



The ABCs of EFAs

A growing body of scientific evidence indicates that essential fatty acids (EFAs) are not only vital to good health, but that an imbalance in these fats can lead to a number of disease processes. Some of these findings have intriguing implications for people with CFS.

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AT-A-GLANCE ▶

- Deficiencies in various vitamins, minerals and nutrients have been implicated in CFS. Among these are essential fatty acids (EFAs).
- EFAs have generated an amazing amount of research in recent years, helping scientists uncover the multiple and vital roles essential fatty acids play in human health.
- Research suggests that EFAs may have etiological and therapeutic implications for CFS patients.

Every year we discover more about the role of diet and nutrition in human health, both in terms of disease prevention and disease proliferation. In fact, the science of nutrition has exploded worldwide in the past 30 years, providing an incredible amount of information to guide medical professionals and consumers. Increasingly, the research is also providing evidence that lifestyle factors—like diet and exercise—may help us prevent, treat or manage many chronic illnesses.

One of the areas of study that could be of particular interest to people with CFS is the science of essential fatty acids, or EFAs. Hardly a week goes by without the publication of yet another study uncovering critical and multiple roles that EFAs play in the body. To understand what all the excitement is about, it helps to know a little about the basics of EFAs.

Essential fatty acids are so named because they're essential to the body and required for human metabolism, but they're not produced by the body and must be introduced through dietary intake. There are two families of EFAs, omega-3 fatty acids and omega-6 fatty acids. Both belong to the class of fatty acids called polyunsaturated fatty acids, or PUFAs. (Omega-9 fatty acids aren't considered essential because the body produces small amounts when EFAs are present.)

The parent compound in the omega-6 fatty acid family is linoleic acid (LA), while the parent compound of the omega-3 fatty acid family is alpha-linolenic acid (ALA). These parent compounds are metabolized to longer-chain fatty acids. LA is converted to gamma-linolenic acid (GLA), then to arachidonic acid (AA), while ALA is converted to eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). While this can be a confusing alphabet soup, recognizing these six EFAs



is basic to understanding the science because they function in different ways in the human body.

EFAs are critical for the normal production of cells, muscles, nerves and organs. They are part of the membrane of every one of the trillions of cells in the human body and are needed for cell membrane metabolism. The human body needs EFAs to manufacture and repair cell membranes, enabling cells to obtain optimum nutrition, expel harmful waste products and prevent damage to cell membranes. Alterations in cell membranes are the chief cause of cell injury, mutation (which can result in disease) and death.

The role of EFAs is still being explored, but we already know that they support the cardiovascular, immune, reproductive and nervous systems.

Balance is everything

So should we immediately rush out and stock our pantries and refrigerators with foods and supplements high in all the EFAs? Before you plan that trip to the grocery store, it's important to draw a distinction between omega-3 fatty acids and omega-6 fatty acids. While many experts believe Americans need to increase our intake of omega-3 fatty acids, a deficiency of omega-6 fatty acids is very rare in Western countries.

In fact, American diets tend to have far too much omega-6, particularly in relation to omega-3 fatty acids. Our diets are full of foods like meat, dairy products, vegetable oils and processed foods, which are all high in omega-6 fats. At the same time, omega-3 fats in our diets have declined dramatically since the Industrial Revolution (see sidebar on page 27).

Guidelines vary, but most experts believe the ratio of omega-6 to omega-3 fatty acids we consume should be 1:1 or 2:1, with 4:1 being the uppermost limit to maintain health. The typical American diet, however, contains 10 to 30 times more omega-6 than omega-3 fatty acids.

Why is this dangerous? Although omega-6 fats are needed for various body functions, they also produce inflammatory prostaglandins, hormone-like substances in the body. These inflammatory prostaglandins not only contribute to generalized inflammation, pain and blood platelet "stickiness," they play an important role in the development of chronic diseases.

On the other hand, omega-3 fatty acids become anti-inflammatory prostaglandins. This type of prostaglandin relieves painful inflammation, improves blood flow, has a

positive effect on allergic conditions and reduces the risk of various diseases and inflammatory conditions.

Omega-6 and omega-3 fats compete for the same metabolic enzymes, so the ratio of omega-6 to omega-3 fats in your diet will significantly influence the ratio of the ensuing eicosanoids (compounds derived from PUFAs, like prostaglandins, leukotrienes and thromboxanes) produced by your body and will alter your body's metabolic function. The balance between the two omega fatty acids is critical because they self-check each other to regulate thousands of metabolic functions through eicosanoid pathways. It's the omega-3 fats that keep the disease-causing, inflammatory effect of omega-6 fats in check.

This doesn't mean that omega-6 fatty acids are "bad" fats in the way trans fats are, or that they should be avoided. It just means that when you make that trip to the market, the goal is to increase your intake of omega-3 fatty acids and decrease your intake of omega-6 fatty acids to achieve a healthy dietary balance.


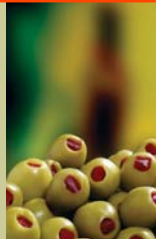
EFAs and the disease process

There is evidence to suggest that low levels of omega-3 fatty acids, or the wrong balance of EFAs, may be a factor in a number of illnesses. The strength of the science varies, and more research needs to be done to confirm the role of EFAs in these various disease processes. But there are some compelling findings that may be of interest to CFS patients.

Scientists have linked EFA deficiency or imbalance to a host of medical conditions and symptoms, including heart disease, stroke, fatigue, weakness, memory and learning problems, Alzheimer's disease, Parkinson's disease, diminished immune function, frequent infections, slow wound healing, tumor formation and cancer, allergies, aching joints and arthritis, asthma, skin disorders, mood disorders, poor digestion and inflammatory bowels, infertility, macular degeneration, menopausal discomfort, obesity and diabetes.

EFA deficiencies have also been linked to CFS. Although more than 40,000 studies on EFAs have been published in peer-reviewed journals, only a handful are specific to CFS. However, abnormal levels of various essential fatty acids have been reported in CFS patients, and several studies link EFA deficiencies to the immune and cognitive dysfunction found in CFS. Chronic immune activation and viral infections can prevent the body from biosynthesizing long-chain PUFAs and EFAs, but it's still not clear whether the EFA abnormalities found in CFS patients are caused by

KEY DIETARY SOURCES OF ESSENTIAL FATTY ACIDS

Omega-3 Fatty Acids	Omega-6 Fatty Acids
<p>ALA (alpha-linolenic acid)</p> <p>flaxseed and flaxseed oil; hempseed and hempseed oil; walnuts and walnut oil; chia seeds; butternuts; green leafy vegetables (spinach, kale, mustard greens, collards, purslane); winter squash; cauliflower; broccoli</p>	<p>LA (linoleic acid)</p> <p>oils (safflower, grapeseed, corn, sunflower, sesame, soybean, cottonseed, almond, walnut, olive, peanut oils); mayonnaise; various salad dressings; margarine, shortening; flaxseed and flaxseed oil</p>
<p>EPA (eicosapentaenoic acid)</p> <p>cold-water fish (salmon, tuna, herring, mackerel, sardines, cod, trout, Pacific halibut, anchovies); some algae</p>	<p>GLA (gamma-linolenic acid)</p> <p>evening primrose oil, black currant seed oil and borage oil; some algae (blue-green algae)</p>
<p>DHA (docosahexaenoic acid)</p> <p>cold-water fish; warm-water fish (although in much lower amounts than cold-water fish)</p>	<p>AA (arachidonic acid)</p> <p>animal meat (especially organ meat) egg yolks; milk; warm-water fish; squid</p>
 <p>Of all food sources, flaxseed and flaxseed oil contain the highest amount of ALA, a healthy omega-3 fatty acid. (Be sure to use ground flaxseed, not whole.)</p>	<p>Olive oil is a monosaturated omega-9 fat with metabolic effects that are neutral when it comes to omega-6/omega-3 balance.</p> 

the disease process, or whether dietary imbalances may contribute to the problem.

With so many EFA studies in the scientific literature, it's impossible to cite even a tiny fraction. Here are a few CFS-related studies and some general findings of interest:

- In a study specific to CFS, which was published in *Neuro Endocrinology Letters* in 2005, researchers in Belgium reported that CFS was accompanied by increased levels of the omega-6 fatty acids LA and AA. The ratio of omega-3 fats to omega-6 fats was significantly lower in the 22 CFS patients than in healthy controls, and the ratio correlated to the severity of the illness, to lower serum zinc levels and to defects in T cell activation. The study authors conclude that a decreased availability of omega-3 fatty acids “plays a role in the pathophysiology of CFS and is related to the immune pathophysiology of CFS.”
- Researchers in China found abnormalities in blood levels of some EFAs in CFS patients. In a 2004 study published in *Nutritional Neuroscience*, the researchers reported that levels of DHA, an omega-3 fat, and of AA, an omega-6 fat, were decreased in erythrocyte (red cell) membranes of

the 42 CFS patients in the study, all of whom met the CDC diagnostic criteria. However, levels of palmitic acid (a saturated fatty acid) and oleic acid (a monounsaturated omega-9 fatty acid) were increased. The researchers speculate that this might be caused by oxidative stress that leads to excessive oxidation in CFS patients, or by insufficient ingestion of specific fatty acids.

- In one of the earliest and largest studies related to CFS, published in *Acta Neurologica Scandinavica* in 1990, 63 patients diagnosed with postviral fatigue syndrome were enrolled in a double-blind, placebo-controlled study to determine the effect of essential fatty acid therapy. After three months of supplementation with four capsules daily of a mixture of evening primrose oil and fish oil, 85 percent of the treated group rated themselves improved, compared to 17 percent of the placebo group. Symptoms like fatigue, pain and depression improved, and plasma EFA levels, which were low in the CFS patients at baseline, rose to normal. (It should be noted that a follow-up study of 50 CFS patients published by the same journal in 1999 failed to support the earlier results. Instead, there was no signifi-

cant difference between the group treated with EFAs and the placebo group.)

■ A study published in 1994 in *Medical Hypotheses* reports that alterations in EFAs and EFA metabolites play a role in immune dysfunction and disease, including CFS, and that dietary EFA therapy may help ameliorate chronic immune system activation. After three months of EFA therapy, 27 out of the 29 CFS patients in the study improved.

■ Abnormalities in brain function and structure—including memory and concentration problems and reductions in gray and white matter—have been reported in CFS. Researchers have shown that omega-3 fatty acids are essential both to brain structure and to brain function. For instance, prolific

essential fatty acid researcher Basant Puri reported that cerebral proton neuro-spectroscopy shows that treatment with the omega-3 fat EPA may be useful to

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treat structural brain changes that have been reported in some patients with CFS, and to induce symptom remission. Puri's findings were reported in 2004 in *Prostaglandins, Leukotrienes and Essential Fatty Acids* and in the *International Journal of Clinical Practice*.

■ In related findings published in *Neurology* in 2004, Dutch researchers who tracked more than 1,600 adults between the ages of 45 and 70 for six years reported that those who regularly ate more omega-3 fats scored higher on a battery of tests involving brain health, including memory.

■ There is preliminary evidence that omega-3 fatty acids might be helpful in depression and anxiety, comorbid conditions that many CFS patients have. In one study published in *Psychiatry Research* in 1999, Belgian researchers found that there is abnormal metabolism of omega-3 fatty acids in depression and that the fatty acid alterations in depression are related to the inflammatory response.

■ Although the research isn't specific to CFS, there is evidence that omega-3 fatty acids may be useful as a pain treatment. Studies in the *Journal of Clinical Epidemiology* and the *Lancet* show that omega-3s can reduce joint tenderness and the amount of corticosteroids needed to reduce the symptoms of rheumatoid arthritis. Other recent studies

suggest that the anti-inflammatory effects of omega-3 fats may help improve pain. Neck pain patients and rheumatoid arthritis sufferers showed benefits comparable to those receiving standard NSAIDs when omega-3 fatty acids were introduced.

■ Two studies on rats and one on mice published in *Neuroscience* and the *Journal of Nutrition* have shown that a diet supplemented with the omega-3 fatty acid DHA significantly improves memory. One study showed dramatic improvements after only four days.

■ There is strong scientific evidence that omega-3 fatty acids significantly reduce blood triglyceride levels, and that regular intake cuts the risk of heart attack. Fish oil stimulates blood circulation, increases the breakdown of fibrin (a compound involved in clot and scar formation) and reduces blood pressure. The evidence is persuasive enough

that the FDA issued a formal statement saying, "Supportive but not conclusive research shows that consumption of EPA and DHA omega-3 fatty acids may reduce the risk of coronary heart disease."

■ Eating fish or fish oil has consistently demonstrated a decrease in the risk of stroke, according to studies published in *JAMA*, the *Archives of Internal Medicine* and the *Journal of the American Board of Family Practice*.

■ Scientists at the Mayo Clinic found that a daily dose of ground flaxseed can reduce hot flashes. They studied 21 postmenopausal women who had at least 14 hot flashes each week. The women consumed four tablespoons of crushed flaxseed daily. After six weeks the severity and number of their hot flashes dropped by 50 percent.

■ Many past studies suggest that evening primrose oil can help with PMS and menopausal symptoms. A recent study published in the *Journal of the National Cancer Institute* reports that evening primrose oil may also help prevent breast cancer. It's rich in the omega-6 fat GLA, which researchers found inhibits a gene that causes nearly 30 percent of breast cancer cases.



■ According to researchers at the University of Kentucky, flaxseed may help improve fatigue. That’s because flaxseed contains more lignans—compounds that help the liver metabolize toxins—than any other food. They found that flaxseed also cuts blood sugar and insulin surges by as much as 28 percent. They say the effects are enough to reduce fatigue, brain fog and hunger pangs.

Dietary recommendations

Everywhere they turn, scientists and physicians are seeing evidence that EFAs may play an important role in chronic inflammation and chronic diseases. But much more basic research needs to be conducted before we fully understand how to use EFAs in the diet to maintain health, manage existing illnesses and prevent additional diseases.

In the meantime, many experts believe the science is at least strong enough to warrant changes in our diets. For CFS patients, managing dietary intake of EFAs may be one more tool to add to your treatment arsenal. EFAs may be useful in managing symptoms like fatigue, memory problems, weakness and inflammatory pain. Equally important, they may help prevent additional diseases—like heart disease, diabetes and cancer—that impose greater burdens than CFS alone. Clinicians indicate that comorbid condi-

tions can make treating CFS much more difficult, and can complicate the course of the illness.

The National Institutes for Health recently published recommended daily intakes of fatty acids. These recommendations include 650 milligrams of the omega-3 fatty acids EPA and DHA, 2.22 grams of the omega-3 fat ALA and 4.44 grams of the omega-6 fat LA per day. However, since the goal is achieving a balance of omega-6 to omega-3 fats that doesn’t exceed a 4:1 ratio, intake of EFAs may need to vary from person to person.

Experts suggest that we get our intake of EFAs through a combination of foods to ensure that we get enough of the various fatty acids, which may each play different beneficial roles in the body. For instance, of all food sources, flaxseed and flaxseed oil contain the highest amount of ALA, a healthy omega-3 fat that protects the immune system and bones, while cold-water fish is a better source of DHA, a building block for brain tissue.

As for deciding between food or supplements, again, many experts suggest a combination. Flaxseed is the best available source of lignans—with a concentration more than 100 times greater than other lignan-containing foods such as grains, fruits and vegetables. A number of studies show that flaxseed lignans help in both prevention and

WHAT YOU CAN DO



Balance EFAs

Diets in Western countries typically contain 10 to 30 times more omega-6 than omega-3 fatty acids. Doctors suggest that we strive for a ratio of between 1:1 and 4:1 of omega-6 to omega-3 fats for optimum health. That means we need to decrease consumption of omega-6 fats and increase our dietary intake of omega-3 fats.



Shop Smart

Heat, light and oxygen destroy EFAs. So when shopping for olive, flaxseed and other oils, look for products that have been produced by “cold or modified expeller pressing,” which means they were made without damaging temperatures or pressure. Opt for dark containers that protect the oil from light, and store opened bottles in a dark, cool place in your pantry or fridge.



Eat Smart

Just because you’re being virtuous and adding healthy EFAs to your diet doesn’t mean you can ignore all the health benefits of fruits and vegetables. Although raspberries and spinach aren’t packed with nearly as many omega-3 fats as fish, seeds and nuts, they do have trace amounts. And they have other nutrients and enzymes the body needs.



Ask Your Doctor

If you have specific health concerns and want to know how a particular essential fatty acid might help, be sure to consult your doctor. For instance, evening primrose oil, made from the flower pictured here, has been shown to reduce menopausal symptoms and may help prevent breast cancer. But high doses can have deleterious effects.

treatment of breast and colon cancer because of their ability to mediate the production and action of the hormones produced by our bodies. Flaxseed oil, on the other hand, doesn't contain lignans. Still, it's advisable not to consume huge amounts of flaxseed meal because it contains more phytoestrogens than oil and because it can cause abdominal discomfort in high doses. Instead, a combination of ground flaxseed and flaxseed oil may be best.

According to cardiologists, the best way to reap the rewards of fish oil—such as lowering triglyceride levels, keeping blood pressure healthy and preventing artery-clogging plaque—is getting it straight from the source. But because we need to be mindful of mercury levels in fish, many experts suggest eating one or two servings of fatty fish (wild, not farmed) per week, and getting our additional EPA and DHA from fish oil supplements.

We're just beginning to understand how diet can protect us against chronic, debilitating diseases. And we don't fully understand the complex interplay between genes and lifestyle factors like diet and inadequate exercise, which may contribute to genetic mutations that cause disease. But studies conducted so far have given us reason enough, right now, to add healthy EFAs to our diet. ■



Cut Trans Fats

Adding flaxseed to your diet may not do you much good if you consume high amounts of trans-fatty acids such as margarine, deep-fried foods, packaged sweets and many prepared foods. That's because these "bad" fats interfere with fatty acid synthesis and the absorption of healthy EFAs. All fats are not created equal—nor should they be consumed in equal amounts!



Know Fat Stats

It's easy to consume far more omega-6 fats than we think we're getting because they're hidden in other foods and used for cooking. For instance, a single tablespoon of mayonnaise made with safflower oil can have 7,176 mg of omega-6 fats, while a tablespoon of corn oil can contain a whopping 10,140 mg. You can find the EFA content on thousands of foods at www.nutritiondata.com.

There is some research to suggest that deficiencies in a variety of vitamins, minerals and other nutrients may play a role in causing, or perpetuating, CFS. In addition to essential fatty acids, deficiencies in magnesium, zinc, sodium, L-tryptophan, L-carnitine, coenzyme Q10, various B vitamins, vitamin C, vitamin D and other nutrients have been found in subsets of CFS patients. We'll continue to update you on those findings in future issues of the CFIDS Chronicle and CFIDS Link.



WHY ARE AMERICANS DEFICIENT IN OMEGA-3 FATS?

Throughout most of human history, people have ingested a relatively equal proportion of omega-6 to omega-3 fatty acids. Today, the average American diet has less omega-3s than our bodies require and many times the amount of omega-6 fats. What are the main culprits for this dramatic shift in dietary patterns?

1 Because of modern agricultural practices, the fats in meat and eggs don't contain nearly the percentage of omega-3 fats they once did. Most farm animals are now raised on grain instead of wild grasses, which contain more omega-3 fats.

2 Modern milling practices of various grains have resulted in decreased consumption of cereal germ, which contains EFAs.

3 Increased consumption of corn, sunflower and safflower oils, all high in omega-6 fats, has contributed to the shift.

4 The invention of hydrogenation in food processing extends the shelf life and stability of oils, but "trans-forms" them into trans-fatty acids. Western diets include foods chockfull of these trans fats, which interfere with fatty acid synthesis and the absorption of healthy EFAs.

5 Our diets contain far more sugar than they did 100 years ago. Sugar interferes with enzymes that synthesize fatty acids.

6 Our increased consumption of trans fats and omega-6 fats has been accompanied by decreased intake of foods rich in omega-3 fats.