



Feeding extruded full-fat cottonseed or white tallow as a source of fat in finishing beef diets: II. Efficiency, objective shelf-life color and fatty acid profiles

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Abstract

Twenty-one Angus heifers were fed (UGA Wilkins Beef Research Center) extruded full-fat cottonseed (FuZzy Pellets™) or tallow to examine the effects of finishing diets with various fat sources on animal performance, meat color stability, and fatty acid profiles. The main objective of this project was to enhance the concentration of conjugated linoleic acid (CLA) by increasing the substrates for ruminal and endogenous synthesis through the feeding of extruded cottonseed pellets. Heifers were blocked by weight and randomly assigned to one of three total mixed ration finishing diets with 13.0% protein and 7.5% fat, as fed, supplied by: 1) 3.7% tallow (TAL), 2) 1.9% tallow and 12.5% extruded full-fat cottonseed pellets (TC), or 3) 25.0% extruded full-fat cottonseed pellets (CTN). The heifers were individually fed, ad libitum, for 82 d. At the end of the feeding period, heifers were transported to the University of Georgia Meat Science and Technology Center for slaughter under federal inspection. Twenty-four hours postmortem the longissimus lumborum was removed and steaks were cut (2.54 cm) for objective color analysis (CIE L* a* b*) on d 1, 3, 6, and 10. One steak was also removed from each loin for fatty acid analysis. Ground beef (80% lean, 20% fat) was produced from the pectoralis profundus on d1 for color analysis on d 1, 2, 4, and 7. A ground beef sample was also retained for fatty acid analysis. As well, a subcutaneous fat sample was collected from the longissimus lumborum for fatty acid analysis.

Heifers did not differ ($P>0.05$) in Gain:Feed or Average Daily Gains across treatments or across days (d 1-22, 23-70, and 71-82). Therefore, cumulative Gain:Feed and Average Daily Gains were not different ($P>0.05$). Heifer weight did not differ ($P>0.05$) among treatments for any weight period, but as expected increased ($P<0.05$) as time on feed increased. Steak L* values were similar ($P>0.05$) between TAL and TC, but CTN was darker ($P<0.05$) than either. There was no difference ($P>0.05$) among treatments for steak a* or b* values. Ground beef L* a* and b* values were similar ($P>0.05$) for all treatments. For steaks, L* values did not change ($P>0.05$) as days on display increased, however, a* and b* values declined ($P<0.05$) as time on display increased. Ground beef L* values indicated that it got lighter ($P<0.05$) as time on display increased, however, like the steak samples, a* and b* values decreased ($P<0.05$) as time on display increased. Feeding extruded full-fat cottonseed pellets as the main fat source did not appreciably increase CLA content in the longissimus lumborum, ground beef, or subcutaneous fat samples. Feeding CTN increased ($P<0.05$) total monounsaturated (MUFA), polyunsaturated fatty acids (PUFA), and ω -6: ω -3 in steaks compared to TAL fed heifers. Subcutaneous fat samples from CTN had increased ($P<0.05$) saturated fatty acids (SFA), PUFA, and ω -6: ω -3 compared to TAL, but lower ($P<0.05$) MUFA. Ground beef samples followed the same trend as the fat samples. Feeding extruded full-fat cottonseed pellets as the main fat source does not increase CLA content in beef.

Table 1. Treatment diets and chemical composition

	TAL	TC	CTN
Ingredient¹			
Whole corn	57.7	58.5	59.3
Cottonseed hulls	20.1	14.7	9.2
Cottonseed meal	12.1	5.9	---
Tallow	3.7	1.9	---
Cottonseed pellet	---	12.5	25.0
Alfalfa meal	4.4	4.5	4.5
Limestone	0.9	0.9	0.9
Bovatec	0.003	0.003	0.003
Trace mineral	0.05	0.05	0.05
Sodium bicarb	1.02	1.03	1.04
Vitamin premix	0.05	0.05	0.05
Composition²			
Crude protein	12.9	12.9	13.0
NDF	29.2	29.5	29.8
Crude fat	7.44	7.50	7.51
TDN	79.6	82.1	84.7
Calcium	0.46	0.47	0.48
Phosphorus	0.26	0.33	0.39
NE maintenance ³	0.89	0.92	0.94
NE gain ³	0.61	0.63	0.63

¹Reported as percent as fed.

²Reported as percent dry matter.

³Meal/pound.

Table 2. Animal efficiency and weight by period

	TAL	TC	CTN
Gain:Feed			
D1-22	0.33	0.23	0.22
D23-70	0.20	0.26	0.28
D71-82	0.28	0.18	0.31
ADG, kg			
D1-22	1.54	1.45	0.88
D23-70	1.11	1.61	1.56
D71-82	1.57	1.18	1.74
Live weight, kg			
D1	448.55 ^d	450.50 ^d	450.89 ^d
D22	482.41 ^c	482.41 ^c	471.34 ^c
D70	535.72 ^b	559.46 ^b	545.12 ^b
D82	554.53 ^a	573.60 ^a	565.94 ^a

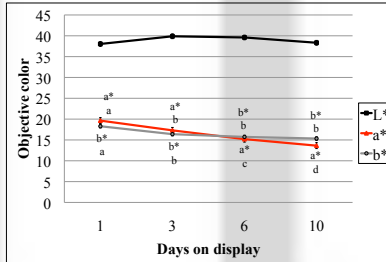
^{a-d}Means in the same column with different superscripts differ ($P<0.05$).

Table 3. Objective steak and ground beef color by treatment

	TAL	TC	CTN
Steak			
L*	39.52 ^a	40.24 ^a	37.13 ^b
a*	15.43	16.55	17.36
b*	16.21	16.75	16.36
80:20 ground			
L*	46.77	45.70	45.34
a*	14.00	13.78	13.96
b*	18.17	18.18	18.02

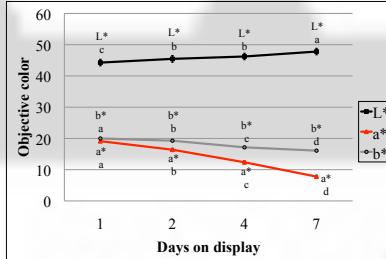
^{a-b}Means within a row with different superscripts differ ($P<0.05$).

Fig 1. Objective steak color over 10 d display period



^{a-d}Means within a color measurement with different superscripts differ ($P<0.05$).

Fig 2. Objective 80:20 ground beef color over 7 d display period

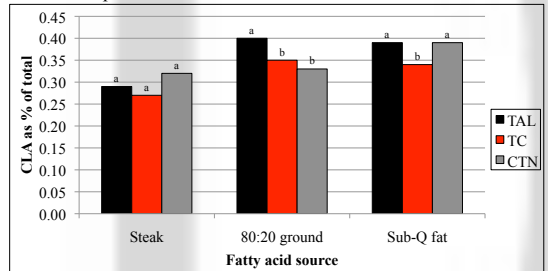


^{a-d}Means within a color measurement with different superscripts differ ($P<0.05$).

Conclusions

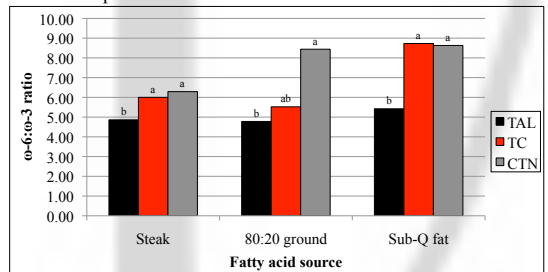
- Feeding heifers cottonseed pellets as a full fat source does not influence efficiency during the finishing period when compared to feeding tallow.
- Feeding heifer cottonseed pellets as a full fat source does not appreciably increase CLA content.

Fig 3. Effect of feeding tallow, tallow with cottonseed pellets, or cottonseed pellets as the main fat source on CLA content



^{a-b}Means within the same fatty acid source with different superscripts differ ($P<0.05$).

Fig 4. Effect of feeding tallow, tallow with cottonseed pellets, or cottonseed pellets as the main fat source on ω -6: ω -3 content



^{a-b}Means within the same fatty acid source with different superscripts differ ($P<0.05$).

Table 4. Effect of feeding tallow, tallow with cottonseed pellets, or cottonseed pellets as the main fat source on fatty acid content

	TAL	TC	CTN
Steak			
Saturated	48.49	49.38	49.14
Monounsaturated	45.81 ^a	45.24 ^{ab}	44.02 ^b
Polyunsaturated	5.70 ^b	5.37 ^b	6.83 ^a
80:20 ground			
Saturated	43.56 ^b	45.47 ^a	46.06 ^a
Monounsaturated	51.88 ^a	49.95 ^b	49.54 ^b
Polyunsaturated	4.55	4.58	4.39
Subcutaneous fat			
Saturated	49.28 ^b	50.18 ^{ab}	51.18 ^a
Monounsaturated	47.08 ^a	46.03 ^{ab}	44.62 ^b
Polyunsaturated	3.62 ^b	3.79 ^b	4.19 ^a

^{a-b}Means within a row with different superscripts differ ($P<0.05$).