

Flax Seed

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Received date: August 19, 2021; **Accepted date:** August 28, 2021; **Published date:** September 07, 2021

Citation: Hayriye Alp (2021), Flax Seed. *J. Gastroenterology Pancreatology and Hepatobiliary Disorders*. 5(5) DOI: 10.31579/2641-5194/045

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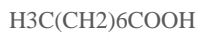
Abstract

Flax seed also known as flax oil and linseed oil, is derived from the seeds of the plant *Linum usitatissimum*. Flax seed oil is a very rich source of alpha-linolenic acid. Alpha-linolenic acid concentration in flaxseed oil ranges from approximately 40 to 60%. Lower amounts of linoleic acid and oleic acid (each about 15%) are also present in flaxseed oil. In addition, flaxseed contains varying amounts of the lignan, secoisolariciresinol diglycoside (SDG).

Keywords: flax seeds; linseed oil;

Introduction

Alpha-linolenic acid (ALA) is an n-3 (omega-3), all-cis polyunsaturated fatty acid containing 18 carbon atoms and three double bonds. It is also known as ALA; ALA, 18:3n-3; 9,12,15-octadecatrienoic acid. ALA has the following structural formula:



ALA is present in flaxseed oil in the form of a triglyceride. The Mediterranean diet high in ALA, appears to lower the risk of coronary artery disease and certain types of cancer.

The lignan SDG belongs to a group of plant substances known as phytoestrogens. See also flaxseed lignans and secoisolariciresinol diglycoside (SDG).

Actions and pharmacology

Actions flaxseed oil may have anti-inflammatory, anti-atherogenic, anti-thrombotic and anti-proliferative activities.

Mechanism of action

ALA is metabolized to eicosapentaenoic acid (EPA). EPA is a precursor of the series-3 prostaglandins, the series-5 leukotriens and the series-3 thromboxanes. These eicosanoids have anti-inflammatory and anti-atherogenic properties. ALA metabolites may also inhibit the production of the pro-inflammatory eicosanoids, prostaglandin E₂ (PGE₂), and leukotriene B₄ (LT-B₄), as well as the pro-inflammatory cytokines, tumor necrosis factor-alpha (TNF-α) and interleukin-1 beta (IL-β). Incorporation of ALA and its metabolites in cell membranes can affect membrane fluidity and may play a role in anti-inflammatory activity, inhibition of platelet aggregation and possibly in anti-proliferative actions of ALA.

Secoisolariciresinol diglycoside (SDG) is metabolized to enterolactone and enterodiol. These substances may have anti-platelet-activating factor

activity, which would produce anti-thrombotic activity. SDG metabolites may also block some of the cancer-inducing effects of estrogen and may have selective estrogen receptor modulating (SERM) activity.

Pharmacokinetics

ALA-laden triglycerides in flaxseed oil are absorbed from the small intestine aided by bile salts. During this process, there is some deacylation of the fatty acids of the triglycerides. Reacylation takes place within the mucosal cells of the small intestine, and the ALA-laden triglycerides enter the lymph system in the form of chylomicrons. ALA-laden chylomicrons are transported from the lymph into blood, where ALA is then carried in various lipid particles to the various cells of the body, where it gets metabolized to EPA and series-3 prostaglandins, the series-5 leukotriens and the series-3 thromboxanes.

The flaxseed oil lignan SDG is metabolized by bacteria in the colon to enterolactone and enterodiol. These substances are absorbed from the colon and metabolized to several hydroxylated metabolites in the body.

Indications and usage

Flaxseed and flaxseed oil may be indicated in hyperlipidemia to decrease platelet aggregation, to lower blood pressure, to help prevent heart attacks and stroke, and to ameliorate some of the symptoms of arthritis. There is a suggestion that it may be helpful in some cancers. Claims that it can be useful in the treatment of anxiety, constipation, vaginitis and weight loss are unsubstantiated.

Research summary

Though high in alpha-linolenic acid (ALA), flaxseed and flaxseed oil may have beneficial effects that may sometimes be independent of their ALA content. In animal models, flaxseed-enriched diets have significantly reduced hypercholesteremic atherosclerosis: this has been true even when CDC-flaxseed (type 2 flaxseed) which contains quantities of oil and lignan similar to that of standard flaxseed but with very little ALA

content, has been used. Lignan content could be responsible for some of the positive effects. Lignans have been shown in the various studies, to contain anti-platelet-activating factor activity and possess antioxidant properties.

Development of atherosclerosis has been reduced by up to 69% in some of these studies using flaxseed-enriched diets.

To what extent research findings using flaxseed itself can be extended to the use of flaxseed oil remains to be determined. There is preliminary clinical evidence suggesting that the oil can decrease platelet aggregation, that it may lower cholesterol (but probably not triglycerides) and that it might have some ability to lower blood pressure and have some anti-inflammatory effects in some with arthritis.

Some animal studies have suggested a possible role for flaxseed in the treatment of some cancers, particularly mammary cancers. Lignans have been shown to block some of the cancer-inducing effects of endogenous estrogens. Human trials are underway.

Recently some poultry farmers have begun feeding chickens diets rich in flaxseed boosting the omega-3 fatty acid content of the eggs of these chickens to levels eight to 10 times that of regular eggs. These functional foods have already captured four percent of the Canadian egg market. It has been reported that two of these eggs supply half of Health Canada's recommended daily intake of omega-3 fatty acids for adults.

A researcher at the Center for genetics, nutrition and health, Washington, DC, has concluded: 'The availability of omega-3 fatty acid-enriched products should lead to improvement in the food supply. Studies with omega-3 enriched eggs lower cholesterol levels, platelet aggregation and blood pressure.'

Claims that flaxseed and flaxseed oil are useful in treating anxiety, vaginitis and weight loss are not substantiated by the available research data. Veterinarians reportedly use these products to treat some animals for constipation, but human data are lacking. And regarding animals, flaxseed oil fed to broiler chickens has been found to reduce pulmonary hypertension and right ventricular hypertrophy in birds raised under hypoxic conditions. No human data are available.

Contraindications

Flaxseed oil is contraindicated in those who are hypersensitive to any component of a flaxseed oil-containing product.

Precautions

Infants, young children, pregnant women and nursing mothers should avoid supplemental flaxseed oil pending long-term safety studies. Because of possible antithrombotic activity, those with hemophilia and those taking warfarin should be cautious about the use of supplemental flaxseed or flaxseed oil. Flaxseed oil intake should be halted in those having surgical procedures.

Adverse reactions

Flaxseed oil may cause mild gastrointestinal symptoms, such as diarrhea.

Interactions

Interactions may occur between flaxseed oil-ALA and its metabolites and warfarin, aspirin and NSAIDs. Such interactions, if they were to occur, might be manifested by nosebleeds and increased susceptibility to bruising. If this does occur, consideration should be given to lowering or stopping intake.

Interactions may occur if flaxseed oil is used with other nutritional supplements, such as fish oils, which have antithrombotic activity.

Interactions may occur between ALA and its metabolites with such herbs as garlic (*Allium Sativa*) and ginkgo (*Ginkgo biloba*). Such interactions might be manifested by nosebleeds and easy bruising.

Over dosage

There are no reports of flaxseed oil overdosage.

Dosage

Flaxseed oil comes in few forms: capsules containing from 40-60 percent ALA, oils and in functional foods. Regarding the latter, ALA-laden eggs are available from laying hens fed flaxseed diets.

Three to four grams of ALA is approximately equivalent to the 0.3 grams of EPA which one would derive from a fish-rich diet. Six 1 gram capsules of flaxseed oil that are 50% ALA-containing flaxseed oil provides about 7.5 grams of ALA. Many use flaxseed oil component in salad dressing. Since flaxseed oil easily oxidizes, it is important that it contains an antioxidant, such as vitamin E. The amount of flaxseed lignans in flaxseed oil are highly variable.

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