

Alpha-Linolenic Acid: An Underappreciated Omega-3

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The inclusion of omega-3 fatty acids from flax oil and fish oil are increasingly popular as food manufacturers seek to improve the nutrient value of their products. Flax contains the omega-3 fatty acid alpha-linolenic acid (ALA). Fish oils are sources of the longer-chain omega-3s eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA).

Despite the positive attributes expounded for the category, and omega-3s' increasing presence in the marketplace, there is also confusing messaging around the health effects of the specific omega-3s, in particular the physiological significance of ALA vs. fish-based EPA and DHA. Recent headlines have warned consumers not to "confuse" the benefits of these omega-3s and have downplayed the significance of ALA for health. However, ALA has an important role in reducing chronic disease through conversion to EPA and DHA, as well as through its own unique metabolic activities. Additionally, what many fail to understand is the critical need for both plant- and fish-based omega-3s, especially considering the increasing predominance of omega-6 fatty acids in the diet.

ALA is the true "essential" omega-3 fatty acid, because it is the parent fatty acid of the omega-3 family and must be obtained from foods.¹ ALA's essential nature is reflected in the federal government's dietary recommendations. The current recommended Adequate Intake (AI), which represents the average usual intake of a nutrient by healthy people, is based on ALA, not EPA or DHA.² Diets deficient in ALA result in impaired vision in monkeys, learning deficits in rats and, in humans, very low levels of omega-3 fatty acids in plasma and red blood cells, as well as nervous system abnormalities such as numbness, weakness and pain in the legs.³

Fast conversion facts

ALA and its counterpart omega-6 essential fatty acid, linoleic acid (LA), are converted to longer-chain fatty acids by a series of alternating desaturations and elongations. Conversion is dependent upon a number of factors. Estimates of the amount of ALA converted to EPA range from 0.2% to 8%, with young women showing a conversion rate as high as 21%.^{4,5} Conversion of ALA to DHA appears limited in humans, with most studies showing a conversion rate of about 0.05%, although one study reported a figure of 4%, and a conversion rate of 9% was reported in young women.⁵ The large differences in the rates of ALA conversion reflect major differences in study methodologies.

The impact that LA has on reducing ALA's health benefits is often overlooked. Diets rich in LA can reduce the conversion of ALA to EPA and DHA. For example, in a study of 22 healthy men, an LA-rich diet reduced the EPA content of plasma phospholipids significantly after four weeks compared to a low-LA diet, even though both diets contained the same amount of ALA.⁶

The absolute amounts of ALA and LA in the diet also affect ALA conversion. Decreasing the intake of LA has been found to increase the proportion of dietary ALA converted into EPA, while increasing ALA intake can increase the absolute amount of DHA synthesized.⁷

Healthy discoveries

Research indicates ALA consumption may reduce the risk of heart disease and other inflammatory diseases by reducing inflammatory compounds called cytokines and eicosanoids. LA is converted to longer-chain omega-6 fatty acids, in particular, arachidonic acid (AA), the precursor of eicosanoids, several of which promote blood platelet aggregation, the clotting of blood within blood vessels (thrombosis) and inflammatory reactions. ALA dampens inflammation by blocking the formation of the compounds that promote it. Inflammation is a feature of many chronic diseases, such as heart disease, type 2 diabetes, metabolic syndrome, obesity, cancer and Alzheimer's disease. In addition, ALA interferes with the conversion of LA to AA—acting as a “nutritional brake” to block further synthesis of AA to its pro-inflammatory eicosanoids.

For example, in a study of healthy men who consumed 1.75 tablespoons of flax oil daily for four weeks, the TXB2 (an inactive metabolite of TXA2) concentration in immune cells decreased by 30%.⁸ TXA2 is one of the most-potent known promoters of both inflammation and platelet aggregation. Similarly, concentrations of the pro-inflammatory cytokines TNF- α and IL-1 β in immune cells decreased 26% and 28%, respectively. In another study, serum levels of TNF- α decreased by 43%, and the production by immune cells of TNF- α and IL-1 β decreased between 18% and 22% in 23 people with high cholesterol levels who consumed a diet rich in ALA compared with the average American diet, further supporting the anti-inflammatory aspects of ALA.⁹

ALA, EPA and DHA have all been shown to prevent sudden death from arrhythmias in animals and reduce the risk of sudden cardiac death in humans.^{10,11,12} Arrhythmias are abnormal rhythms of the heart muscle that can lead to sudden death. ALA assists in achieving a normal heart rhythm by decreasing the heart muscle recover time after a heart beat and by maintaining a steady heart beat.¹³ In the Nurses' Health Study, women who consumed as little as 1.2 grams of ALA daily (the amount found in less than 1 teaspoon of flax oil) had a 40% lower risk of sudden cardiac death than women with a low-ALA diet.¹²

Epidemiological studies and, increasingly, clinical work support the beneficial effects of ALA in minimizing the risk of heart disease and for anti-inflammatory effects. ALA is the main, if not only, omega-3 in the diet of at least one billion vegetarians worldwide; despite not consuming fish, vegetarians do not have a higher prevalence of chronic diseases than nonvegetarians.

There is no doubt that EPA and DHA are beneficial, as these fatty acids have been the subjects of thousands of clinical trials. In Sept. 2004, FDA approved a qualified health claim for reduced risk of coronary heart disease on conventional foods that contain EPA and DHA. This claim, however, does not extend to ALA, because ALA was not a part of the petition process. The FDA has never assessed nor denied a qualified health claim for ALA.

Assessing intake

The current AI of ALA for men is 1.6 grams of ALA per day; for women who are not pregnant or breastfeeding, it is 1.1 grams of ALA per day. Of these amounts, about 10%—160 mg per day for men and 110 mg per day for women—can come from a combination of EPA plus DHA.²

Canadian children consume 1.2 grams of ALA and 92 mg of EPA plus DHA on

average every day. Although their average omega-3 intake appears to be adequate, only 61% of the children met the AI for ALA and only 22% met the AI for EPA plus DHA.¹⁴

Some experts believe higher intakes of omega-3 fatty acids are needed for health: an intake of 2.2 grams per day for ALA; an EPA plus DHA intake of 500 mg per day to decrease the risk of coronary heart disease; and an EPA plus DHA intake of 1,000 mg (or 1 gram) per day for adults with diagnosed heart disease.¹⁵ Clinical studies suggest that 3.6 grams of ALA (found in less than 1.5 teaspoon of flax oil) can be converted by the body to 500 to 540 mg of long-chain omega-3s, bringing current intakes closer to that recommended for reducing the risk of heart disease.^{16,17}

It is unfortunate that in the “omega-3 debate” there are those who choose to downplay the importance of ALA in the diet and simply ignore the omega-6 side of the metabolic equation. The typical North American diet is “deficient” in omega-3 fatty acids and overly rich in omega-6 fatty acids. The omega-6 to omega-3 ratio may be as high as 17:1 in some Western diets. In the Women’s Health Study, some women ate diets with a ratio of 33:1.¹⁸ The omega-6 to omega-3 ratio recommended by international nutrition agencies ranges from 4:1 to 10:1.¹⁹ The best route to improving one’s omega-6 to omega-3 ratio is by decreasing the intake of omega-6 fats and increasing the intake of the omega-3 fats ALA, EPA and DHA in whole foods, flax, fortified foods and supplements.

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