Paddocks Containing Red Clover Compared to All Grass Paddocks Support High CLA Levels in Milk

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Introduction

Conjugated linoleic acid (CLA), an isomer of linoleic acid, is a potent anticarcinogen. In rat models, feeding CLA inhibited epidermal and colonic tumors. In human models, CLA inhibited the proliferation of malignant melanoma, lung adenocarcinoma, and breast and colorectal cancer cells. The National Research Council (1996) stated that CLA is the only fatty acid shown unequivocally to inhibit carcinogenesis in experimental animals.

The effective intake of CLA for humans is estimated to be 3.5 g/d. This is approximately 3 to 4 times what is consumed in the average American diet each day. Dairy products are the major natural dietary source of CLA. In milk, the concentration of CLA averages 5.5 mg/g of fat, ranging from 2.5 to 18.0 mg/g. Concentrations are higher in summer than in winter, coinciding with seasonal availability of fresh pasture. The highest level of CLA in milk that has been found in individual cows approaches 50 mg/g of fat. This level of milk CLA could easily result in a daily intake of 3 g of CLA or more by humans, which approximates the dosage level thought necessary for efficacy.

In a previous research summary, we (Dhiman et al., 1995) reported changes of CLA concentration in milk when pasture contributed different proportions to the cow's feed intake. Changes in concentration of CLA in milk when cows were changed from conventional feeds to pasture were determined in the present study.

Materials and Methods

Grazing began in the middle of May 1997, when pasture became available in Wisconsin. The diet before grazing consisted of 30% alfalfa silage, 20% corn silage, 28% high moisture ear corn, 8% soybean meal, 12% roasted soybeans, and 2% mineral-vitamin supplements. Forty cows (20 primiparous) were grazed, including 27 on a pasture that consisted of grasses only and 13 on a mixed pasture that consisted of 20% red clover and 80% grasses. The grasses in both pastures were primarily Kentucky bluegrass, quack grass, and smooth bromegrass. Grazing cows on both pastures were also fed a supplemental concentrate mix. The mix consisted of 75% corn, 11% corn silage, 10.6% roasted soybeans, and 3.4% mineral-vitamin supplements. The amount of the mix fed was 15.4 lb (DM) daily. This provided approximately 40% of the total feed intake. Cows were allowed to graze all of the time during the 24-h day except for 4 h/d when taken to the milking parlor and fed the supplemental mix. Electric fences were used to allocate a new paddock of fresh pasture daily. Milk yield was recorded and milk samples were taken one day before and six weeks after cows were taken to the pasture.

Results and Discussion

The concentration of CLA in milk before and during grazing did not differ between primiparous and multiparous cows (Table 1). Grazing increased the concentration nearly 2 fold (10.8 vs. 5.8 mg/g of fat, $P < 0.001$) without changing milk fat content. Pasture provided approximately 60% of the total feed intake (due to feeding of the supplemental mix). Energy supplements are usually fed to grazing cows for maximum milk yields. Grazing with little or no supplementation can increase CLA even more (see 1995 USDFRC Research Summaries). Concentration of CLA in milk was approximately 50% (14.0 vs. 9.2 mg/g) higher ($P < 0.001$) for cows grazing mixed red clover and grasses than those grazing grasses only.

The CLA in milk originates from the rumen and is formed as an intermediate in the biohydrogenation process of unsaturated fatty acids. Fatty acids in immature herbage exist mainly as galactolipids and phospholipids. These complex lipids are rapidly hydrolyzed in the rumen, resulting in release of free fatty acids. Rapidly available fatty acids are associated with increased formation of biohydrogenation intermediates rather than end products. Because the

retention time of feed particles in the rumen under grazing conditions is shorter than the retention time with dry feeds, these intermediates might be rapidly passed from the rumen before being further biohydrogenated. The fact that fresh immature pasture forages contain 6-7% lipids compared with 3-4% in hay or corn feeds makes passing of CLA from the rumen more possible.

Conclusions

Grazing lactating cows increased concentration of CLA in milk. The concentration was further increased when the pasture contained red clover. Grazing on pastures containing abundant red clover with minimum concentrate supplementation has potential to produce milk with exceptionally high CLA content.

Table 1. Concentration of fat and CLA[1] in milk of cows grazed on pasture.

	Parity		Grazing			Pasture type[2]	
	P[3]	M[3]	Before	After		Grass	Red clover
Item	(n = 40)	(n = 40)	(n = 40)	(n = 40)	SEM	(n = 27)	(n = 13)
Fat, %	4.05	3.91	4.10	3.85	0.2	3.93 $\pm$ .14	3.69 $\pm$ 0.21
CLA, mg/g of fat	8.4	8.2	5.8a	10.8a	0.5	9.2 $\pm$ 0.4[a]	14.0 + 0.6[a]

[1]Conjugated linoleic acid.

[2]The red clover pasture contained 20% red clover and 80% grasses. Values are means $\pm$ SD.

[3]P = primiparous, M = multiparous.

[a]Values before and after grazing and between grasses and red clover are significantly different at $P < 0.001$.