CLA: What is it, and

Available evidence leaves little doubt that CLA can have a major effect on improving certain health problems in people. It has also been shown that CLA can have an impact on changing the saturation levels of body fat in pigs.

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OVER the past several years, much has been reported about a unique set of fatty acids classified as conjugated linoleic acids (CLA).

There are many published references about the benefits to both people and animals of incorporating CLA into their dietary regimes. There are also a large number of publications that describe the chemistry and functionality of CLA. The purpose of this article is to present a summary of the published information that describes and defines CLA, how it functions and its potential benefits when it is incorporated into the diets of people and animals.

Functional isomers

CLAs are a group of polyunsaturated fatty acids that are positional and geometric isomers of linoleic acid (C18:2). The Figure depicts the structures of linoleic acid and two different CLA isomers. The double bonds of linoleic acid are separated by a methylene group, whereas the double bonds in CLA are conjugated — that is, they are not separated by a methylene group and occur in a continuous configuration (Kritchevsky, 2000).

There are many different isomers of CLA found in nature. Of the natural sources, CLA is primarily found in ruminant meat and milk products (Wang and Jones, 2004; House et al., 2005).

As shown in the Table, 14 individual CLA isomers have been identified in milk products derived from dairy cows (Lock and Bauman, 2004).

CLA is naturally produced during bacterial fermentation in the rumen of ruminant animals. The biohydrogenation of linoleic acid from the diet is the first step in ruminant CLA synthesis. It produces cis-9, trans-11 CLA, also known as rumenic acid, and is the result of isomerization of the delta-12 double bond by linoleate isomerase (Bauman et al., 1999; Wahle et al., 2004). Rumenic acid is further hydrogenated to produce trans-11 18:1 vaccenic acid. Variability in these reactions results for the different isomers and concentrations of CLA in ruminant products (Wahle et al., 2004).

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Beneficial effects

The two primary CLA isomers thought to be the most biologically active are cis-9, trans-11(c9t11) and trans-10, cis-12 (t10c12; Figure). The main isomer produced by ruminants is rumenic acid (c9t11, about 90% of total CLA; Wahle et al., 2004).

Research has been conducted with laboratory animals, cultured cells and people on the effects of CLA and has shown beneficial effects of CLA against obesity, cancer, atherosclerosis and diabetes (Belury, 2002; Wang and Jones, 2004; House et al., 2005). The wide array of CLA effects are mainly attributed to the differences between isomers, and, thus, differences in findings are sometimes due to the amount and composition of CLA supplemented.

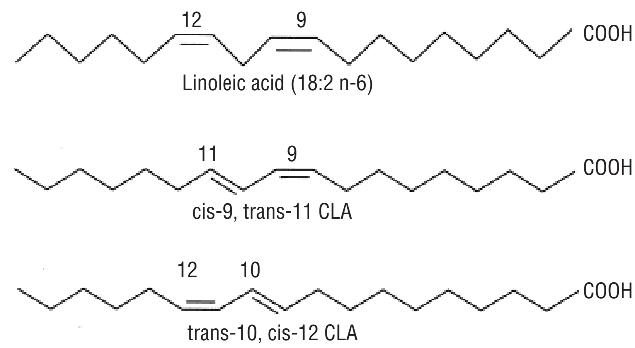
The c9t11 isomer has a unique ability to be readily incorporated into phospholipids of cell membranes, which has led researchers to postulate that this may contribute to the apparent biological effects of the reduction in atherosclerosis and some forms of cancer in laboratory animals and cell line models (Belury and Kempa-Steczko, 1997).

Conversely, the t10c12 isomer results in decreased fat accretion, perhaps due to increases in fat mobilization and oxidation, along with increases in energy expenditure (Wahle et al., 2004).

Many studies have shown that CLA mixtures are able to reduce adipose tissue depots in rodents, pigs and people and that this effect is specific to the t10c12 isomer or a mixture containing greater than 50% t10c12 (Belury, 2002; Wang and Jones, 2004). Postweanling mice fed 1% CLA for 28-30 days had a 50% reduction in total adipose tissue compared to control mice (Park et al., 2001).

In pigs, CLA inclusion in feed has resulted in decreased back fat thickness in grow-finish pigs (Tischendorf et al., 2002; Wiegand et al., 2002). Overweight or obese people given CLA for 12 weeks had reduced body fat mass, but their body mass index remained unchanged (Blankson et al., 2000).

1. Structure of linoleic acid, cis-9, trans-11 CLA and trans-10, cis-12 CLA (Evans et al., 2002)



Range of CLA isomers found in conjugated 18:2 fatty acid in milk

Isomer	% of total CLA isomers*
Trans-7, cis-9	1.20-8.89
Trans-7, trans-9	0.02-2.39
Trans-8, cis-10	0.06-1.47
Trans-8, trans-10	0.19-0.37
Cis-9, trans-11	72.56-91.16
Trans-9, trans-11	0.77-2.87
Trans-10, cis-12	0.03-1.51
Trans-10, trans-12	0.28-1.31
Cis-11, trans-13	0.18-4.70
Trans-11, cis-13	0.07-8.00
Trans-11, trans-13	0.28-4.24
Cis-12, trans-14	0.04-0.80
Trans-12, trans-14	0.33-2.76
Cis, cis isomers	0.0-4.80

*Data derived from studies in which FA analyses were carried out on milk, cheese and butter samples. Table adapted from Lock and Bauman, 2004.

As previously mentioned, a noted effect of CLA is the inhibition of cancer, specifically mammary, prostate, skin, colon and stomach cancers (Belury, 2002). The anti-carcinogenic effects of CLA have been mainly attributed to the c9t11 isomer (Wang and Jones, 2004). In studies of mammary and prostate cancer cell model lines, feeding 1% CLA significantly reduced the growth of cancerous cells. Other studies of the same cell lines have not demonstrated these effects (Belury, 2002).

Several studies have also demonstrated tumor growth inhibitory effects and cell proliferation inhibitory effects of CLA in animal and cell models (Wahle et al., 2004). These effects have made CLA a candidate for nutritional intervention prior to or in conjunction with chemotherapeutic agents given to cancer patients, potentially reducing the amount of the standard drug used and, thus, reducing the associated side effects (Wahle et al., 2004).

CLA reduces atherosclerotic plaque formation (Belury, 2002). Inclusion of 0.5 g per day in hypercholesterolemic diets fed to rabbits for 12 weeks resulted in significantly reduced serum triacylglycerols, low-density lipoprotein (LDL) cholesterol levels and atherosclerotic plaque formation in the aorta (Lee et al., 1994). Other studies have shown reduced plaque formation, inhibited cytokine formation and inhibited angiogensis (Wahle et al., 2004). The reduction of plaque deposits by CLA was proposed to be due to changes in LDL oxidative susceptibility (Belury, 2002).

Effects of CLA on the onset of diabetes and insulin resistance are inconsistent. Rats fed CLA have shown significantly reduced fasting glucose, insulinemia, triglyceridemia, free fatty acids and leptinemia

Live-animal test to detect scrapie developed

GOATS are tough, spirited animals, but they're no match for scrapie, a form of transmissible spongiform encephalopathy.

Now, Agricultural Research Service (ARS) scientists and collaborators have developed a live-animal test to detect scrapie in goats.

Called the rectal mucosa biopsy test, or rectal biopsy, the new method involves snipping a tiny piece of lymphoid tissue from the lining of a suspected animal's rectum. A dab of local anesthetic eases the animal's discomfort, noted microbiologist Katherine O'Rourke with the ARS Animal Diseases Research Unit in Pullman, Wash.

Lymphoid tissue is used because it collects malformed proteins called prions, which are thought to cause scrapie, O'Rourke added.

O'Rourke is a member of a scrapie research team that includes Washington State University, Colorado State University, the Animal & Plant Health Inspection Service (APHIS), the National Park Service and the Canadian Food Inspection Agency.

Advantages of using the rectal biopsy test method include its speed, easier methodology and its generation of a high number of repeat samples from individual animals.

On a related front, ARS Pullman geneticist Stephen White is leading studies to characterize the prion protein gene of goats and identify differences between individual animals and breeds harboring the gene.

His team has so far examined the sequences and distribution of alleles — alternative forms of genes — from 446 goats representing 10 breeds, including Alpine, Angora, Boer and Nubian.

The ARS Pullman lab also is collaborating with APHIS to formulate a strategy aimed at helping the goat industry eliminate scrapie from the U.S. herd, which numbers 4 million head.

Hardships imposed by scrapie on America's goat and sheep producers include the physical loss of animals, costs of carcass and offal disposal, trade restrictions and diminished domestic and international markets for breeding stock, semen and embryos. ■