The CLA Network

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Harvesting the health promise of conjugated linoleic acid

Dairy advances lead charge for CLA progress

Natural dairy fat shows promise for a range of human health benefits.

The 150 Holstein cows that call the Edmonton Research Station home are not your ordinary bovine milk producers – they are innovators.

A computerized record keeping system monitors daily intake, production, and health data for the herd. Scientists conduct ground breaking studies to advance knowledge for the dairy industry. A state-of-the-art facility provides a living classroom for students.

On this day, this select group of dairy cows are producing milk designed for use in products with enhanced levels of conjugated linoleic acid (CLA).

CLA is a "good fat" produced by ruminants and found naturally in dairy and beef products. Though the CLA research effort is young, pioneering studies based largely on animal models have identified CLA potential for human health benefits related to cancer, heart disease, obesity, diabetes, kidney disease and bone density.

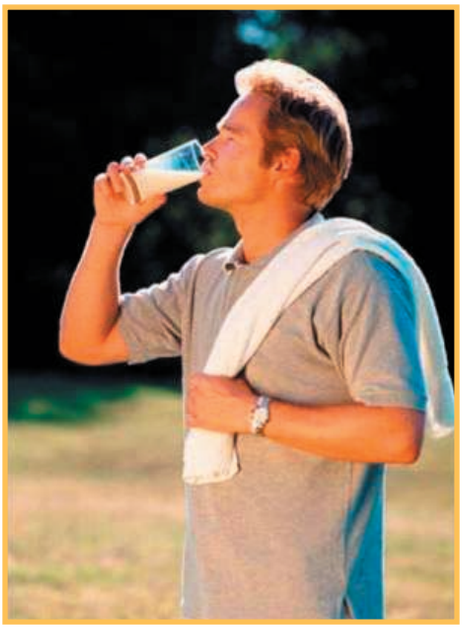
"CLA has shown significant health promoting properties, including potent anticarcinogenic activity," says Dr. John Kennelly, a professor of dairy cattle nutrition and metabolism and Dean of the University of Alberta Faculty of Agriculture, Forestry, and Home Economics. "That presents a very promising opportunity for Canada's dairy industry."

Moving toward products

The dairy cows at the university's Dairy Research and Technology Centre have been used to produce CLA-enhanced milk and butter oil for use in a series of animal studies by scientists in the Alberta-based CLA Network and Health Canada.

This component of the CLA Network's research is designed to examine the health benefits of CLA in animals consuming CLA-enriched dairy products.

"The animal work is an important part of a broader plan to support commercial production of CLA-enriched dairy products," says Kennelly, a member of the CLA Network. "Already, we have shown that using practical dairy feeding strategies it is possible to increase the



concentration of CLA in bovine milk by five times or more. If we can strengthen the connection between this production potential and the rising health potential, it will be a great step forward for this effort."

With continued progress, CLA could become a valuable marketing feature of dairy products in the future, he says. Because CLA is already found naturally in dairy products, it can help strengthen the health image and increase demand for existing products. If potential enriched products are confirmed to have added health value, then those advantages can be multiplied with a number of new product opportunities.

In past research led by Kennelly, results have indicated the approximate level of CLA in the human diet ranges from 52 to 137 mg per day, based on typical consumption of existing dairy and beef products.

The levels needed to deliver human health benefits need to confirmed, says Kennelly, but signs are a level of just 1.5 grams per day or less may be health significant. "Determining the significant level for humans remains a work in progress, but if the results thus far hold true, it appears normal consumption of dairy and beef products could be enough for a benefit. Products with enriched CLA levels would potentially allow consumers to obtain significant levels more quickly and easily."

Strong production opportunity

CLA is produced naturally in dairy animals when fat sources containing linoleic or linolenic acid from livestock feed is converted into CLA, as a result of microorganism activity in the rumen and the mammary gland. Studies have confirmed this natural CLA is transferred into dairy products as a portion of milk fat, and the natural CLA level can be multiplied through a variety of livestock production strategies.

One of the most simple and effective of these is adding a dietary supplement of plant oil or seed that is high in linoleic acid.

"Our studies have shown that supplementing oilseeds to the dairy diet is an effective method for increasing CLA in milk fat," says Kennelly. "We have tested a range of oilseed types including canola, soy, sunflower, safflower, linola and flaxseed at various levels in the diet. Overall, we've found that oilseeds characteristically high in linoleic acid, such as sunflower, safflower and linola, are the most effective at increasing CLA."

Extracted oil tends to produce a greater increase than seed except for sunflower seed, which gives similar results to feeding the extracted oil, he notes.

Teamwork-driven

Further investigating optimal feeding strategies is just one of many objectives the CLA Network is pursuing, to help the dairy industry and dairy consumers capture the promise of this unique nutrient.

Founded in Alberta in 2001, the CLA Network is a collaborative team from academia, industry and government, including representatives from many areas of expertise such as research, food industry, health and communications.

Network activity is based around several modules working together towards a common goal. These modules cover the areas of dairy production and product development, beef production and product development, animal mechanisms, human health, market research and product development, and communications.

Tapping natural benefits

Though the CLA Network is a young effort, the dairy production and product development module has already tackled a broad range of research and made important strides, says Dr. David Glimm, a University of Alberta dairy biochemists who co-leads the module with Kennelly.

"We've established a lot of the fundamentals," says Glimm. "We're confident of developing effective production strategies that will both support enhanced CLA levels and make sense economically for livestock producers. Now we're honing in more on the product development opportunities."

While there are many different isomers, or types, of CLA, two of these have been studied most extensively and have the strongest links to health benefits, he notes. These two isomers, CLA 9,11 and CLA 10,12 are the ones found most prominently in dairy products.

Also confirmed to be found naturally dairy products is vaccenic acid, which studies have identified as a precursor to CLA 9,11. This precursor is converted into CLA by a natural human enzyme once inside the human body.

Windows on progress

Module research has targeted a number of opportunities with these specific types of CLA, in a range of studies.

Milk synthesis studies. Among these have been several studies to provide insight into the biology of milk synthesis. In particular, researchers have investigated the regulatory factors that influence the amount and type of CLA in milk.

"This work has involved experiments at the level of mammary cells, at the level of rumen microbiology and ecology, all the way to the level of the nutrition and metabolism of the whole dairy cow," says Glimm. "This work provides the knowledge and tools to control the level of CLA in milk and thus produce dairy product that contain an enhanced level of naturally-occurring, dairy–derived CLA."

In dairy animals, the majority of CLA appears to be produced in the mammary gland, notes Kennelly. "In conjunction with the University of Vermont and the Teagasc research institute in Ireland, we're pursuing some fundamental work to better understand the conditions that cause the enzymes in the mammary gland to make best use of the feed-derived material – called substrate – that's available for CLA synthesis. This can further help us in designing diets that optimize CLA production."

Along with attaining high levels of CLA in milk, a parallel target of the work is minimizing the amount of substrate required to reach those high levels.

"This will help reduce costs associated with the substrate as well as minimize any detrimental effects of increased substrate on overall digestion in the rumen," says Kennelly. "We don't want farmers to have any negative side effects from producing milk with high CLA."

Dietary options to increase CLA. Within this broad framework, several dairy module studies focus specifically on dietary factors that influence CLA in milk. "The nature of work in this area spans the spectrum of discovery-type experiments to establishing the practical implications of the findings for on-farm feeding," says Glimm. "We've looked at ways to both identify new feed ingredients that influence milk CLA levels, as well as to develop new feeding strategies for those ingredients."

One current focus is looking at differences caused by grazing. "It has been shown that grazed animals produce higher levels of CLA," says Kennelly. "If we can find out why that it so, it will provide us with further knowledge to optimize CLA levels. A theory we're exploring is that different bacterial populations present in a grazing situation may have some effect."

Product development. At the level of product development, including the effort on CLA enriched butter, researchers are working on several fronts with industry partners to bring new, CLA-enhanced products, to the market. In addition to work with Health Canada, this component of the module also involves work with the Canadian Food Inspection Agency.

"The idea is to have a smoothly paved road in place on the regulatory front when CLA enriched products advance more toward commercialization stages," says Glimm.

Supporting human health claims. On the health front, the butter oil animal study with Health Canada is one of several ongoing studies with a main purpose to produce milk with specific amounts of CLA that can be processed to generate products for use in experiments to study the health benefits of naturally-produced CLA.

One of the most advanced efforts involves cell culture studies to examine anti-cancer benefits of CLA. Parallel animal model studies are investigating CLA advantages against disorders such as diabetes and metabolic syndrome.

These studies are leading toward planned future human health trials, says Glimm. "A growing portion of our work is devoted to addressing the need to standardize and optimize the CLA-enhanced products we're developing, for use in human trials."

Learn more

For more information on the CLA Network, visit www.CLAnetwork.com or email: CLAnetwork@gov.ab.ca.

Visit www.CLAnetwork.com for more articles on activity and progress.

The CLA Network
Email: CLAnetwork@gov.ab.ca
Web: www.CLAnetwork.com

Vince Ohama, CLA Network Manager
Alberta Agriculture,
Food and Rural Development
Tel: (403) 340-5545 Fax: (403) 340-4896

Bruce Beattie,
CLA Network Chair
Cell: (403) 638-7896