

# SUPPLEMENT Industry Executive™

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## Essential Fatty Acids—Essential for Good Health © SIE

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Essential fatty acids (EFAs) must be obtained through the diet and cannot be synthesized by the human body. EFAs are classified on the basis of the length of the carbon chain backbone, the number of double bonds, and the position of the first double bond (omega number).

For example, conjugated linoleic acid (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.

There are two main types of EFAs—omega-6 and omega-3 fatty acids. Omega-6 acids include linoleic acid (LA), gamma linolenic acid (GLA), dihomo-gamma-linolenic acid, and arachidonic acid (AA). Omega-3 fatty acids include eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), and alpha-linolenic acid (ALA). Omega-9 includes oleic acid. The body can make EPA and DHA from alpha-linolenic acid. Omega-3 and omega-6 are not inter-convertible in the body, and are metabolically distinct—their balance in the body is important for growth and development.

These essential fatty acids are key components of biological cell membranes that surround and protect every cell in the body, and a balanced intake of both omega-6 and omega-3 fatty acids is necessary for healthy cell function. In the human diet, linoleic acid (LA) is the major omega-6 fatty acid, while alpha-linolenic acid (ALA) is the major omega-3 fatty acid.

GLA, EPA, DHA, and AA are all available in the typical human diet. AA comes mostly from red meat. DHA and EPA are commonly referred to as fish oil. EPA and DHA are also found in mother's milk, algae and some seed oils. Flax seed oil contains both omega-3 and omega-6. Evening primrose, corn,

safflower, black cumin (*Nigella sativa*) and sunflower are rich in omega-6, linoleic acid.

Omega-6 and omega-3 fatty acids are the precursors for the production of eicosanoids, such as prostaglandins, thromboxanes and leukotrienes. 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 acids are metabolically and functionally distinct from those derived from omega-3 acids.

### **EPA and DHA (Omega-3)**

EPA and DHA can be synthesized in the body from alpha-linolenic acid, which is mainly found in green leafy vegetables, flax seeds, wheat germ, soybeans and walnuts. DHA is an essential component of cell membranes and occurs in particularly high concentration in the retina and brain.

### **Heart Health**

On October 31, 2000 (modified on February 8, 2002), The Food and Drug Administration announced that supplement manufacturers could make a health claim regarding heart disease for products containing omega-3 polyunsaturated fatty acids. The claim should include that consumption of omega-3 fatty acids from all sources should not exceed two grams per day.

The first evidence of the effect of the intake of omega-3 fatty acids in preventing heart diseases came from the observation that Eskimos, with a relatively large intake of omega-3 acids in their traditional diet of mostly fish, exhibited low incidences of cardiovascular diseases.

A 20-year prospective study of 852 men from the Netherlands showed that mortality from heart diseases was more than 50 percent lower among those who consumed a fish meal twice a week. Singh et al, reported an intervention trial involving patients who survived heart attacks. Patients were given 6 grams of fish oil daily, providing 2 grams of EPA and DHA. After one year, the rate of death from heart attacks was about half in the fish group compared to that in the placebo group. The fish oil group also showed significant less arrhythmia than in the placebo group.

Recently, an Italian study (GISSI) has shown a 20 percent reduction among 12,000 survivors of a heart attack given one gram of fish oil containing 85 percent EPA and DHA. The trial lasted over three years.

In myocardial infarction (heart attack), a blood clot large enough to completely block off blood flow in the coronary arteries is formed. Clumping or aggregation of platelets initiates the formation of a blood clot. Therefore, preventing platelet aggregation may reduce the risk of a heart attack.

A study published in the Journal of American Medical Association found that eating fish two to four times per week is associated with 30 percent reduction in the risk of thrombotic stroke (blood clot inside the brain). The study concluded that higher consumption of fish and omega-3 fatty acids is associated with a reduced risk of thrombotic infarction, primarily among women who do not take aspirin regularly.

Researchers in Denmark have also shown that a diet rich in fish omega-3 fatty acids could protect against heart attacks by reducing C-reactive protein (CRP) in blood. CRP has recently emerged as an independent risk factor for coronary artery disease. This study found that subjects with the highest levels of DHA had lower levels of CRP in their blood. The researchers suggested that fish consumption protects blood vessel against inflammation by inhibiting the formation of CRP in blood.

A recent Canadian study on the relationship between fish consumption and death from ischemic heart disease found positive associations between both EPA and DHA, and total cholesterol, HDL cholesterol, and systolic blood pressure.

An Italian case-control study found that an intake of a small portion of fish per week is inversely related to nonfatal acute myocardial infarction (AMI). The study concluded that a small amount of omega-3 fatty acids might reduce the risk of AMI.

High serum levels of total cholesterol, especially low-density lipoprotein (LDL), and triglycerides have been linked to increased risk of heart diseases. Fish-oil omega-3 fatty acids supplementation has also been shown to achieve marked reductions in serum triglycerides and the ratio of triglycerides to HDL-cholesterol in postmenopausal women receiving and not receiving hormone replacement therapy.

### **Infant Brain and Vision Development**

Sixty percent of the human brain is fat, 25 percent of which is DHA. DHA is also abundant in the retina of the eye, and an essential nutrient for eye and brain development in infants. Infants get their DHA from their mother's milk, which is rich in DHA, or the diet. Premature infants often have low levels of DHA and are at higher-than-average risk of neurological disorders. Children with hyperactivity or attention deficit

disorder also tend to have low levels of DHA.

A study in the Lancet reported that infants given a DHA-enriched formula had better problem-solving ability at 10 months compared with infants who had a standard low-DHA diet.

Clinical studies have shown that dietary supplementation with omega-3 fatty acids results in an improvement in visual function in formula-fed premature infants to match that of human milk-fed infants. In a randomized, double-blind trial, infants were supplemented with DHA (0.35 %) and AA (0.75 %) in a formula designed to closely match that of mother's milk. Infants in the supplemented group showed a significant increase in the Mental Development Index after 18 months, and an improvement in the visual performance at 12 months of age.

### **Rheumatoid Arthritis**

Fish oil EPA and DHA in a dose of 3 grams daily have been shown to reduce joint tenderness and morning stiffness, and to reduce the dose of non-steroidal anti-inflammatory drugs in patients with rheumatoid arthritis.

Another study also reported that the use of omega-3 supplements, 360 mg EPA and 240 mg DHA daily, appeared to decrease production of pro-inflammatory prostaglandin E2 in bone, and significantly stopped bone loss. Flax seed oil was also found to reduce the production of these pro-inflammatory compounds. Flax seed oil contains alpha linolenic acid (omega-3), which can be converted after ingestion to EPA.

In a most recent double-blind, placebo-controlled study at the University of Newcastle in Australia, 50 people with rheumatoid arthritis were randomly assigned to take either 40 mg/kg body weight of fish oil containing 60 percent omega-3 fatty acids, or placebo daily for 15 weeks. At 15 weeks, the fish oil group showed modest improvement in symptoms (joint stiffness, and soreness).

### **Depression and Memory Loss**

Deficiencies of DHA have been linked to memory loss and depression. In a 1994 multi-center European study, 494 elderly people supplemented with 90 mg DHA (contained in 300 mg bovine phosphatidyl serine) daily for six months showed improvement in apathy and social withdrawal symptoms.

A 1999 double-blind, placebo-controlled study involving 30 manic-depressive patients showed that 64 percent of those who took 10 grams of fish oil per day for four months reported

a marked improvement in symptoms, as compared to only 19 percent in the control group.

In summary, EPA and DHA, the most prominent omega-3 fatty acids in fish oils, promote overall heart health by lowering blood triglycerides, and reducing the tendency of blood clot. EPA and DHA also support the development of brain and eyes in infants, reduce the release of pro-inflammatory molecules in rheumatoid arthritis patients, and improve symptoms of depression.

### **Conjugated Linoleic Acid (Omega-6)**

Conjugated Linoleic acid (CLA) is a collective name for a mixture of several isomers 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, and may exert their biological effects via different biochemical mechanisms.

CLA is the main omega-6 polyunsaturated fatty acid in the diet, and it is essential for optimum health. CLA is found in grass-fed beef and lamb, dairy products, and most vegetable oils, such as sunflower, safflower, and flaxseed oils.

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 (4.2g/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.

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

### **Gamma Linolenic Acid (Omega-6)**

Linoleic acid is vital to health, and it must be first converted, with the help of delta-6-desaturase enzyme, to gamma linolenic acid (GLA), and subsequently to prostaglandin E1, a hormone-like substance that has anti-inflammatory properties. GLA is found in the oils of borage, evening primrose, black currant, and mother's milk and plays a critical role in the development of infants.

GLA has also recently become popular as a natural support 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.

Evening primrose oil (EPO) is extracted from the seeds of a yellow flowering willow family plant (*Oenothera biennis*). It is rich in the omega-6 fatty acid gamma-linolenic acid (GLA). EPO is helpful in the treatment of heart disease, arthritis, skin problems, and in relieving the premenstrual syndrome (PMS).

Gamma-linolenic acid 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 than the placebo-group.

Essential fatty acids (EFA) are needed by the body to strengthen cell membranes, promote the growth of the brain and eyes in infants, improve cholesterol profile and inhibit blood clotting and thus prevent heart diseases. The anti-inflammatory properties of EFA help in the treatment of arthritis and asthma. **SIE**

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