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Conjugated Linoleic Acid © VR

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Conjugated Linoleic Acid (CLA) is a collective name for a mixture of several isomers (or chemical forms) of octadecadienoic acid in which the two double bonds are conjugated. Recent studies have established that various isomers (cis-9, trans-11 and trans-10, cis-12) have distinct biological effects, which they may exert via different biochemical mechanisms.

Short-term feeding of cis-9, trans-11 or CLA-containing mixtures of isomers to Syrian hamsters resulted in significantly lower levels of plasma triglycerides and total cholesterol in the CLA-group than the cis-9, trans-11 group. The CLA-group also had significantly lower weight gain but greater food intake than in the cis-9, trans-11 group.

A Chemical Profile

CLA has the capabilities to prevent cancer and heart disease, improve immune function, and treat obesity. CLA is the main omega-6 polyunsaturated fatty acid in the diet, and it is an essential fatty acid.

Essential fatty acids include omega-6 (such as CLA, gamma linolenic acid, dihomo-gamma-linolenic acid, arachidonic acid), and omega-3 fatty acids, such as eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). These essential fatty acids are the main structural components of biological cell membranes, and a balanced intake of both omega-6 and omega-3 fatty acids is necessary for healthy cell function.

Omega-3 and omega-6 are not inter-convertible in the body, and are metabolically and functionally distinct. Their balance in the body is important for growth and development.

CLA is designated as 18:2n-6, where the n-6 designation means that the first double bond begins at the sixth carbon atom counting from the methyl end of the carbon chain, and hence the name omega-6. The number 18 indicates the length of the carbon chain (18 carbon atoms), and the number 2 indicates the presence of two double bonds in the carbon chain.

CLA is found in grass-fed beef and lamb, dairy products, and most vegetable oils, such as sunflower, safflower, and flaxseed oils. The most common isomer of CLA found in the diet is cis-9/trans-11. CLA contents of dairy products range from 3 to 9 mg per gram fat, of which the cis-9/trans-11 CLA isomer comprises between 70 and 90 percent of the total CLA. CLA found in most dietary supplements is manufactured from sunflower oil or safflower oil.

The human body cannot produce CLA; it can only be obtained through diet, including beef and dairy products. The amounts of CLA in beef and cow's milk depends on the animals' diet, which over the years has shifted from grazing in pastures to prepared feeds to make them gain more weight and produce more milk. As a result, the CLA content in beef and dairy products has declined steadily. In one study, cows grazing in pastures and receiving no supplemental feed had 500 percent more CLA in the milk fat than cows fed typical dairy diets.

Eicosanoids

Omega-6 and omega-3 fatty acids are the precursors for the production of a group of chemicals known as eicosanoids; this group includes prostaglandins, thromboxanes (potent platelet aggregator and vasoconstrictor), and leukotrienes (pro-inflammatory).

Eicosanoids regulate many cell functions and play crucial roles in a variety of physiological processes, including regulation of smooth muscle contractility and various immune and inflammatory functions. Eicosanoids derived from omega-6 fatty acids have different metabolic properties than those derived from omega-3 fatty acids.

In general, eicosanoids are classified into three different series of chemicals: series-1 and series-3 are anti-inflammatory, whereas series-2 is pro-inflammatory. The biochemical pathway to series-3 begins with the omega-3 fatty acid alpha-linolenic acid, while that of series-1 and series-2 begins with CLA.

GLA

CLA with the help of delta-6-desaturase enzyme is converted to gamma linoleic acid (GLA), which is also found in the oils of borage, evening primrose, black currant, and mothers' milk. It plays a critical role in the development of infants. GLA has also become popular recently as a natural aid to weight loss management; a typical dose of GLA is 500 to 700 mg daily. Research showed that subjects taking GLA lost almost 10 pounds over a six-week period.

GLA with the help of elongase enzyme is converted into dihomo-gamma linolenic acid (DGLA), which in turn is converted, by delta-5-desaturase enzyme to arachidonic acid (AA). DGLA is the precursor to series-1 eicosanoids, while AA is the precursor to series-2 eicosanoids. The cyclo-oxygenase enzyme catalyzes the addition of two oxygen molecules to AA leading to prostaglandins and thromboxanes, while the lipoxygenase enzyme catalyzes the addition of a single molecule of oxygen to AA leading to leukotrienes. AA, which predominates in the brain tissue, is present in red meat.

Studies indicate that omega-6 fatty acids decrease bleeding time and are vasoconstrictive, while omega-3 fatty acids have anti-inflammatory, antithrombotic, antiarrhythmic, hypolipidemic, and vasodilating properties. These beneficial effects have been shown in the prevention of heart diseases, Type II diabetes, rheumatoid arthritis, and Crohn's disease. A balanced intake of both omega-3 and 6 is essential for health.

The potential anti-cancer effects and cardiovascular protection of CLA have been attributed to several possible mechanisms including its action as an antioxidant.

Immune System
GLA derived from black currant seed oil was shown in a recent study to stimulate immune function in older people. In this double-blind, placebo-controlled study, 29 people older than 65 took 4.5 g daily of either black currant seed oil or soybean oil for two months. At the end of the study subjects who took black currant seed oil showed a 28 percent greater immunity (a dramatic drop in prostaglandin PGE-2 production) than the placebo-group.

The prostaglandin PGE-2 is known to lower immunity in older people by interfering with T-cell function. T-cells function by stimulating other cellular components of the immune system to kill or neutralize invading bacteria and viruses.

The ability of CLA to alter immune status was also examined in another study involving 17 healthy women, aged 21 to 41 years. Seven subjects ate a normal diet for three months, and 10 subjects ate the basal diet (a diet that gives enough energy to maintain vital activities) for the first month, followed by 3.9 g CLA (Tonalin) per day for the next two-months. CLA made up 65 percent of the fatty acids in the Tonalin capsules. None of the indices of the immune system tested, including white blood cells, were altered in both control and CLA groups. The study concluded that short-term CLA supplementation in healthy people is safe, but it does not confer any added benefit to their immune status.

In a test tube experiment CLA has been shown to enhance cellular immunity by modulating phenotype (expressed features of cells) and CD 8(+) cells (a critical subpopulation of white blood cells), which are essential for the development of cell-mediated protection against intracellular pathogens (such as bacteria and viruses) and cancerous cells.

Cancer Prevention
About 12 years ago, researchers at the University of Wisconsin discovered that CLA has cancer-fighting properties in a study of rats fed fried hamburger. In other animal studies CLA was found to inhibit several types of cancer, and in vitro studies also supported the ability of CLA to kill human skin cancer, colorectal cancer and breast cancer cells.

Bovine milk fat enriched with CLA, consisting primarily of the cis-9, trans-11 isomers, was shown to inhibit growth of human breast cancer cells, and to enhance the antioxidant defense system: superoxide dismutase, catalase, glutathione peroxidase. CLA was also shown in an animal study to inhibit 1,2-dimethyl hydrazine induced colon carcinogenesis in rats.

A recent study published in the Journal of Nutrition showed that high levels of CLA in dairy foods reduced the incidence and number of tumors in rats fed butter made from milk containing increased levels of CLA.

Weight Loss Management
The Journal of International Medical has published a recent study presented by the Scandinavian Clinical Research AS, Kjeller, Norway, which demonstrates that CLA reduces body fat in humans. This is the fifth study published in a peer-reviewed medical journal within 18 months confirming CLA's role in body fat reduction.

The randomized, double-blind study comprised of 20 participants, ages 18 to 30, who were recruited from a physical fitness center where they engaged in regular physical training consisting of 90 minutes of strenuous exercise, three times a week. Volunteers were directed not to change their diet or lifestyle during the study.

Body fat, measured using near infrared light, was significantly reduced in the group taking CLA during the study. This study shows those participants who ingested 1.8 grams of CLA per day experienced body fat reduction versus the placebo group.

Another study published in The Journal of Nutrition found that without a change in exercise or diet, participants taking CLA

experienced an average reduction of six pounds of body fat, compared with a placebo group.

Last year, a study that appeared in The International Journal of Obesity showed that male subjects classified as abdominally obese lost an average of one inch from their waistlines in a four-week period when using CLA.

Researchers at Uppsala University in Sweden reported similar findings. Fifty-three healthy men and women, aged 23 to 63 years, were randomly assigned to supplementation with CLA (4.2 g/day) or olive oil for 12 weeks. Body fat was decreased by 7.8 percent in the CLA group, but not in the control group. No change in body weight was observed in both the CLA and control groups. When fed to growing mice, CLA reduced body fat by 25 percent.

In an in vitro study, researchers at the University of North Carolina reported that the anti-obesity actions of a supplement containing a crude mixture of CLA isomers given to humans might be due to inhibition of lipogenesis by the trans-10 and cis-12 isomers.

CLA has also been shown to reduce body fat mass (BFM) in humans in a dose-dependent manner. In a randomized, double-blind study, 60 overweight or obese volunteers were divided into five groups receiving placebo (9 g olive oil), 1.7, 3.4, 5.1 or 6.8 g CLA per day for 12 weeks. The CLA group showed a significant reduction in BFM as compared to the placebo. The study indicates that 3.4 grams of CLA per day is enough to reduce BFM.

DeLany and West at Pennington Biomedical Research Center in Baton Rouge, LA conducted several studies showing that CLA reduces fat accumulation in mice. They proposed that CLA reduces body fat by increasing energy expenditure.

A new study on CLA published in the August issue of the International Journal of Obesity showed that overweight men taking CLA lost more fat than those not taking the product.

Summary
CLA shows remarkable health benefits, it stimulates the immune system, reduces body fat, protects against certain kinds of cancer, and improves cardiovascular health. ClA also increases thermogenesis (calorie expenditure). CLA is available as a dietary supplement; dosages range from 2 to 6 g daily. ***VR***

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