

Fatty acid composition for cows fed supplements of no flax (Control)

	Treatment		Statistics	
	CON	FLX	SE	P-values
---% of total fatty acids---				
4.72	4.90	0.11	0.36	
0.04	0.04	0.003	0.53	
2.57	2.55	0.02	0.50	
0.04	0.03	0.002	0.26	
1.46	1.42	0.02	0.22	
0.04	0.04	0.002	0.32	
3.09	2.93	0.04	0.13	
0.29	0.28	0.005	0.15	
0.07	0.06	0.003	0.22	
3.53	3.43	0.12	0.62	
0.09	0.08	0.004	0.14	
11.03	10.67	0.10	0.12	
0.64	0.53	0.03	0.13	
1.00	0.95	0.01	0.14	
0.02	0.02	0.01	0.88	
29.33	26.88	0.17	0.01	
0.98	0.79	0.08	0.22	
0.03	0.01	0.01	0.42	
0.49	0.47	0.01	0.21	
0.18	0.16	0.006	0.17	
10.50	11.21	0.13	0.06	
22.59	24.60	0.20	0.02	
2.47	2.44	0.09	0.83	
0.21	0.21	0.06	0.98	
0.08	0.07	0.03	0.83	
0.35	0.42	0.02	0.12	
0.53	0.85	0.03	0.02	
0.05	0.04	0.007	0.30	
0.0004	0.01	0.005	0.23	
0.02	0.05	0.004	0.04	
0.01	0.01	0.004	0.72	
0.02	0.03	0.006	0.52	
0.009	0.009	0.003	0.98	
0.09	0.06	0.02	0.35	
0.01	0.01	0.002	0.24	
0.07	0.07	0.01	0.83	
0.02	0.03	0.005	0.38	
0.01	0.01	0.002	0.18	
0.05	0.04	0.005	0.26	
0.03	0.04	0.009	0.65	
0.01	0.02	0.003	0.19	
0.06	0.03	0.02	0.48	
0.009	0.00002	0.003	0.15	
0.001	0.0002	0.001	0.40	
0.00	0.00	-	-	
1.29	1.44	0.09	≥ 0.11	
15.96	15.77	0.22	0.60	
45.54	42.52	0.23	0.01	
37.53	40.85	0.29	0.02	
24.12	25.91	0.24	0.03	
4.01	4.32	0.07	0.09	
68.19	65.90	0.28	0.03	
0.54	0.85	0.03	0.02	
2.82	2.75	0.06	0.47	
5.46	3.23	0.24	0.02	
0.43	0.50	0.02	0.10	

Values with different superscripts differ ($P < 0.06$).
 ---number of carbons:double bonds.
 ---saturated fatty acid.
 ---monounsaturated fatty acids (C_6 to C_{12}).
 ---polyunsaturated fatty acids (C_{14} to C_{17}).
 ---short-chain fatty acids (C_{18}).

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EVALUATION OF MILK COMPONENT PROFILE, AND PRODUCTION OF FLAXSEED ON TWO COMMERCIAL DAIRIES

Objective

The objective of this field trial was to study the effects of supplementing early lactation dairy cow diets with rolled flaxseed on milk composition, fatty acid profile, and yield.

Materials and Methods

Cows and Diets

This study was conducted on two commercial dairies: Minglewood Dairy (MWD), Deer Park, WI (herd size = 750 lactating cows), and County Line Dairy (CLD), Edgerton, MN (herd size = 500 lactating cows). The trial was initiated at MWD in December, 2006, whereas the trial was initiated at CLD in June, 2007. Each site consisted of cows naive to flaxseed before initiation of the trial. Cows were assigned randomly to treatment upon leaving the fresh-cow pen (approximately 10 d postpartum) within parity (primiparous or multiparous). For both dairies, cows remained in the study until confirmed pregnant or culled from the herd. Treatments consisted of either their existing post-fresh diet (control, CON; n=408) or a similar diet re-formulated with rolled flaxseed (flax, FLX; n=507; 0.85 kg DM/cow daily). Analyses presented herein included a total of 915 cows. Diets were formulated by each dairies' nutritionist and were approved by the study authors (Tables 1 & 2).

Sample Collection

The milk, base feed component, and TMR samples along with exportation of the DairyCOMP 305 data were collected monthly throughout the duration of the trial. For each treatment pen at each site, milk samples were collected via string sampling kits (CA DHIA, Clovis, CA). Milk samples were placed on dry ice immediately following collection and frozen until analysis at the University of Wisconsin, Dairy Science Nutrition Laboratory. Data regarding milk production and milk composition were collected at each site via DHIA records. All TMR and base feed component samples were collected in plastic bags, frozen, and stored until the trial concluded. DairyCOMP 305 data was transferred and stored for later analyses.

Results and Discussion

Milk Composition

Our study showed that supplementing early lactation dairy cow diets with rolled flaxseed increased milk yield, milk protein, and milk fat. These results are consistent with previous studies that have shown a positive response to flaxseed supplementation in dairy cows. In a study with 9.3% EE (rolled flaxseed) and formaldehyde, milk production was increased (Petit, 2001). This study comprised 500 lactating cows and showed a 10% increase in milk production. The authors suggested that silage quality was found reduced in whole flaxseed. Cows fed rolled flaxseed produced 0.85 kg DM/cow daily. The authors assumed that 50% barley was used in the production of digestible feed.

As with the control and Khorasani (1992), however, flaxseed (P = 0.06) increased milk production. The authors observed differences in milk production and milk composition. The authors were aided in protein from formaldehyde. The authors observed differences in milk production and milk composition.

The presence of flaxseed likely led to an increase in unsaturated fatty acids.

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Cows fed supplements of no flax (Control) or flax seed (Flax)				
Dairy DM	Control		Flax	
	P ¹	M ¹	P ¹	M ¹
	59.78	59.78	60.96	60.96
	38.95	38.96	34.87	34.84
	-	-	3.26	3.49
	0.79	0.79	0.16	0.16
	0.48	0.48	0.55	0.55
Position:				
Crude protein, %	5.42	5.42	5.35	5.35
Crude fiber, % of DM	1.72	1.72	1.72	1.72
Cellulose, %	18.50	18.50	18.50	18.50
Acid-detergent fiber, %	20.20	20.20	20.10	20.10
Lignin, %	29.10	29.10	28.90	28.90
Starch, %	0.91	0.91	0.95	0.95
Starch, % of DM	0.42	0.42	0.42	0.42

M = Multiparous
 Diets: corn silage, haylage, and beet pulp
 Supplements: corn, roasted soybeans, sodium bicarbonate, extruded soybeans, distillers grain, blood meal, urea, salt, magnesium oxide, dicalcium, magnesium sulfate, and OmniGen-100 (Vita Plus Corp., Quincy, IL)

Cows fed supplements of no flax (Control) or flax seed (Flax)				
Dairy DM	Control		Flax	
	P ¹	M ¹	P ¹	M ¹
	46.52	46.52	47.47	47.47
	48.59	48.59	48.89	48.89
	-	-	3.35	3.35
	4.03	4.03	-	-
	0.71	0.71	0.30	0.30
	0.16	0.16	-	-
Position:				
Crude protein, %	5.00	5.00	5.00	5.00
Crude fiber, % of DM	1.54	1.54	1.57	1.57
Cellulose, %	16.90	16.90	17.10	17.10
Acid-detergent fiber, %	17.80	17.80	17.10	17.10
Lignin, %	32.40	32.40	31.20	31.20
Starch, %	0.95	0.95	0.99	0.99
Starch, % of DM	0.46	0.46	0.44	0.44

M = Multiparous
 Diets: corn silage, haylage, dry alfalfa hay
 Supplements: corn, corn gluten, rolled corn, soybean meal, soy hulls, canola meal, blood meal, sodium bicarbonate, salt, sesquicarbonate, vitamin E, Omnigen-AF (Prince Agri Products, Inc., Quincy, IL), Vita Plus Corp., Madison, WI, Vi-COR Amax Yeast, (ViCOR Varied Industries Corp., Eden Prairie, MN), Sel-Plex (Altech, Flemington, NJ), Rumensin (Elanco Animal Health, Greenfield, IN), and Vita Plus Corp., Madison, WI

Table 3. Milk production and components for cows fed supplements of no flax (Control) or flax seed (Flax)

Item	Treatment	
	CON	FLX
Number of cows	408	507
Peak milk, (kg)	45.50	46.46
Milk yield, (kg/d)	36.25	36.72
Milk fat, (%)	3.39	3.29
Milk fat yield, (kg/d)	1.23	1.21
Milk protein, (%)	2.75	2.78
Milk protein yield, (kg/d)	1.00	1.02

degradation of the flax seed protein. Diets were formulated to contain 5% EE with the intent of following recommendations by the 2001 Dairy NRC which suggests not exceeding 6 to 7 % EE on a DM basis. It has been well documented (Allen, 2000; Devendra and Lewis, 1974) that dietary fat levels exceeding 5% will lead to decreased DMI, and reduced fiber digestibility. Clearly, a loss of DMI and fiber digestibility leading to decreased milk production and a reduced slope for the elevating energy status of the cow would diminish a protein response induced by feeding flax seed. Other studies have shown reproductive improvements when feeding flax seed with proposed mechanisms indicating independence from the improvement in energy status, while specifically increasing levels of omega-3 FA in diet to contribute to less series-3 prostaglandins (Mattos, 2001).

Milk Fatty Acid Profiles

Concentrations of C16:0 were significantly reduced for cows fed rolled flaxseed (Table 4). This result is in agreement with Khorrasani and Kennelly (1994) which reported increased C16:0 for the control diet compared to that of diets including whole flaxseed or rolled flaxseed. Our study also showed increased concentrations of C18:0, C18:1, C18:3n3, and C20:0 with the inclusion of rolled flax seed in the diet. These increases in C18 fatty acids are products of biohydrogenation in the rumen from the linolenic acid supplied by the rolled flax seed. The increase in C18:3n3 shows some unsaturated fatty is escaping ruminal

biohydrogenation. Concentrations of C16:0 were significantly reduced for cows fed rolled flaxseed (Table 4). This result is in agreement with Khorrasani and Kennelly (1994) which reported increased C16:0 for the control diet compared to that of diets including whole flaxseed or rolled flaxseed. Our study also showed increased concentrations of C18:0, C18:1, C18:3n3, and C20:0 with the inclusion of rolled flax seed in the diet. These increases in C18 fatty acids are products of biohydrogenation in the rumen from the linolenic acid supplied by the rolled flax seed. The increase in C18:3n3 shows some unsaturated fatty is escaping ruminal

Implications

Feeding flax seed to dairy cows may improve milk yield and milk composition. The application of flax seed supplements may increase milk yield and milk composition.

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