Improving Health Benefits of Beef and Milk: A Field Study

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Summary and Implications

A study was conducted to assess the concentration of conjugated linoleic acid in beef and milk from various farms in northeast Iowa and southwest Wisconsin that represent a broad range of management systems. Intensively pastured cows produced milk with CLA concentrations that were about 3- to 4-fold greater than the initial concentration. Ribeye steaks from cattle finished on a combination of pasture and concentrates were higher in CLA content than steaks from cattle finished on conserved forages plus concentrates. Therefore, pasture grazing is an effective method to improve the healthfulness of milk and beef.

Introduction

Conjugated linoleic acid (CLA) is a collective term for a mixture of positional and geometric isomers of linoleic acid (C18:2). This fatty acid is known to have anticarcinogenic, antiobesity, antiatherogenic, and antidiabetic properties. The major food sources of CLA are of ruminant origin, with *cis9 trans11* comprising about 80% of the isomers. The normal concentrations of *cis9 trans11* is about 0.30% of the total fatty acids in milk fat and about 0.35% in beef lipids. However, this concentration can be elevated markedly by increasing the supply of precursors for CLA synthesis through nutritional manipulations. For example, inclusion of plant oils, raw or extruded oil seeds in the diet increase CLA content in milk. Pasture grazing also increases CLA in milk and beef lipids. We evaluated the CLA concentrations of beef and milk from a broad spectrum of largely pasture-based beef and dairy operations in northeast Iowa and southwest Wisconsin.

Methodology

Four beef and 12 dairy producers from two regional locations, northeast Iowa and southwest Wisconsin, participated in this study. However, one dairy producer discontinued because of a change in ownership of the farm. A monthly farm visit was undertaken to the different farms to collect a sample of every feed component of the cattle's diet as well as milk sample from the bulk tank. Beef samples were collected after harvest of finished cattle. Beef and milk samples were analyzed for total fatty acids including CLA. Feed samples also were analyzed for crude protein and total fatty acids (data not presented). Four CLA isomers were identified during the fatty acid analysis, but only *cis9 trans11* isomer, the most prevalent isomer, will be presented and referred to as CLA for the rest of the report.

Results and Discussion

Presented in Table 1 are the total lipid and CLA contents of the ribeye steaks from the different farms in northeast Iowa and southwest Wisconsin. Farm A had 3 groups of cattle based on time of finishing period: Group 1 cattle were fed with alfalfa silage, alfalfa hay and high moisture corn for five and a half months (winter 2001-2002), then, pastured during summer 2002; Group 2 cattle were started on alfalfa silage, alfalfa hay and high moisture corn for five and a half months (winter 2001-2002), followed by pasture grazing during summer 2002, then, finally fed with alfalfa hay, corn and barley for three and a half months (winter 2002-2003); and Group 3 cattle were pastured in summer 2002, then, finished with alfalfa hay, corn and barley for five and a half months (winter 2002-2003). The cattle from the other three producers were finished entirely on conserved forages, with each farm supplementing different concentrate mixes. As shown in Table 1, total lipid content of ribeye steaks from Farm A were lower compared with those of the other three producers. Feeding system during the finishing period of cattle also seemed to have an effect on the CLA content of ribeye steaks, although differences between farms were not as pronounced as in the dairy farms as described later. The highest CLA-containing ribeye steaks were from groups 1 (0.42%) and 2 (0.46%) cattle of Farm A and the lowest were observed from the steaks coming from Farm B (0.26%) and Farm D (0.23%).

The concentrations of milk CLA from the different dairy farms are presented in Figures 1 (northeast Iowa) and 2 (southwest Wisconsin). The 2003 average initial CLA concentration in the milk of northeast Iowa farms was 0.35% and that of the southwest Wisconsin farms was 0.27% of the total fatty acids. These initial CLA concentrations remained constant through the first quarter of the year and started to rise in the month of April when grazing season began. In general, the CLA concentration was highest during the months of May and June when grazing season was in full swing; then, concentrations declined thereafter. Among the northeast Iowa dairy producers, Farm E produced milk with the highest CLA concentrations, 1.00% and 1.29% of the total fatty acids in May and June, respectively, which is about a 3- to 4-fold increase from the average initial concentration. In southwest Wisconsin, the highest CLA-containing milk were from the Farms J, K and L. The CLA concentrations of milk from Farm L were 1.10% and 1.38% of the total fatty acids and those of Farm K were 0.80% and 1.00% in

May and June, respectively. Farm J produced milk with a CLA content of 1.08% of the total fatty acids in the month of July. It should be pointed out that the above-mentioned producers are intensive graziers. Because of prolonged dry season, all farms ceased grazing in August and the decline in CLA also was evident in these farms. However, Farms E and J resumed intensive pasture grazing by their cows while Farm K resumed pasturing to a limited extent only. The resumption of grazing resulted in another peak of CLA concentration in these farms (E, J, and K) in October although the concentration was lower than what was obtained during the summer months but much higher than the other farms that resorted to full feeding of conserved forages and concentrates. The average CLA concentrations in the last sampling month was a reversion to the initial concentrations, which were 0.34% and 0.21% of the total fatty acids for northeast Iowa and southwest Wisconsin, respectively. The milk from the farms of Farms E and J however, still exhibited CLA contents well above the mean concentrations.

Why does pasture-feeding increase CLA content of beef and milk? A likely explanation relates to fatty acid composition of the grasses. Linolenic acid accounts for the greatest proportion of the fatty acids in pasture grasses. This fatty acid can be degraded to vaccenic acid (C18:1*t11*) during the biohydrogenation process in the rumen. Trans-vaccenic acid is a precursor for CLA synthesis in the mammary gland and adipose tissue of ruminants via Δ^9-desaturase activity, which would explain for higher CLA contents in beef and milk from pastured cattle.

Acknowledgments

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Table 1. Total lipid and *cis9 trans11* CLA contents of ribeye steaks from the different farms.

Producer			Total lipid, %	CLA, wt % of total fatty acids
Farm A	Group 1	n = 8	4.74	0.42
	Group 2	n = 3	3.82	0.46
	Group 3	n = 26	4.62	0.34
Farm B		n = 8	8.22	0.26
Farm C		n = 11	6.63	0.33
Farm D		n = 13	7.07	0.23

Figure 1. *cis9 trans11* CLA concentrations in milk from the different farms in northeast

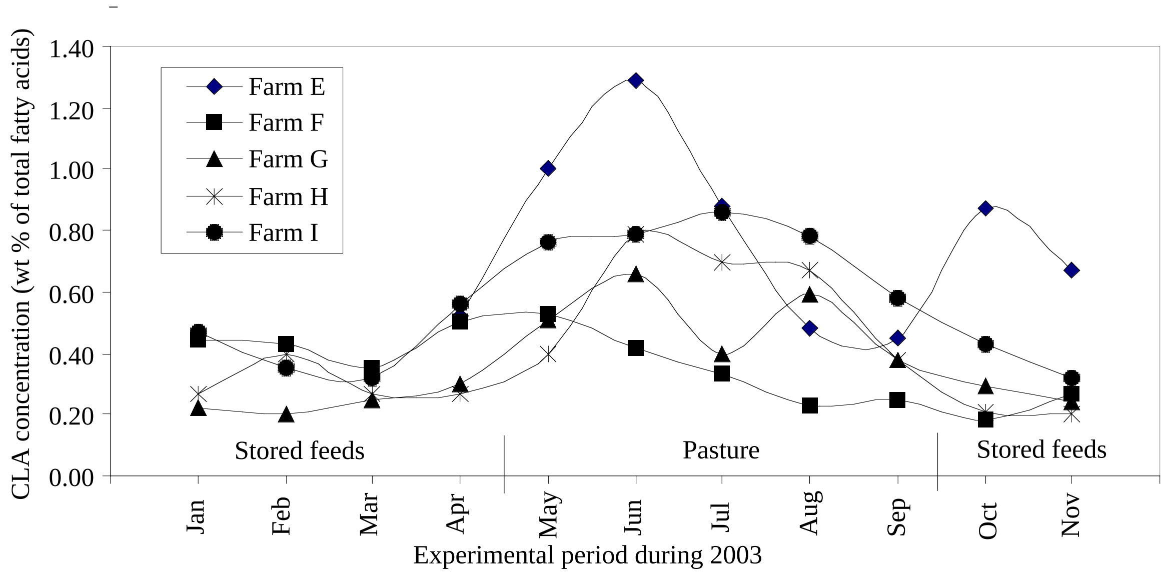

Figure 2. ***cis9 trans11*** **CLA concentrations in milk from the different farms in southwest**