

Methods

18 yearling Angus steers were grazed together on typical northern Great Plains grassland beginning in early May and were placed on test in August and continued grazing until the trial ended in early November.

In early August they were weighed (initial BW 399 ± 21 kg) and randomly allotted to 3 equal-sized treatment groups. Treatment 1 steers (LN) received a daily supplement of ground flaxseed (0.20% of BW); Treatment 2 steers (CS) received a daily supplement of ground corn and soybean meal (0.28% of BW) that had levels of CP and TDN similar to the supplement for LN steers; Control steers (CT) were not supplemented.

LN and CS steers were individually fed the treatments each morning from mid-August to 7 November while grazing different types of growing forage.

Steers were weighed at about 30 day intervals and at the end of the trial, and were harvested under commercial conditions with pre-rigor hot carcass weights collected and carcasses chilled at 2°C for 24 hours before carcasses were ribbed between the 12th and 13th ribs and evaluated with standard USDA procedures.

Longissimus lumborum steaks were collected from each carcass, shrink-wrapped, and frozen for later fatty acid and sensory analysis and evaluation of retail shelf life.

For fatty acid analysis, muscle samples were lyophilized and ground with a liquid- cooled sample mill before extraction then separation of fatty acid methyl esters with GLC. Shelf-life evaluation of steaks was done under simulated retail display with objective measures using a Minolta chromameter. Warner-Bratzler shear force measures were done using a minimum of 6 1-cm cores from cooked steak. Steak sensory attributes were evaluated with a 10-member trained taste panel.

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Results and Discussion

Growth rate of LN steers was 25% greater than that of CT steers (P < 0.01; 1.04 and 0.83 kg/day, respectively), but similar to CS steers (1.09 kg/day; P = 0.45).

No differences between groups were observed for carcass traits ($P \geq 0.14$), Warner-Bratzler sheer force ($P \geq 0.12$), or sensory attributes (P ≥ 0.29) except for a slightly more intense off-flavor detected in steaks from LN steers ($P \leq 0.07$).
In the 9-day shelf life evaluation, steaks from LN steers had lower values for a*, b*, and CHR, but higher values for HUE than CT (P < 0.01).

The n-3 fatty acids α-linolenic acid and eicosapentaenoic acid were 62 and 22% higher, respectively, in beef from LN versus CT steers (P < 0.001). The ratio of n-6 to n-3 fatty acids was lower (P < 0.001) in beef from LN compared to CT and CS beef.

Results indicated that daily supplementation of linseed to steers that are grazing growing forages on the northern Great Plains of North America may improve growth rate and enhance the healthfulness of the fatty acid profile of beef. However, changes in the color of steaks presented in retail display indicated that supplementing linseed to forage-finishing steers may reduce the acceptability of fresh beef to consumers when purchased from retail display cases.

Effect of supplementation of grass basal diet with flaxseed or a corn-soybean meal mixture on the fatty aci concentration (mg/g) of freeze-dried *longissimus* muscle

	Supplement [1]				*P*-value[2]			
Fatty Acid	CONT	FLAX	CSBM	SE	TRT	CONT vs. FLAX	CONT vs.CSBM	FLAX vs.CSBM
14:0	2.29	1.76	2.28	0.31	0.26	0.16	0.98	0.16
14:1	0.44	0.33	0.48	0.08	0.27	0.25	0.69	0.13
15:0	0.37	0.30	0.37	0.04	0.25	0.14	0.89	0.17
16:0	26.30	21.91	27.68	3.00	0.22	0.21	0.69	0.10
16:1	3.49	2.90	3.77	0.47	0.27	0.27	0.61	0.12
17:0	0.96	0.76	0.99	0.09	0.09	0.08	0.74	0.04
17:1	0.65	0.50	0.69	0.07	0.06	0.07	0.62	0.03
18:0	16.86	16.07	16.83	1.81	0.91	0.70	0.99	0.71
18:1 *t*-11	2.91	2.89	2.79	0.31	0.94	0.95	0.74	0.79
18:1n-9	39.22	36.21	42.36	4.37	0.46	0.54	0.53	0.22
18:1 *c*-6,11	2.00	1.63	2.05	0.22	0.23	0.16	0.86	0.12
18:2n-6 (*c*-9,12)	3.23	3.13	3.07	0.14	0.73	0.61	0.44	0.79
18:2n-6 (*t*-9,12)	0.19	0.23	0.20	0.03	0.40	0.21	0.81	0.31
18:2 *c*-9, *t*-11	0.57	0.58	0.60	0.07	0.96	0.93	0.79	0.85
18:2 *t*-10, *c*-12	0.03	0.07	0.02	0.01	0.009	0.007	0.93	0.006
18:3n-3	0.76	1.23	0.63	0.05	<0.001	<0.001	0.10	<0.001
20.0	0.11	0.09	0.11	0.01	0.24	0.14	0.97	0.15
20:1	0.16	0.13	0.16	0.02	0.35	0.21	0.96	0.23
20:3n-6	0.29	0.24	0.30	0.01	0.005	0.009	0.50	0.002
20:4n-6	1.30	1.19	1.34	0.05	0.12	0.12	0.62	0.05
20:5n-3	0.22	0.28	0.20	0.02	0.004	0.01	0.37	0.002
22:0	0.12	0.22	0.13	0.02	<0.001	0.003	0.69	<0.001
22:2n-6	0.09	0.11	0.08	0.001	0.004	0.01	0.33	0.001
22:5n-3	0.50	0.55	0.52	0.02	0.09	0.03	0.45	0.14
n-3 PUFA[3]	1.49	2.07	1.36	0.07	<0.001	<0.001	0.22	<0.001
n-6 PUFA[3]	5.07	4.86	4.94	0.20	0.76	0.47	0.65	0.78
n-6:n-3 ratio	3.41	2.34	3.63	0.06	<0.001	<0.001	0.02	<0.001
SFA	50.4	44.1	51.0	5.32	0.46	0.31	0.93	0.27
MUFA	49.0	44.7	52.4	5.38	0.45	0.48	0.57	0.21
PUFA	7.0	7.4	6.8	0.31	0.32	0.37	0.54	0.14
Total	109.6	99.3	113.4	11.2	0.52	0.42	0.77	0.27

[1]CONT = grass grazing only; FLAX = grass grazing and supplemented daily with flaxseed (0.20% BW/d); CSBM = grass grazing and supplemented daily with a mixture of corn-soybean meal (0.28% BW/d) that had similar levels of CP and TDN as the flaxseed supplement.
[2]*P*-value for *F*-test for treatment (TRT) and for pre-planned comparisons.
[3]n-3 PUFA = omega-3 fatty acids 18:3n-3, 20:5n-3, and 22:5n-3; n-6 PUFA = omega-6 fatty acids 18:2n-6 *cis* and *trans*, 20:3n-6, 20:4n-6, and 22:2n-6