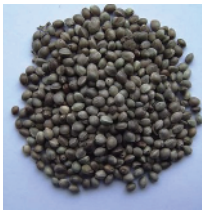
Quality is in our nature

Canada



Courtesy of Canadian Hemp Trade Alliance

Courtesy of Bioriginal Food & Science Corp.

Gamma-Linolenic Acid

Healthy Canadian Ingredient

Gamma-linolenic acid (GLA), an essential omega-6 fatty acid, complements the dietary intake of omega-3 fatty acids. It is recommended that omega-6 and omega-3 fatty acids be consumed in a ratio of approximately 4:1 to maximize health benefits.[1]

The primary sources of GLA are commercialized plant seed oils, namely borage (Borago officinalis), evening primrose (Oenothera biennis) and black currant (Ribes nigrum). Small amounts of GLA are also found in human milk and organ meats.[2]

Borage oil contains the highest level of GLA (22-25%); evening primrose the lowest (8-10%); and black currant oil values are intermediate (~15%). Hemp *(Cannabis sativa L)* seeds, a relatively new introduction to the GLA market, contain about 2-3% GLA. Other sources of GLA under development include Echium *(Echium plantagineum)* oil (10-11 %), biotechnology-derived safflower oils (35-65%) and canola oils (36-40%).

While evening primrose is the most established source of GLA, borage is becoming the preferred source due to its high proportion of GLA[3] in its seed oil.

Health Benefits

Omega-3 and omega-6 fatty acids are essential fatty acids (EFA) because they are not produced by the body and must be supplied through the diet or by supplementation[4]. Omega-3s are important for proper neural, visual and reproductive function while omega-6s are critical for proper tissue development during gestation and infancy.

Linoleic acid (LA) is the precursor for synthesis of the long chain omega-6 fatty acids, GLA, dihomo-gamma linolenic acid (DGLA) and arachidonic acid (AA).

GLA is sometimes called a “conditional” EFA because a large percentage of the population is unable to produce GLA effectively from its precursor, LA, due to dietary deficiencies, alcohol abuse, smoking, viral infection, medical conditions or aging.[5] Dietary supplementation with GLA ensures adequate levels of long chain omega-6 fatty acids are present in the body.

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By adding GLA to the diet, the rate limiting conversion of LA to GLA can be avoided resulting in more efficient production of long chain omega-6 fatty acids and eicosanoids.[6] Eicosanoids, like prostaglandins and leukotrienes, aid in regulating pain, swelling and inflammation, water retention, blood clotting, nerve transmission, allergic response, steroid production, and hormone synthesis.[6]

Dietary GLA is converted directly to DGLA. Increased levels of DGLA promote the synthesis of anti-inflammatory metabolites[7] (i.e. 1-series prostaglandins (PGE_1)) and reduce the biosynthesis of the AA derived pro-inflammatory metabolites (i.e. 2-series prostaglandins, 4-series leukotrienes and platelet activating factor).

Many of the beneficial effects of GLA are attributed to increased tissue levels of PGE_1, known to suppress chronic inflammation.[8] The most promising research demonstrates the efficacy of dietary GLA in the treatment of rheumatoid arthritis and other inflammatory disorders.[9] A reduction in joint pain, swelling, tenderness and a decreased need for non-steroidal inflammatory drugs (NSAIDS) with GLA supplementation have been demonstrated in numerous clinical studies.[10,11]

Few clinical trials have investigated the role of GLA in cardiovascular health. However, dietary GLA supplementation in animal and human studies has shown a reduction in LDL cholesterol,[12] plasma triacylglycerols,[13] blood pressure and smooth muscle proliferation.[14]

GLA has been found to be effective in the treatment of diabetic neuropathy[15] (loss of peripheral nerve function), atopic eczema[16], cyclical mastalgia (pre-menstrual breast pain),[17] aging, hyperactivity disorders and as an anti-tumor agent in the treatment of certain cancers like breast,[18] prostate, ovarian and pancreatic carcinomas.[19]

GLA may also be useful with dry eye conditions since PGE_1 is linked with healthy mucosal tissue and tear film.[20,21] Inconsistent results have been found for its effect on multiple sclerosis.[22]

The biological activity of various sources of GLA remains unclear–research is continuing to evaluate GLA's clinical efficacy.

Innovative Applications

Several methods can be used to extract GLA from plants–conventional solvent extraction, cold pressing and supercritical fluid extraction depending on the seed type, desired market attributes, product form, and cost. Processing research is investigating the best ways to concentrate or enrich GLA content.

GLA is used as a nutraceutical and dietary supplement, usually taken in capsule form and often sold in combination with flaxseed oil, fish oil or minerals and vitamins. GLA is commonly used in cosmetic products like lotions, creams and shampoos. New technologies for encapsulating oils and manufacturing EFA powders are providing options for inclusion of GLA in food products, including breads and beverages.

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Evening primrose oil was granted approval for the treatment of atopic eczema in the UK in 1988 and subsequently approved for pharmaceutical use in many countries. Canada's Bioriginal Food and Science Corporation has been granted GRAS (generally recognized as safe) status in the US for its BioAsteri, a GLA functional food ingredient made from borage oil and available in both oil and powder forms.

Courtesy of Bioriginal Food & Science Corp.

Canadian Research Expertise

• Canadian Centre for Agrifood Research in Health and Medicine (CCARM) (Winnipeg, MB) (St. Boniface General Hospital Research Centre)

– Investigating the health benefits of functional ingredients on cardiovascular disease and its determinants (G. Pierce)

– Lipoprotein nutrition, metabolism and coronary heart disease (M. Moghadasian)

• Richardson Centre for Functional Foods and Nutraceuticals (Winnipeg, MB)

– Dietary factors controlling cholesterol and plant sterol metabolism in humans and in animal models; human dietary fatty acid absorption and oxidation; human energy metabolism (Jones)

• University of Prince Edward Island (Charlottetown, PEI): Canada Research Chair in Psychoneuroimmunologly

– Study of omega-3/6 fatty acids to treat symptoms of neurodegenerative diseases like Alzheimer's, multiple sclerosis and Parkinson's (Song)

• University of Sherbrooke (Sherbrooke, QC): Canada Research Chair on Use of Dietary Fatty Acids and Cognitive Functions during the aging process

– Effect of PUFAs (polyunsaturated fatty acids) on cognitive functions (S. Cunnane)

• University of Toronto (Toronto, ON)

– Nutrition and metabolism of lipid-lowering ingredients in functional foods (D. Jenkins, C. Kendall)

Canadian Suppliers

1. *Bioriginal Food and Science Corporation* (Saskatoon, SK) http://www.bioriginal.com
2. *Omega Nutrition Canada Inc* (Vancouver, BC) http://www.omeganutrition.com
3. *Hemp Oil Canada, Inc* (Ste. Agathe, MB) http://www.hempoilcan.com/
4. *Ruth's Hemp Foods* (Toronto, ON) http://www.ruthshempfoods.com
5. *Manitoba Harvest* (Winnipeg, MB) http://www.manitobaharvest.com/

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