

Written and Edited By:
Thomas G. Guilliams Ph.D.

FATTY ACIDS: Essential...Therapeutic

Few things have been as confusing to both patient and health care provider as the issue of fats and oils. Of all the essential nutrients required for optimal health, fatty acids have not only been forgotten they have been considered hazardous. Health has somehow been equated with “low-fat” or “fat-free” for so long, to suggest that fats could be essential or even therapeutic is to risk credibility. We hope to give a view of fats that is both balanced and scientific. This review will cover the basics of most fats that will be encountered in dietary or supplemental protocols. Recommendations to view essential fatty acids in a similar fashion as essential vitamins and minerals will be combined with therapeutic protocols for conditions ranging from cardiovascular disease, skin conditions, diabetes, nerve related disorders, retinal disorders and more. A complete restoration of health cannot be accomplished until there is a restoration of fatty acid nutritional information among health care professionals and their patients.

Fats- What are they?

Dietary fats come to us from a variety of sources, but primarily in the form of triglycerides. That is, three fatty acid molecules connected by a glycerol backbone (see fatty acid primer page 3 for diagram). These fatty acids are then used as energy by our cells or modified into phospholipids to be used as cell or organelle membranes. Some fatty acids are used in lipoprotein molecules to shuttle cholesterol and fats to and from cells, and fats may also be stored for later use. Typical western diets include 25-45% of the total energy as fats (9 calories/gram), which amounts to 10-25% by weight. While many debates are ongoing concerning the ideal level of fats in the overall diet, this review will focus only on the types of fats available in dietary or supplemental forms and how they either harm or benefit your patients.

Fats- What's the difference.

We have tried to condense most of the important information concerning fatty acids on page three. The text here will serve to step through the same information in text form. Fatty acids are simply a string of carbon molecules of varying length with a carboxylic acid group on one end (sometimes called the delta end). A saturated fatty acid is one in which all the carbons along the chain have two hydrogen molecules bonded to them, with the exception of the last carbon which has three hydrogen molecules attached (this is called the omega carbon). Saturated fatty acids have no double bonds and are very rigid and hard. Saturated fats are found in high amounts in things like butter, coconut oil, palm kernel oil and beef fat.

The formation of a double bond between two carbon molecules is defined as an unsaturated fatty acid; a single unsaturated bond is called a monounsaturated fatty acid (MUFA). By far the most common monounsaturated fatty acid is oleic acid. High amounts of oleic acid are found in olive oil, Canola oil, peanut oil, sunflower oil, safflower oil, and chicken fat. Oleic acid can be written in short hand as follows: 18:1w9, where the first number defines the number of carbons, the number after the colon defines the number of double bonds, and the following letter and number define the location of the first double bond; in this case it is between the 9 and 10 carbon from the omega (w) end. Each fatty acid can be described this way (see page 3). Polyunsaturated fatty acids (PUFA) are those fatty acids with 2 or more carbon double bonds and found primarily in vegetable oils, nut oils (almonds, walnut etc), and fish oils. It is in this category that both essential fatty acids are found.

Essential Fatty Acids EFAs

There are two fatty acids that are considered essential; linoleic acid (LA, 18:2w6) and alpha-linolenic acid (LNA, 18:3w3). They are essential in that they are absolutely required for human health but cannot be synthesized by humans. In this respect these two fatty acids can be considered “vitamins”. We are incapable of forming double bonds at either the omega-3 or omega-6 positions, although we can synthesize longer and more unsaturated fatty acids once we take these essential fatty acids in through our diet. Unfortunately many of the sources of polyunsaturated fatty acids in our diet have been partially or fully hydrogenated (saturated) to make cholesterol-free substitutes of food products (margarine, vegetable shortening) or used for deep-frying, which oxidizes and alters the fatty acids beyond the ability of our enzymes to recognize them. The processing of commercial oil products has also done much to eliminate a great deal of the natural health benefits of

(continued from page 1)

vegetable oils. A complete discussion of this can be obtained by reading the excellent resource "Fats that Heal, Fats that Kill" written by Udo Erasmus. We shall only say here that commercially prepared oils are not as "healthy" as they are portrayed to us because of their polyunsaturated, cholesterol-free status.

Omega-6 vs. Omega-3

Over the past 100 years a dramatic change in our diet has occurred. We have invented an industry of prepared foods made in factories and shipped to consumers via supermarkets. With this "invention", shelf-life became a premium. EFAs, on the other hand, kill shelf-life because they have a tendency to go rancid when exposed to heat, light and oxygen. At the same time, large commercial oil manufacturers began producing the refined vegetable oils we are now so familiar with. Currently, 4 oils (soybean, cottonseed, corn, and canola) account for 96% of the vegetable oil use in the U.S. The w6:w3 ratio of these combined oils is between 12:1 and 25:1. An estimate of the w6:w3 ratio in our diet 100 years ago is between 3:1 and 5:1. This dramatic shift toward w6 oil consumption, coupled with the alteration of the fats via hydrogenation and oxidation is thought to be one of the leading factors in the rise of chronic illnesses, especially cardiovascular diseases over the past century. Modern agricultural practices have a dramatic effect on the EFA ratios of animal products. For example, a free-range chicken egg has a w6:w3 ratio of 1.3, while a corn fed USDA chicken egg has a w6:w3 of 19.4 (1).

To regain a balanced w6:w3 ratio in our diet is almost impossible without supplementing our diets with high levels of w-3 containing oils such as flaxseed oil or concentrated fish oil supplements. Recommended levels of linoleic acid (omega-6 EFA) are 6-9 grams per day (3-5% of total calories) and alpha-linolenic acid (omega-3 EFA) are 4-6 grams per day (2-3% of total calories). Of course, therapeutic levels may exceed these several-fold with almost no toxicity known for these substances.

Therapeutic use of Omega-3 fatty acids

Therapeutic uses of the omega-3 essential fatty acid linolenic acid, and its derivatives EPA and DHA (usually from fish oil) have become more prevalent in the past several decades. Omega 3 fatty acids have been used therapeutically for cardiovascular diseases, hypertension, inflammatory and autoimmune disorders, cancer, diabetes and several lipid disorder/deficiency syndromes.

Omega 3 and Cardiovascular Effects

Recent interest in omega-3 fatty acids stems from the fatty acid profile and low rate of coronary heart disease discovered among Greenland Eskimos (2). While having a diet high in total fat, they consumed a high proportion of marine fats (seal, whale, and fish). These fats contain high amounts of the long chain, highly-unsaturated, omega-3 fatty

acids (EPA and DHA), originally made by plankton and consumed by these marine animals. A current review has concluded that omega-3 fatty acids prevent heart disease through the following actions (3):

- Prevention of arrhythmias (ventricular tachycardia and fibrillation)
- formation of and competition against various prostaglandins and leukotrienes
- anti-inflammatory properties (partly by prostaglandin effect)
- antithrombotic effect
- hypolipidemic effect on triglycerides and VLDLs
- inhibition of atherosclerosis.

We will briefly summarize some of the more important aspects of these activities.

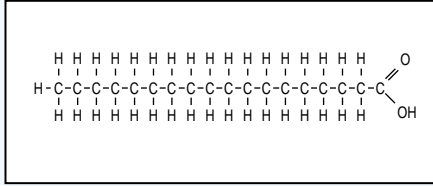
Induced cardiac arrhythmias, in both animal and cell culture studies, were halted by the administration of EPA and DHA (4). The mechanism seems to be related to the PUFA's ability to stabilize the membrane excitability of heart cells that leads to arrhythmia. While these experiments cannot be reproduced in humans (ethically), a population case-controlled study showed that increased intake of long-chain omega-3 fatty acids from seafood is associated with a reduced risk of primary cardiac arrests (5). Additionally, patients advised to eat fatty fish after recovering from a myocardial infarction had a 29% reduction in mortality in the following 2 years than those not advised to do so (6). A similar secondary prevention trial was also done using increased levels of the essential fatty acid linolenic acid (18:3w3) (7). 302 patients were randomly selected and placed on an LNA-rich diet after a first myocardial infarction, another 303 patients were placed on a normal post-infarct prudent diet. After two years, the group receiving the LNA-rich diet had 70% fewer fatal and non-fatal myocardial infarctions as well as a 70% reduction in overall mortality. The use of flaxseed oil and fish oil should be considered to reduce the risk of primary cardiac arrest and certainly as a post infarct secondary prevention.

A recent review discusses the aspects of using long-chain omega-3 fatty acids from fish oil as prevention for atherosclerosis (8). The mechanism of action includes modification of lipid profile (lower triglycerides, lower cholesterol concentration, increased HDL), moderate reduction in blood pressure, a shift in eicosanoid patterns (increased vasodilation, decreased platelet aggregation) and a decrease in platelet-derived growth factor (thought to play a role in atherosclerosis). The data, while promising in the prevention of atherosclerosis, is less conclusive for reversing already formed plaques.

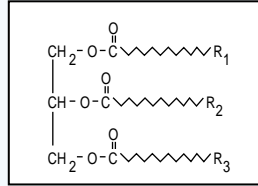
Perhaps the most conclusive therapeutic result using fish oils is the reduction of serum triglycerides. Studies have shown that the consumption of fish oil reduces cholesterol levels moderately and tryglycerides significantly (11, 18).

FATTY ACID PRIMER

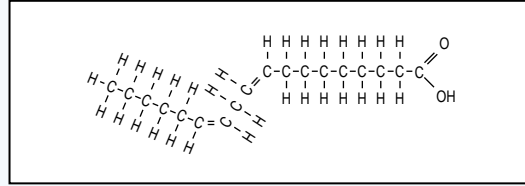
STRUCTURES



Fatty Acid (18:0)



Triglyceride

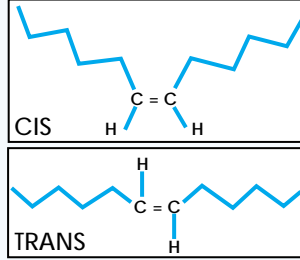


Linoleic Acid

NAMING FATTY ACIDS

Common Name	Shorthand
Oleic	18 : 1 w9
Linoleic	18 : 2 w6

● Number of Carbons
● Number of Double Bonds
● Location of First Double Bond



An unsaturated fatty acid double bond is normally in the cis conformation (both hydrogens on the same side). This gives the molecule a bend or kink at each double bond. These bends increase the fluidity or mobility of the fatty acid. When these molecules are heated, exposed to damaging light or oxygen; or partially hydrogenated, trans bonds form. These cause fluid oils to become more rigid (margarine). These new molecules are difficult for the body's enzymes to metabolize. There are significant levels of research looking into the connection between the increased dietary intake of trans-fatty acids and the increased incidence of chronic illnesses.

Saturated Fatty Acids:

Butyric Acid	[4:0]
Caproic Acid	[6:0]
Caprylic Acid	[8:0]
Capric Acid	[10:0]
Lauric Acid	[12:0]
Myristic Acid	[14:0]
Palmitic Acid	[16:0]
Stearic Acid	[18:0]

Monounsaturated Fatty Acids:

Oleic Acid	[18:1w9]
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Polyunsaturated Fatty Acids:

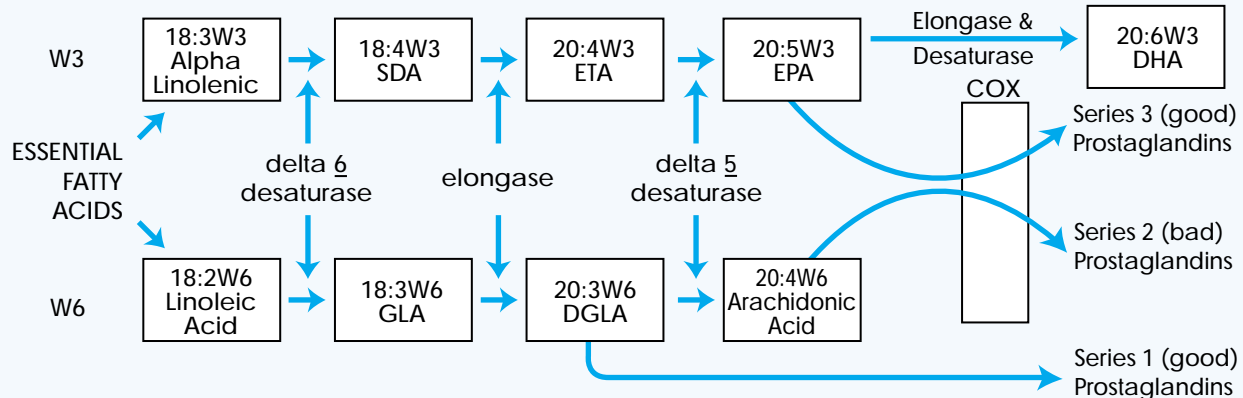
Linoleic Acid (LA)	[18:2w6]
Alpha-linolenic acid (LNA)	[18:3w3]
Gamma-linolenic acid (GLA)	[18:3w6]
Arachidonic acid (AA)	[20:4w6]
Eicosapentanoic acid (EPA)	[20:5w3]
Docosahexanoic acid (DHA)	[22:6w3]

Typical Fatty Acid Profile of Various Fats & Oils (% of total fat)

	Saturated			Mono-unsaturated		Polyunsaturated			
	4:0-14:0	16:0	18:0	18:1w9 Oleic	Other MUFA	18:2w6 LA	18:3w3 LNA	20:5w3 EPA	22:6w3 DHA
Butter	22	26	12	25		2.2	1.4		
Milk Fat	23.5	30.6	12.5	26.9		3.1	1		
Chicken Fat	0.9	21.6	6	37.3		19.5	1		
Beef Fat	3.7	24.9	18.9	36		3.1	0.6		
Olive Oil	-	11	2.2	72.5		7.9	0.6		
Corn Oil	-	10.9	1.8	24.2		58	0.7		
Safflower Oil	-	4.3	1.9	74.6		14.4	0		
Canola Oil	-	4	1.8	56.1		20.3	9.3		
Soybean Oil	0.1	10.3	3.8	22.8		51	6.8		
Sesame Oil	-	8.9	4.8	39.3		41.3	0.3		
Sunflower Oil	-	5.4	3.5	45.3		39.8	0.2		
Cottonseed Oil	0.8	22.7	2.3	17		51.5	0.2		
Coconut Oil	58.7	8.2	2.8	5.8		1.8	0		
Palm Oil	1	43.5	4.3	36.6		9.1	0.2		
Fish-Herring	7.3	11.7	1	12	34	1.1	0.7	6.2	4.2
Fish-Salmon	3.3	9.8	4.24	17	12.3	1.5	1	13	18
Walnut Oil	0	7	2	22.2		53	10.4		
Flax Seed Oil	-	5.5	4.5	18		15	55		
E. Primrose Oil	-	-	2	6.4		73.2	9.4*		

* - as gammalinolenic acid (18:3w6) not ALA (18:3w3)

W3 and W6 FATTY ACIDS COMPETE FOR ENZYMES DURING METABOLISM



SDA - Stearidonic Acid, ETA - Eicosatetraenoic acid, DGLA - Dihomogammalinolenic Acid, COX - Cyclooxygenase

Figure 1

ST. JOHN'S WORT- MORE GOOD RESEARCH, WITH A LITTLE CAUTION.

The positive research on the use of St. John's wort extracts for depression continues on. A new meta-analysis has looked at 27 trials (2291 patients) using various St. John's wort (SJW) preparations. As has been determined before, SJW extracts are significantly better than placebo and equally effective as other (bi and tricyclic) antidepressant products. Reported side effects with SJW were 26.3%, while standard antidepressants were 44.7% in these trials.

But what about fluoxetine (Prozac®) and sertraline (Zoloft®)?

Abstracts:

Equivalence of St John's wort extract (Ze 117) and fluoxetine: a randomized, controlled study in mild-moderate depression.

Schrader E *Int Clin Psychopharmacol* 2000 Mar;15(2):61-8

Treatment with St John's wort extract tablets (hypericum Ze 117) and the commonly used slow serotonin reuptake inhibitor (SSRI) fluoxetine was compared in patients with mild-moderate depression with entry Hamilton Depression Scale (HAM-D) (21-item) in the range 16-24, in a randomized, double-blind, parallel group comparison in 240 subjects; fluoxetine: 114 (48%), hypericum: 126 (52%). After 6 weeks' treatment, mean HAM-D at endpoint decreased to 11.54 on hypericum and to 12.20 on fluoxetine ($P < 0.09$), while mean Clinical Global Impression (CGI) item I (severity) was significantly ($P < 0.03$) superior on hypericum, as was the responder rate ($P = 0.005$). Hypericum safety was substantially superior to fluoxetine, with the incidence of adverse events being 23% on fluoxetine and 8% on hypericum. The commonest events on fluoxetine were agitation (8%), GI disturbances (6%), retching (4%), dizziness (4%), tiredness, anxiety/nervousness and erectile dysfunction (3% each), while on hypericum only GI disturbances (5%) had an incidence greater than 2%. We concluded that hypericum and fluoxetine are equipotent with respect to all main parameters used to investigate antidepressants in this population. Although hypericum may be superior in improving the responder rate, the main difference between the two treatments is safety. Hypericum was superior to fluoxetine in overall incidence of side-effects, number of patients with side-effects and the type of side-effect reported.

Comment: This study, as well as one published last year (*Arzneimittelforschung* 1999; 49(4):289-96), have been anticipated for many years now. These patients are still considered mildly to moderately depressed, but are the ones likely to take St. John's wort for treatment. The number and severity of side effects are dramatically different and should be a deciding factor.

Comparison of an extract of hypericum (LI 160) and sertraline in the treatment of depression: a double-blind, randomized pilot study.

Brenner R, Azbel V, Madhusoodanan S, Pawlowska M

Clin Ther 2000 Apr;22(4):411-9

BACKGROUND: Hypericum (St. John's wort) has been shown to be as efficacious and well tolerated as standard antidepressants in the treatment of depression but has not been compared with selective serotonin reuptake inhibitors (SSRIs). OBJECTIVE: This study compared hypericum and the SSRI sertraline in the treatment of depression. METHODS: In a double-blind, randomized study conducted in a community hospital, 30 male and female outpatients (19 women, 11 men; mean age, 45.5 years) with mild to moderate depression received 600 mg/d of a standardized extract of hypericum (LI 160) or 50 mg/d sertraline for 1 week, followed by hypericum 900 mg/d or sertraline 75 mg/d for 6 weeks. RESULTS: The severity of symptoms, as assessed by scores on the Hamilton Rating Scale for Depression (HAM-D) and the Clinical Global Impression scale, was significantly reduced in both treatment groups ($P < 0.01$). Clinical response (defined as a $>$ or $=50\%$ reduction in HAM-D scores) was noted in 47% of patients receiving hypericum and 40% of those receiving sertraline. The difference was not statistically significant. Both agents were well tolerated. A post hoc power analysis indicated that failure to reach statistical significance between treatments resulted primarily from an absence of clinical differences rather than the small sample size. CONCLUSION: The hypericum extract was at least as effective as sertraline in the treatment of mild to moderate depression in a small group of outpatients.

Comment: Although this was a small trial, the results are extremely positive. We will have to wait for a large comparative trial between SJW, Zoloft®, Prozac® and others in the future, which will likely brew some interesting debates.

Some Safety Concerns with SJW use.

The increased use of SJW extracts around the world has been overwhelmingly safe, but over the past year, a few concerns have been raised. Most recently the FDA has issued a warning following an article published in *Lancet* that reads as follows:

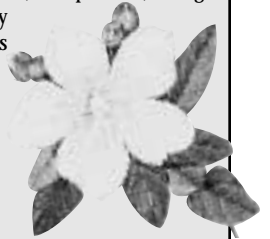
The Food and Drug Administration would like to inform you about results from a study conducted by The National Institutes of Health (NIH) that showed a significant drug interaction between St John's wort (hypericum perforatum), an herbal product sold as a dietary supplement, and indinavir, a protease inhibitor used to treat HIV infection. In this study, concomitant administration of St. John's wort and indinavir substantially decreased indinavir plasma concentrations, potentially due to induction of the cytochrome P450 metabolic pathway. For additional information on this study please refer to the February 12, 2000 *Lancet* publication (Piscitelli, et al).....

.....Other drugs

Based on this study and reports in the medical literature, St. John's wort appears to be an inducer of an important metabolic pathway, cytochrome P450. As many prescription drugs used to treat conditions such as heart disease, depression, seizures, certain cancers or to prevent conditions such as transplant rejection or pregnancy (oral contraceptives) are metabolized via this pathway, health care providers should alert patients about these potential drug interactions to prevent loss of therapeutic effect of any drug metabolized via the cytochrome P450 pathway.

All health care professionals are encouraged to report any serious adverse event associated with the concomitant use of prescription drugs and St. John's wort products to the FDA's MedWatch program at 1-800-FDA-1088 (fax 1-800-FDA-0178).

Comment: This is an interesting finding, one of the body's detoxification pathways (cytochrome p450) is enhanced by SJW extract to the detriment of these drugs. Maybe this should tell us something about these drugs (toxins) and also about the potential of SJW for other purposes. Regardless, SJW use should not be considered to be without side effect in all patients and care should be taken to monitor concomitant drug use. Use of St. John's wort with other prescription antidepressant drugs is still considered unwise and not recommended.



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This response is dose-dependent (9) and linked to the w-3 fatty acid's reduction in very low density lipoprotein (VLDL) synthesis (10). The use of a low carbohydrate diet with the addition of fish or fish oil supplements is becoming the first step of many practitioners when dealing with patients with elevated tryglycerides, with or without elevated cholesterol.

EFAs for inflammatory and autoimmune disorders

The figure at the bottom of page three shows the metabolism of essential fatty acids as it pertains to their elongation, desaturation, and conversion to prostaglandins. Arachidonic acid (AA, 20:4w6) is the precursor to both the series 2 prostaglandins (PGE2 etc.) via the cyclooxygenase pathway and the series 4 leukotrienes via the 5-lipoxygenase pathway. Both of these compounds are strong inflammatory mediators. EPA (20:5w3), either ingested directly from fish oil or converted from LNA (18:3w3), competes with the enzymes that converts AA into these proinflammatory agents (for review see 12). EPA is also the precursor to the series 3 prostaglandins, many of which counteract the negative effects of the AA series 2 prostaglandins. Since the Western diet is heavily weighted toward w-6 fatty acid consumption, chronic inflammatory diseases are difficult to address without increasing the intake of omega-3 fatty acids from flaxseed oil or fish oils.

Several reports have summarized that the use of fish oil (3g/day) for three months has a significant impact on joint tenderness and morning stiffness in patients with rheumatoid arthritis (13, 14). [Recall that this is rheumatoid and not osteoarthritis, the latter condition being better treated with chondroprotective agents such as chondroitin sulfate and glucosamine (see Standard newsletter Vol. 2, No. 3)].

The ingestion of gamma-linolenic acid (GLA, 18:3w6) from evening primrose oil (EPO) or borage oil counteracts the arachidonic acid cascade when it is converted into dihomogammalinolenic acid (DGLA, 20:3w6). GLA is considered by some to be an essential fatty acid because the important enzyme delta-6-desaturase (see page 3) is poorly used in many individuals or out-competed by the overload of trans-fatty acids. Patients with rheumatoid arthritis given 540g/day of GLA (from EPO) use significantly less non-steroidal anti-inflammatory drugs than those given placebo (15). The combination of EPO/Flax or EPO/Fish oil should be considered routine for natural therapy in patients with rheumatoid arthritis as well as other rheumatologic disorders like Raynaud's syndrome and Sjogren syndrome (17). The use of 3-6 grams per day of fish oils has also been very effective for the treatment of inflammatory bowel diseases like Crohn's disease and ulcerative colitis (16).

Essential Fatty Acids and Skin Disorders

Linoleic acid (18:2w6) is the most abundant PUFA in the

human skin. Among other things, it plays a vital role in preserving our epidermal water barrier. Deficiencies in this EFA result in scaly skin and excessive water loss (23). Interestingly, the desaturase enzymes that convert LA to GLA and DGLA to AA (see figure page 3) are deficient in normal epidermal cells. Increasing dietary GLA (Borage, EPO) increases DGLA in epidermal tissues without raising arachidonic acid levels (19). Not surprisingly, patients with atopic eczema had elevated levels of LA (18:2w6) but significantly reduced levels of the longer and more unsaturated metabolites, including GLA and DGLA (20). Patients with atopic eczema seem to have less active systemic delta-6 desaturase (22), and more than 10 studies have shown an improvement in symptoms by using evening primrose oil (dose dependent at 2, 4, and 6 g/day; [21]). Both GLA and fish oil concentrates have been used for treating psoriasis with minimal or conflicting results (24).

Essential Fatty Acids and Diabetes

Among the many metabolic alterations associated with diabetes, fatty acid metabolism is of major concern. As in eczema patients, the delta-6 desaturase enzyme is greatly impaired in many diabetic patients. Without this enzyme, the longer and more unsaturated fatty acids in the omega-6 pathway cannot be properly synthesized. This is thought to be one of the leading causes of diabetic neuropathy. Both animal and human studies have shown that the addition of GLA (from EPO) to the diet can stop and even reverse diabetic neuropathy by speeding up nerve conduction velocity (22,25). These humans studies were done with 320mg/day of GLA (equal to about 4-5 grams of EPO) and lasted at least 6 months. The use of GLA-rich oils along with EPA/DHA rich fish oils would be recommended for diabetic retinopathy (See Dr. Mercola sidebar) as this may be a complication of both reduced omega-6 metabolites as well as a deficiency in omega-3 fatty acids.

Other considerations

There is a complete set of research that has looked into the various aspects of fatty acid metabolism and child development. The important aspects of fatty acid metabolism for pregnant mothers, infants and young children is a much larger topic than can be discussed adequately here. As one would expect, the proper amounts and ratios of fatty acids is even more vital to these little ones as they develop every organ, especially the complexities of the nervous system. Information on the neurological differences of children who had been breast-fed as opposed to formula-fed has led to the addition of PUFAs to formula in the past decade (27). Clinically, children with ADHD have an increased w6:w3 fatty acid ratio (26). While certainly not the only therapeutic angle for ADHD diagnosed children, increasing EFA intake, especially w-3 fatty acids, is likely to improve overall health and may have a beneficial effect on behavior.

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Flaxseed Oil

The cultivation of flax (*Linum usitatissimum* L.) for its fiber (linen) and nutritive value is an ancient practice that goes back thousands of years. While many of the same benefits (and more) can be gained by eating freshly ground flax seeds (29), this discussion will only cover the use of the expressed oil derived from the seed of flax here.

Flaxseed oil (or linseed oil) has the highest amount of the omega-3 essential linolenic acid (18:3w3), containing 55% on average. No other edible oil even comes close. Increasing consumption of flaxseed oil would benefit nearly every patient, lowering the unhealthy w6:w3 ratio they are likely consuming. Fresh, expeller pressed flax oil can be added to salad dressings, protein shakes, fruit smoothies, or with just about anything else. The taste should be pleasant and slightly nutty, many just take a tablespoon directly. Flaxseed oil can be used in baking bread; the heat is usually not enough to destroy the oil (except in the crust). Do not fry using flaxseed oil, this highly unsaturated oil will oxidize quickly, turning a healthful oil into molecules that your body will not recognize. For many people, softgel capsules are a convenient and easy way to take flaxseed oil. Regardless of the package, flax seed oil should be refrigerated after opening.

The consumption of flaxseed oil increases the longer and more unsaturated metabolites EPA and DHA (28, see the previous discussion for the benefits of increasing these fatty acid). One particular therapeutic use of flaxseed oil seems to be due to other components, namely the lignan and LNA components for cancers (esp. breast). Several promising *in vitro* and animal studies show that flaxseed oil is able to lower the risk of mammary cancer (by inducing structural changes in the mammary gland, 30) and by reducing growth and metastasis of existing mammary tumors (31,32). Low levels of LNA in adipose breast tissue were associated with increased metastasis in 121 women with initially localized breast tumors (33). More recently it was shown that women in the highest quartile of LNA in breast adipose tissue had a 64% lower relative risk for breast cancer (34). The amount of flaxseed oil needed to prevent breast cancer therapeutically has not been studied to date. An ideal dose of alpha-linolenic acid is 4-6 grams per day. That is equivalent to 8-11 grams (1-1.5 tablespoons) of flaxseed oil per day.

Fish Oil

There has been significant research on the health benefits of fish and fish oil supplements, many of which have been discussed in this review. Of the many supplements available, which one should practitioners recommend to their patients? That question has not been addressed with any clinical trial of major importance, and would depend on what goals the patient was trying to accomplish with fish oil supplementation. One of the questions still under debate is whether oils in which EPA/DHA levels are concentrated (while lowering some of the other fatty acids) is a better

A WORD FROM DR. MERCOLA

Fish or EPA/DHA Supplements May Help Protect Vision

Chalk up another possible health benefit of eating fish: prevention of age-related macular degeneration, the leading cause of irreversible blindness in the US. The macula is the central portion of the retina in the eye and when it is damaged, visual problems — including blindness — are the unfortunate result. Australian researchers found that more frequent consumption of fish appeared to protect against late age-related macular degeneration. Only a moderate intake of fish was necessary for the protective effect. Those who ate fish one to three times a month had about half the risk of late-stage disease than those who ate fish less than once a month. And more fish was not necessarily better. The greatest amount of protection was seen in those who ate one serving of fish a week, and there was no additional benefit of consuming more. The investigators note that eating too much fish may interfere with the absorption of vitamin E in the elderly, which could explain the threshold protective effect from dietary fish.

Archives of Ophthalmology
March, 2000;118:401-404

COMMENT: Identifying preventable risk factors for age-related macular degeneration, now the most common cause of blindness in western countries, may be the only way of reducing the burden of this disease as current treatments are rarely effective in the longer term. It is important to recognize the threshold effect the authors describe. There did not appear to be any benefit of having fish more than once a week. The authors do not address the additional serious concern that virtually all waterways in the world are contaminated and there really is no such thing as organic commercial fish. If one is healthy, it is likely that they could effectively eliminate the heavy metals and PCBs that many fish have. So, it appears that fish more than once a week are not necessary. To obtain the benefits of fish one can use a high quality EPA/DHA supplement. Mega doses are not required and it is likely one a day would be sufficient.

Dr. Mercola is board certified in family medicine and is the medical director of the Optimum Wellness Center in Schaumburg, Illinois. He has a monthly column published in Townsend Letter. This commentary, as well as hundreds of others, are available at his website www.mercola.com

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approach than taking un-concentrated fish oil? While many of the health benefits can be related directly to EPA and DHA, it is very likely that the blend of fatty acids, which includes a number of monounsaturated fatty acids not found in high amounts elsewhere, are likely to be of benefit. This, and the low threshold of benefit from fish oil (see Dr. Mercola sidebar), leads to a dual recommendation. High EPA/DHA products should be taken by individuals where this is vital to the therapeutic approach; such as elevated triglycerides, diagnosis of one of the cardiac conditions mentioned previously, an autoimmune or inflammatory condition, macular degeneration etc. Patients using fish oils as a preventative for such conditions would likely benefit just by taking a un-concentrated salmon or herring oil. While no research has been done to elucidate such a claim, it is likely that the addition of an un-concentrated fish oil (like salmon oil) to a high EPA/DHA product would increase the benefits of the latter.

Some concerns need to be considered when using fish oils. First, as many of these fish are caught in coastal waters, accumulation of heavy metals and fat soluble pesticides is a vital concern. It is now a standard practice to measure levels of mercury, lead, and cadmium, as well as several specific pesticides including DDT. Your supplier should be able to tell you if the fish oil you dispense is free of these dangerous compounds. Secondly, an increased bleeding time is correlated with elevated fish oil consumption. While this is a benefit for many patients, consider this for those already on blood thinning drugs or prior to surgeries where this is not a plus. Finally, many people will find that they will begin to burp up a fishy taste. Some believe that this is a sign of rancidity and others believe this is an inevitable aspect of ingesting fish oils. Taking these supplements with meals and including a digestive aid with both lipases as well as ox bile extract should help deal with these fishy triglycerides. If that doesn't help, try other fish oil sources, other digestive aids or look for other digestive complaints.

GLA-Rich Oils

Of all the GLA-rich oils, Evening primrose oil (EPO) is the most widely used, although both borage oil and black current seed oil contain more GLA. Let us first discuss EPO before touching on the other oils.

Evening Primrose oil is extracted from the seeds of the evening primrose plant (*Oenothera biennis* L.), a yellow flowering plant found throughout North America. The oil is one of the highest in omega-6 oils, with over 70% LA and between 9-11% gamma-linolenic acid (GLA 18:3w6). Most of the research discussed previously with GLA was done using EPO. The GLA content has been given most of the credit for its therapeutic effect, although borage oil (24% GLA) and black current seed oil (18% GLA) have not gained the therapeutic success that EPO has. It has been postulated that borage oil, although having more GLA than EPO, also contains small amounts of metabolites which prevent the full

benefit of the GLA from being effective. Some clinicians, though, find borage oil to be as effective as EPO. Few studies have compared black current seed oil with borage or EPO therapeutically, but many report it to be useful for the same conditions that EPO is used for.

Evening Primrose oil is often used in the treatment of skin conditions such as eczema, psoriasis and dermatitis of various types. The combination of high levels LA with the addition of GLA makes it the perfect oil for skin health. David Horrobin has done an excellent job of reviewing this subject and concludes that the use of GLA is very effective, especially for atopic eczema (21), characterized by dry, scaly, red and weeping lesions on the skin.

As we mentioned previously, diabetics have a deficiency in delta-6-desaturase activity and benefit from the addition of GLA in their diet. Many physicians recommend 4-6 grams of EPO per day for at least 6 months to reduce the neuropathy associated with diabetic conditions.

While there is conflicting reports on the use of EPO for female cycle conditions, especially PMS, it is a very common treatment for such conditions (35). Of all the associated symptoms, breast pain and tenderness seems to be the most effected by EPO and is being used and recommended as the first-line specific treatment for women with cyclical mastalgia (36,37). A dose of 3 grams per day of evening primrose oil has been used successfully for mastalgia (38). Evening Primrose oil is most often found in soft-gel capsules containing 500, 1000 or 1300 mg of expressed oil.

Other Oils

There are many other natural oils with beneficial fatty acid profiles. Among them are the nut oils (walnut, almond etc), marine mammals (whale, seal etc) and a variety of plant seeds, especially hemp. A variety of issues prevent these from becoming readily available such as cost, accessibility, a lack of bulk extraction procedures or legal issues. Eating these foods directly or consuming things that eat these things (free-range chicken eggs for example) are the best way to get the fatty acids from these food sources.

CLA- Conjugated Linoleic Acid

Conjugated linoleic acids (CLA) are geometric isomers of linoleic acid, which naturally occur primarily in meat fats. They have received considerable attention because of their ability to reduce several forms of tumorigenesis in animal models. A complete review of this topic is available (39) and will not be discussed here. The use of CLA as a therapeutic agent seems very promising and it would be prudent to watch for large studies in humans to confirm these animal studies.

Conclusion

Fatty acids are vital to human health. Deficiencies, enzymatic insufficiencies, imbalanced diets and the introduction of trans-fatty acids makes the intake of

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unmodified omega-3 fatty acids a concern for most people in the western world. Therapeutic doses of flaxseed oil and fish oil are easily obtainable and extremely affordable. Using GLA-rich oils like evening primrose oil have been shown to be very effective for a number of conditions. It is difficult to understand how such a simple biochemical concept as balanced fatty acid metabolism could be completely ignored

by most health practitioners. Those with a fuller understanding of this topic realize that this review is only scratching the surface of this vast subject. For those whose interest has been piqued concerning fatty acid metabolism, I would recommend getting the books or articles listed in the reference section, which will lead to other excellent resources.

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