

# Vitamins, Minerals and Specialty Nutrients



## Essential Fatty Acids (EFAs)

### Description

Essential fatty acids (EFA's) are important in the diet because EFA's are a main component of phospholipids, the main constituent of cell membranes. Phospholipids help determine the fluidity and integrity of the cell membranes, and the type of fat ingested will play a major role in determining the health of the cell membranes. Saturated fats (i.e. butter or lard), trans-fatty acids (i.e. margarine or deep fried foods), or excess arachidonic acid (i.e. processed meats) all decrease cell membrane fluidity and function, while "good" essential fatty acids (i.e. fish oils or black currant seed oil) enhance cell membrane fluidity and function. Essential fatty acids also play an important role in inflammation, hormone synthesis, nerve transmission and many other bodily functions.

### Clinical Applications/Research

Principle uses include: inflammation, skin condition (psoriasis, eczema and dermatitis), allergies, heart disease, hypertension, premature aging, autoimmune disorders, ulcerative colitis, neonatal development, arthritis, immune impairment, PMS, menopause and fibrocystic breast disease.

Technically, the essential fatty acids (EFA's) include linoleic (Omega-6), alpha-linolenic (Omega-3), and arachidonic acid (Omega-6), which are sometimes collectively referred to as vitamin F. Arachidonic acid can be synthesized from linoleic acid, and is not considered by some to be essential if there is enough linoleic acid. EFA's are essential for normal growth. They are the major components in cell membranes and function in energy production and steroid synthesis, and keep the skin and tissues youthful due to their lubricating quality. Gamma-linolenic acid, while not technically considered "essential" because it can be made from linoleic acid, is a very beneficial fatty acid, and can serve to balance the other fatty acids and their by-products, which can be inflammatory and pain-producing. Gamma-linolenic acid makes a series of by-products that are antiinflammatory and do not produce pain. These by-products are called, "prostaglandins," or "eicosanoids," and when they are derived from gamma-linolenic acid, they belong to a category called, "series one."

Alpha-linolenic acid (i.e. flaxseed oil) is a precursor to longer-chain fatty acids (oils), which make by-products (prostaglandins) of the three series, which are also antiinflammatory and do not produce pain.

Arachidonic acid (i.e. meat, dairy, etc.) makes prostaglandins of the two series. This is not a bad series, however an over-production of series two, without enough series one or series three, puts the balance in favor of inflammatory, pain-producing prostaglandins.

### **Balance**

A balance of the fatty acids is essential. Allergic eczema is believed by some to be caused by an imbalance of fatty acids in the body (Heinerman, John. Heinerman's Encyclopedia of Fruits, Vegetables and Herbs. Parker Publishing, West Nyack, NY 1988 p. 134). Heinerman proposes that allergy relief can be experienced after taking fatty acid supplements a month before season (ibid, p. 184). In fact, Heinerman believes that a host of diseases, including coronary artery disease, hypertension, hypercholesterolemia, allergic eczema, cancer, premature aging, chronic inflammation and autoimmune disorders are related to an imbalance of fatty acids in the body (ibid, p. 134).

While linoleic acid is needed for normal immune response (J Am Coll Nutr 1991;10:406-28), an imbalance of the series 2 products (prostaglandins) that arachidonic acid, which is made from linoleic, makes can have unfavorable results. A balance of the other fatty acids is necessary, and in fact, "In a number of diseases, plasma levels of linoleic acid are normal or elevated while those of gamma linolenic and further metabolites are below normal" (Pgs, Lts & EFAs 1991;42:245-9). An example of an oil high in linoleic acid (omega 6) is sesame

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seed oil. Sesame seeds are rich in protein, zinc, calcium, copper, magnesium, phosphorus and potassium. Sesame also contains some vitamin A, E and most of the B vitamins. An example of oil high in alpha-linolenic acid (omega 3) is flaxseed oil. Alpha-linolenic is converted in the body to longer chain fatty acids naturally found in fish oil. Fish oils are comprised mostly of docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA). These are highly unsaturated fatty acids found in fish oil; some examples are cod liver oil, shark liver oil, halibut liver oil, and skip jack oil. Gamma-linolenic acid is found in black currant seed oil, evening primrose oil, and borage oil. Borage oil is not recommended as a food source, due to possible hepatotoxicity.

### FISH OIL

#### Cardiovascular

Fish oil (omega-3/n-3) seems to have many beneficial effects on the cardiovascular system. In fact, "The mechanisms by which dietary n-3 fatty acids might modulate the morbidity and mortality from coronary heart disease have been related to their effects on plasma lipids and lipoproteins, eicosanoid metabolism, and platelet-endothelial cell interactions. In addition, more recent studies have shown positive effects on myocardial function and blood pressure" (AJCN 1993;57:634). Since fish oil does thin the blood, it may increase risk of stroke from hemorrhaging.

#### Ulcerative colitis and Crohn's Disease

In addition, the effect of fish oil on ulcerative colitis was investigated in 87 patients. Treatment with fish oil resulted in, "measurable clinical benefit" - there was a trend toward achieving remission (being taken off corticosteroids) faster in the patients taking 4.5 grams fish oil daily for a year (Gut 1992;33(7):922-8). More recent studies have verified the positive effect of fish oil on ulcerative colitis. The New England Journal of Medicine reported that fish oil was effective in preventing relapses of Crohn's disease, and said the mechanisms could include the antiinflammatory effect on prostaglandins and leukotrienes, which are elevated in Crohn's disease. They suggested fish oil could also be working by a beneficial effect on cytokines, by scavenging free radicals, and by increasing intestinal mucosal surface area. Additionally, they noted that fish oil is used as a treatment for a variety of chronic inflammatory disorders (NEJM 1996;334:1557-1560).

#### Brain/visual development

Artificial formulas, unlike human milk, do not contain any long-chain polyunsaturated fatty acids (PUFA's). Arachidonic acid, along with some of the longer chain PUFA's, is an essential requirement for proper brain function, especially in the fetus and neonatal subject. The PUFA's found in fish oil, such as docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), are an example of very long chain PUFA's. Their high degree of unsaturation is needed for membrane fluidity. In the 1960's, clinical signs of essential fatty acid (EFA) deficiency became apparent in infants fed skim-milk based formulas (Am J Clin Nutr 1993;57:807S-12S). "The demand of the fetal and neonatal brain for docosahexaenoic acid (DHA)... increases substantially during the last trimester of pregnancy and the first months of postnatal life. Consequently, the use of these artificial formulas could lead to a considerable deterioration of the EFA status after birth, especially in children who are born prematurely" (Am J Clin Nutr 1993;57:829S).

In a study on infants performed 57 weeks after birth, a fish oil-supplemented formula (omega-3 with some linoleic acid) was compared to human milk and a corn oil-based formula (linoleic acid with no omega-3). The corn oil based diet, which lacked the long chain DHA present in the fish oil formula and human milk, caused impaired visual acuity at both 36 and 57 weeks. "The study supports a role for omega-3 long chain PUFA's as required nutrients for the optimal maturation of visual and cortical function in preterm infants" (Am J Clin Nutr 1993;57:807S-12S). It is important to include the linoleic acid, however, with the fish oil in developing children.

DHA was found to be associated with psychomotor and mental development indexes in preterm infants, when it was measured in 211 diabetics for four years (AJCN 1993;57:801S-6S). Another study concluded that, "the early dietary fat regimen can influence the development of brain and visual function" (AJCN 1993;57: 807S-12). Subtle clinical symptoms, including peripheral neuropathy, "may occur in response to an insufficiency of the

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specific metabolic derivative of alpha-linolenic acid, namely DHA (AJCN 1993;57: 807S-12).

Omega-3 fish oils, combined with black currant seed oil, resulted in the smallest mammary tumors when compared to a 23% corn oil diet that enhanced tumor growth in a study of rats (Pgs, LTs & EFA 1993;48:309-14).

### Immune system

Fish oil may very well have an important role to play in reducing the incidence of autoimmune diseases, because it can inhibit the inappropriate expression of certain molecules on the cell surface that are involved with initiating autoimmune disease (MHC class II). In fact, by being able to inhibit this inappropriate expression, scientists now believe that this influence on the immune system could possibly prevent the lesion development of atherosclerosis. Scientists also believe that this may one of the important ways in which fish oil is related to reduced risk for heart disease (AJCN. 1996;63:267-272). It is theorized that the unique action on cytokines, such as tumor necrosis factor alpha, allows fish oil to enhance antitumor action while protecting against undesirable systemic inflammatory effects of overproduction (J Nutr 1992;122:1942-1951).

### BCSO

#### Rheumatoid arthritis, Immune system, etc.

Black currant seed oil (BCSO) is a balanced oil which contains some linoleic acid, but is also one of the few oils containing gamma-linolenic acid (makes prostaglandins of the one series). Of the oils containing gamma-linolenic acid (GLA), BCSO contains the largest percentage of GLA. It has strong antiseptic properties, and is used in the treatment of Candida yeast infection, whooping cough, hypertension, and various skin diseases, including arthritic inflammations (Heinerman, John. Heinerman's Encyclopedia of Fruits, Vegetables and Herbs. Parker Publishing, West Nyack, NY 1988 p. 36). A study on rheumatoid arthritis patients showed, "A significant improvement in morning stiffness was noted in the rheumatoid arthritis patients receiving black currant seed oil" (British J Rheumatology 1993;32:1055-8). Black currant seed oil also has a profound effect on the immune system, and, "A correlation was found between the degree of developing resistance to infection, virus accumulation in the brain, blood, spleen and thymus..." (Vopr Virusol 1993;38:170-3).

### Cardiovascular

Vessel wall thrombus formation was decreased when a diet rich in black currant seed oil was fed. "This latter effect was better obtained when gamma-linoleic acid was present, suggesting a secondary effect of this fatty acid." Platelet adhesion was also significantly decreased on the fish oil diet. "We conclude that both fish oil and black currant seed oil rich diets inhibit platelet/vessel wall adhesion" (Thromb Res 1990;59(5):819-30).

In two Canadian studies, both the main constituent in evening primrose oil (EPO), gamma-linolenic acid (GLA) and the plant oil (EPO) itself, significantly reduced blood pressure (Heinerman J. p. 134). The black currant seed also contains gamma-linolenic oil, which reduces both hypertension and arthritic inflammations (Heinerman, John. Heinerman's Encyclopedia of Fruits, Vegetables and Herbs. Parker Publishing, West Nyack, NY 1988 p.36).

### Female

Thirty women with severe PMS took 3 gms of a gamma-linolenic acid-containing oil from the 15th cycle day to menses during 2 cycles, and placebo for 2 cycles. Symptoms, especially depression, were alleviated. Up to 6 capsules a day gave therapeutic benefits (ibid, p. 134). Black currant seed oil alleviates hot flashes and some of the symptoms of menopause.

### Dermatitis

Supplementation of evening primrose oil (10% gamma linolenic acid) was tested on dermatitis, and antiinflammatory substances were increased. The abnormal fatty acid pattern seen in dermatitis is believed to be involved in the pathogenesis of the disease, "and should therefore be the target for future therapeutic approaches with fatty acid supplements" (Lipids 1991;26:557-60). In another study of 12 volunteers, gamma

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linolenic acid-enriched oil not only inhibited the inflammatory substance LTB<sub>4</sub>, but the larger dose (1.5g) had a greater inhibition than the .5 g dose (AJCN 1992;55:39-45).

### **Contraindications/Toxicology**

Fish oil, since it does thin the blood, may increase possible risk of hemorrhage and stroke. Normally, thinning the blood is advantageous because it reduces the risk for blood clots and heart attack. Substantial amounts of fish oil should not be combined with blood-thinning drugs. Check with your licensed professional.