Fishy Advice: Part I

By Eric Cressey

If you're even remotely up-to-date on your nutrition-for-health reading, you're well aware of the benefits of fish oil. Moreover, if you're anything like me, you've also gone to great lengths--often to no avail--to convince people that they should be taking it even if it does sound "icky." In an effort to save you and I a lot of future time and energy, I've compiled the following for you to share with your relatives, mailman, proctologist, lunchlady, and anyone else with whom you associate that isn't currently "on da fish."

Based on undeniable scientific evidence and anecdotal evidence, I strongly encourage you to incorporate into your diet two specific omega-3 fatty acids: eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), commonly referred to as fish oils. EPA and DHA deficiencies have been linked to problems that include, but are certainly not limited to heart disease, hypertension, arthritis, cancer, immune disorders, chronic intestinal disorders, growth retardation, liver disorders, skin lesions, reproductive failure, visual problems, kidney disorders, and neurological disorders (1).

Dietary alpha-linolenic acid can be converted to EPA and DHA in the body for utilization as important raw materials in healthy cell membranes. Significant amounts of alpha-linolenic acid can be found in the following oils: flaxseed, soybean, hempseed, pumpkinseed, canola, wheat germ and walnut. Products such as margarine and shortening that are derived from these oils also contain modest amounts of alpha-linolenic acid. Some nuts and seeds--butternuts, walnuts, pumpkinseeds, and flaxseeds--and vegetables (soybeans) are good sources as well (1). However, the conversion of alpha-linolenic acid to EPA and DHA is quite inefficient; estimates place the conversion rates at less than 5-10% for EPA and 2-5% for DHA (2). Lifestyle factors can also negatively influence these conversions. There is also evidence to suggest that females are more efficient at converting linolenic acid than men; this is likely due to increased demands for EPA and DHA during pregnancy and lactation (3). Even if you eat plenty of the aforementioned foods regularly, you still might come up short on EPA and DHA because the fatty acid quality is often degraded due to the typical overprocessing that occurs in commercial production (4). As such, it is best to get your EPA and DHA directly whenever possible.

EPA and DHA are commonly referred to as fish oils because coldwater fish are by far the best sources. Although the terms EPA/DHA and fish oils are substituted for one another in writing and conversation, EPA and DHA are actually just two kinds of fatty acids contained in fish oils (5). These fish include, but are not limited to: salmon, mackerel, bluefish, tuna, mullet, herring, anchovy, and sardines (For some yummy fish recipes check out Christina's installment of The Rugged Kitchen in this issue). Infants receive plenty of EPA and DHA from their mothers' milk (1). Certainly, eating fish every day isn't appetizing for most people, and drinking human milk after the age of one is neither feasible nor socially acceptable! Plus, the typical vegetarian diet is extremely low in alpha-linolenic acid, so even if conversion was efficient, these individuals would still be coming up short (clinical studies have proven that vegetarians have insufficient levels of EPA and DHA) (2). Luckily, fish oil supplements in both liquid and softgel form are widely available to ensure that EPA and DHA requirements can be met easily.

EPA and DHA exert their most powerful effects in an anti-inflammatory role. Arachidonic acid, which is created out of the omega-6 fatty acids in our diets, serves as the building block for certain eicosanoids that control the synthesis of cytokines that are pro-inflammatory and immunoregulatory; when these cytokines are overproduced, chronic inflammatory diseases (and even septic shock) can result. Omega-3 fatty acids, on the other hand, inhibit the production of arachidonic acid--thus preventing the production of certain mediators of inflammation--and serve as the raw materials for a healthier class of eicosanoids with anti-inflammatory properties (6). Given how out-of-whack the typical diet is in terms of the omega-6: omega-3 ratio, it should come as no surprise that the world is as unhealthy as it is!

Here is some pretty impressive data on a variety of fronts:

Cardiovascular Health/Atherosclerosis/Hyperlipidemia/Hypertension:
• An eleven year study of 20,557 male U.S. physicians showed that those who consumed fatty fish at least once per week were 52% less likely to suffer a sudden cardiac death than those who only ate it once per month or less (5).

• The typical Greenland Eskimo diet is devoid of fruits and vegetables and very high in fats from animal sources: not your traditional "heart healthy diet." However, the Eskimos had far lower instances of coronary heart disease (CHD) than a Denmark population of nearly identical ethnical composition (same ancestors). The Eskimo and Danish diets both consisted of a high percentage of calories from fat (39% and 42%, respectively), so why didn't the Eskimos suffer from such CHD like the Danes and everyone else? The secret lay with the types of fat that the Eskimos were eating. The typical Danish diet consisted of 22% of total calories from saturated fat and less than 1% from omega-3 polyunsaturated fatty acids (PUFAs). Meanwhile, only 9% of total calories in the Eskimo diet came from saturated fat. Perhaps more importantly, 4.2% of the Eskimos' total calories came from omega-3 PUFAs (5). Similar trends are readily apparent in coastal villages of Korea and Japan and throughout Scandinavian countries. Not surprisingly, they all rely extensively on coldwater fish in their everyday lives. Need further proof? A recent comparison of two Japanese villages: one fishing, one farming, found that the farming village had eight times more atherosclerotic plaques than their fishing counterparts (7).

• In a study of 59 patients with diagnosed heart disease, Durrington et al (2001) monitored the effects of 2 g daily of Omacor, a pharmaceutical grade fish oil concentrate. The researchers found that "there was a sustained significant decrease in serum triglycerides by 20-30% and in very low density lipoprotein (VLDL) cholesterol by 30-40% in patients receiving active Omacor at three, six, and 12 months compared either to baseline or placebo (8)."

• Not only do fish oils lower serum triglycerides and, in high dosages and combination with dietary modifications, low density lipoprotein (LDL) cholesterol, but they also decrease arterial platelet collection, which can lead to dangerous clots (5).

• Harper and Jacobsen (2001) reported that randomized clinical trials with fish oils "have demonstrated reductions in risk that compare favorably with those seen in landmark secondary prevention trials with lipid-lowering drugs (5)."

• Following coronary artery bypass surgery with venous grafts, patients that receive 4 g per day of omega-3 fatty acids have a significantly lower risk of graft occlusion (obstruction/closure) (9).

Hypertension:
• There are like 80 bizillion studies out there proving that fish oil reduces blood pressure (although you'll obviously derive greater benefits if you eat right and exercise, too). That said, 4 g omega-3 fatty acids per day is the minimum you'll need to see an improvement (9). You can expect not only reduced blood pressure, but also decreased vascular wall thickness (10). I've included a few more references (11-13) for those of you that either don't believe me or have a lot of time on your hands for extra reading.

Cardiac Arrhythmias:
• There is significant backing for the assertion that fish oils' antiarrhythmic capacity is the most important. Without sufficient EFAs, the body is forced to make cell membranes out of saturated fatty acids, which yield membranes that are far less elastic. When cardiac cells are made from EFAs (and are thus appropriately elastic), the heart has an easier time returning to a resting state. However, the rigid cell membranes made from saturated fatty acids can cause arrhythmias and alter the cardiac muscle cell contraction (5).

Inflammatory Diseases of Joints and Connective Tissues:
• In patients with degenerative and inflammatory joint diseases, supplementation with omega-3 fatty acids decreases both the "degradative and inflammatory aspects of chondrocyte metabolism,
whilst having no effect on the normal tissue homeostasis (14)."

- Chondrocytes are the building blocks of articular cartilage and work with the extracellular matrix of collagen and proteoglycans to dissipate forces. If the cartilage is constantly eroding due to chondrocyte degradation, the structure tends to soften as its water content increases. Interventions with omega-3 fatty acids are effective in reducing these negative trends and their related symptoms in most patients with osteoarthritis (15,16).

- In more than two dozen studies, researchers have found that fish oil supplementation reduces fatigue and stiffness in rheumatoid arthritis (RA) afflicted individuals. In fact, some studies found the effects to be dramatic enough to allow for substantial decreases in nonsteroidal anti-inflammatory drug (NSAID) dosages (16-18). Generally speaking, in trials of 3 g combined EPA and DHA (the minimum recommended dose for RA patients), the benefits of fish oil supplementation were not noticeable until the 12-week mark, so be patient! On a microscopic level, the omega-3 supplementation tended to limit the release of leukotrien B(4) and interleukin 1 from neutrophils and monocytes. In plain English, this means that two inflammation-causing factors were present in lesser quantities (17).

- RA patients that supplemented with Vitamin E and fish oil showed an even greater decrease in NSAID requirements, indicating a synergistic effect between the two (18).

- Raynaud's Phenomenon is a vascular disorder that falls under the inflammatory diseases of joints and connective tissues. In this condition, tiny blood vessels that feed the skin periodically contract (called a "vasospasm"), limiting blood flow to the skin. As oxygen deprivation sets in, the skin--especially in the hands and feet--turns white and eventually blue. There is speculation that this phenomenon is due to the body's overreaction to cold, as the body excessively vasoconstricts these arteries to conserve heat. However, while cold atmospheres are most likely to cause a vasospasm, emotional stress can be a causative factor as well. Because omega-3 fatty acids "induce a favorable response to vascular ischemia," they have been investigated as a potential treatment for Raynaud's. DiGiacomo et al (1989) found that fish oil supplementation improved cold exposure tolerance and significantly delayed the onset of vasospasm in Raynaud's patients. Furthermore, this cold tolerance improvement was associated with a significantly increased digital systolic blood pressure in a cold atmosphere (20).

- Systemic lupus erythematosus (SLE) -- better known simply as lupus - is a chronic, autoimmune rheumatic disease with a wide variety of symptoms. Typically, this disease affects women of childbearing age (21). Symptoms include arthritis, skin rash, vascular inflammation, and profound effects on the central nervous, renal and cardiopulmonary systems (22). Mohan and Das (1997) found that concentrations of EPA and DHA were low in the plasma phospholipids of SLE patients; this supported pre-existing data that EPA and DHA supplementation could lead to clinical remission without side effects (22).

- In cases of pediatric SLE, dyslipoproteinemia -- essentially high triglycerides, low HDL, and high LDL - is often present. Provision of fish oil supplements has proven effective in significantly improving blood lipid profiles (decreased serum triglycerides concentrations) in these patients beyond dietary intervention alone (24).

Osteoporosis:

- Two short-term studies have found that a lower omega-6 to omega-3 fatty acid ratio (achieved via omega-3 supplementation) attenuates bone loss in patients with osteoporosis. These effects are likely due to decreases in the production of Prostaglandin E2 (PGE2), an eicosanoid widely implicated in bone resorption (25). Overall eicosanoid balance is largely dependent on fatty acid intake; so it's important to consider both the quantity of omega-3s and omega-6s present.

Kidney Disease/Renal Failure:
• Researchers at the Mayo Nephrology Collaborative Clinic found that fish oils slowed the progression of immunoglobin A nephropathy in patients at a high risk for kidney disease (26).

• Omega-3s have shown promise in reducing urinary calcium levels in kidney stone patients and preventing blood clots in hemodialysis patients (26).

• Hemodialysis patients given fish oil required 16% less erythropoietin while experiencing a 3.6% increase in serum albumin levels in comparison to a placebo group (27).

• The side effects (such as skin lesions and hyperlipidemia) of cyclosporine, a medication often prescribed for kidney transplant patients, are noticeably less significant when patients supplement with fish oil (28).

Prostate Cancer:
• A longitudinal study of 6,272 Swedish men showed that those who regularly consumed fish were approximately 50% less likely to be diagnosed with prostate cancer and roughly 70% less likely to die from it than those who avoided fish. Three servings per week appeared to be the minimum amount needed to attain such benefits (29).

• Augustsson et al (2003) validated the Swedish study with a larger sample size of 47,882, and noted that the strongest association also existed between fish consumption and metastatic cancer (meaning that it's extensive and spreads to other parts of the body via the blood vessels or lymphatic system). Those men that ate fish more than three times per week were 24% less likely to be diagnosed with metastatic cancer (30).

Colon Cancer:
• Collett et al noted that incidences of colon cancer in rats were reduced significantly with DHA supplementation in the form of fish oil (31).

Breast Cancer:
• In a five-year prospective study of 35,298 Singapore Chinese women ages 45-74, high levels of dietary omega-3 fatty acids (mostly from shellfish) were associated with a significantly reduced (26% lower) risk of breast cancer (32).

Skin Cancer:
• In animals, omega-3 fatty acids have been proven effective as protection against photocarcinogenesis, likely due to the fatty acids' ability to combat oxidative stress. Rhodes et al studied the effect of 4 g/day EPA supplementation "on a range of indicators of ultraviolet radiation (UVR)-induced DNA damage in humans, and assessed effect on basal and post-UVR oxidative status" in 42 healthy subjects. The control group received oleic acid, a monounsaturated fatty acid, for the three-month study. Sunburn sensitivity was reduced in the EPA group only; likewise, other early markers of skin cancer diminished significantly with EPA supplementation. These results imply that there was protection against acute UVR-induced damage by dietary EPA; the researchers hypothesized that "longer-term supplementation might reduce skin cancer in humans (33)."

That concludes part one; hopefully, you've picked up some valuable information. Next month, I'll besiege you with another 8,471 references supporting my argument on a variety of different fronts. Stay tuned!

References


Fishy Advice, Part II  
By Eric Cressey

Time to pick up where I left off last month in Part I. To "reset" the stage, I'll just say that fish oil is good because it helps with what?

Crohn's Disease:
• Belluzzi et al (1996) found that 2.7 g of fish oil per day for one-year significantly reduced the incidence of relapse in Crohn's patients in remission. Thirty-nine of the patients received the fish oil, while 39 others received a placebo; the relapse rate was 41% lower in the former group. Regression analysis indicated that the positive effects of fish oil were independent of patient age, sex, previous surgery history, disease duration, and smoking status (34).

Ulcerative Colitis:
• Barbosa et al (2003) hypothesized that omega-3 fatty acids from fish oil tend to exert their anti-inflammatory effects in ulcerative colitis via decreases in plasma oxidative stress, acting as free radical scavengers (35).
• In a study of eighteen patients with active ulcerative colitis (characterized by diarrhea and rectal inflammation; ain't that a pretty picture?), four months of 5.4 g combined EPA and DHA supplementation (vs. placebo) led to significantly "reductions in rectal dialysate leukotriene B4 levels, improvements in histologic findings, and weight gain (36)." English translation: their rectums looked, felt, and performed better.

Asthma:
• Nagakura et al (2000) found that ten months of EPA and DHA supplementation lessened asthma symptoms and acetylcholine sensitivity in 29 children with severe bronchial asthma (in collaboration with a controlled environment and diet) (37).
• Three weeks of 5.4 g combined EPA and DHA markedly blunted exercise-induced asthma in ten elite athletes and improved post-exercise pulmonary function significantly (38).

Cystic Fibrosis:
• In a study of thirty cystic fibrosis patients that received EPA and DHA supplementation as 1.3% of their total calories for eight months, researchers noted significant decreases in markers of inflammation. Subtle improvements in forced expiratory volume (a measure of pulmonary function) were noted as well. Furthermore, in comparison with the previous eight-month period, the patients (collectively) required much fewer days (392 vs. 721) of antibiotic therapy during the eight months on EPA and DHA (39).

Chronic Obstructive Pulmonary Disease (COPD):
• Shahar et al (1994) examined the relationship between dietary omega-3 fatty acid intake and COPD in 8,960 smokers, finding that combined EPA and DHA intake was "inversely related to the risk of COPD in a quantity-dependent fashion (40)." In other words, if you're going to smoke, you might as well complement that metallic cough with some fish breath; it'll probably protect you from COPD down the road.
Romieu and Trenga (2001) observed that "data also suggest that omega-3 fatty acids may have a potentially protective effect against airway hyperreactivity and lung function decrements" in both children and adults (41).

Sickle Cell Anemia:

- In patients with sickle cell disease, omega-3 fatty acid supplementation at 0.1 g/kg per day "reduced the frequency of pain episodes requiring presentation to the hospital from 7.8 events during the preceding year to 3.8 events/year." Conversely, subjects receiving dietary olive oil (the control group) experienced 7.1 pain events/year, only slightly less than the 7.6 event average from the previous year. This reduction in pain episodes was likely attributable to the effects of EPA and DHA on reducing prothrombotic activity (42).

- A study of Nigerian children found that omega-3 fatty acid concentrations were 40-50% lower in the phospholipid membranes of children with sickle cell disease than in those of healthy children. The researchers noted that "the phospholipids of the children with SCD are less fluid relative to those of their healthy counterparts. (43)"

Menstrual Symptoms:

- In a Danish study, low intakes of omega-3 fatty acids were correlated with more severe menstrual symptoms. Dysmenorrhea correlations were also observed in low omega-3: omega-6 ratios and vitamin B12 deficiencies. The body utilizes omega-3s to create type-3 prostaglandins that are less "aggressive" than those formed from other fatty acids. The net result of utilizing omega-3s as raw materials appears to be milder symptoms. Prostaglandins act like hormones, controlling uterine contractions and pains (44).

Vision/Eye problems (glaucoma):

- Ninety days of DHA with vitamins E and B significantly improved computerized visual field (CVF) and retinal contrast sensitivity in thirty chronic glaucoma patients. The researchers concluded that such a supplement merits inclusion in an intervention to prevent the progression of glaucoma-related damage (45).

Multiple Sclerosis:

- Cunnane et al (1989) found that in comparison with their healthy counterparts, MS patients had lower omega-3 fatty acids in their plasma (46).

- As a follow-up, Gallai and colleagues (1995) found that omega-3 supplementation in MS patients led to decreases in proinflammatory eicosanoids, indicating potential for fish oil in modulating some immune function decrements associated with MS (47).

Prenatal and postpartum support:

- Supplementation with DHA between the 24th and 28th week of pregnancy significantly increased (by roughly six days on average) the duration of gestation. Birth weight, length, and head circumference all increased slightly as well (48).

- A study of Norwegian children found that "use of cod liver oil in the first year of life was associated with a significantly lower risk of type 1 diabetes." Regression analysis implied that this effect was independent of the oil's vitamin D content, and was likely due to the omega-3 fatty acids in the oil (49).
Malcolm et al (2003) noted an association between "the DHA status of infants at term and early postnatal development of the pattern-reversal VEP [visual evoked potential], indicating that DHA status itself may influence maturation of the central visual pathways" in infants. These assertions were based on results seen in a trial of one hundred women that received either fish oil capsules or a placebo (50).

Uauy and colleagues (2003) found not only that long chain polyunsaturated fatty acid supplementation in newborns improved visual acuity at four months, but also there was "a significant relation between the total DHA equivalents provided and effectiveness (51)." In other words, more was better (to a certain point, of course). This effect is likely due to effects on physical properties of the membranes, neurotransmitters, and modulation of gene expression in the retina and brain (52).

Because of the crucial role of essential fatty acids as structural components of all cell membranes, profound implications can be seen at the "brain, retina and other neural tissues are particularly rich in long-chain polyunsaturated fatty acids (LC-PUFA) (52)."

Uauy et al (2001) asserted that "light sensitivity of retinal rod photoreceptors is significantly reduced in newborns with n-3 fatty acid deficiency, and that docosahexaenoic acid (DHA) significantly enhances visual acuity maturation and cognitive functions (52)." Furthermore, "DHA also has significant effects on photoreceptor membranes and neurotransmitters involved in the signal transduction process; rhodopsin activation, rod and cone development, neuronal dendritic connectivity, and functional maturation of the central nervous system (52)." It beats feeding potato chips to your kids, doesn’t it?

Data from Dunstan et al (2003) suggests that there may be a role for omega-3 fatty acids in the prevention of allergic disease. In a study of 83 atopic pregnant women receiving fish oil or placebo, the researchers noted that infants from the fish oil group had significantly less severe atopic dermatitis at age one, although no difference in the frequency of the disease was apparent between groups (53).

Williams and colleagues (1995) described preeclampsia (affecting pregnant women) as "a systemic disease characterized by diffuse endothelial dysfunction, increased peripheral vascular resistance, coagulation abnormalities, antioxidant deficiency, persistent elevations of maternal leukocyte-derived cytokines, and hyperlipidemia (54)." These researchers conducted a study to examine the relationship between omega-3 fatty acid intake and preeclampsia. Women with the lowest omega-3 levels were 7.6 times more likely than those with the highest levels to have preeclampsia-related complications during their pregnancies. Moreover, "a 15% increase in the ratio of omega-3 to omega-6 fatty acids was associated with a 46% reduction in risk of preeclampsia (54)."

Psoriasis:

Psoriatic lesions are characterized by increased concentrations of arachidonic acid. EPA exerts an anti-inflammatory effect that likely works to counteract the pro-inflammatory effects of arachidonic acid and its metabolites. In a study of 83 patients with chronic plaque-type psoriasis, researchers found that omega-3 fatty acid infusions were superior to omega-6 infusions (the placebo) "with respect to change in severity of psoriasis per body area, change in overall erythema, overall scaling and overall infiltration, as well as change in overall assessment by the investigator and self-assessment by the patient (55)."

Grimminger et al (1993) observed that high dose intravenous omega-3 fatty acid supplementation exerted a rapid beneficial effect on inflammatory skin lesions in twenty patients hospitalized with acute guttate psoriasis. These effects were most likely mediated through eicosanoid metabolism regulation (56).
Photosensitivity:
- Hydroa vacciniforme, also known as photosensitivity, is a serious skin disorder characterized by blistering (especially on the face) after even the slightest amount of sun exposure; it affects primarily children. In a small study, Rhodes and White reported that three months of fish oil supplementation reduced erythemal sensitivity to UVA and UVB (two types of ultraviolet radiation), and yielded modest improvements in overall symptoms (57).

Diabetes/Insulin Resistance:
- Increased oxidative stress is a hallmark of type 2 diabetes. Jain et al (2002) sought to determine the effects of very low dose omega-3 fatty acid supplementation (0.6 g combined EPA and DHA) on type 2 diabetics. Even at such a low dose, they found that the patients in the omega-3 group exhibited significantly greater improvements in glycemic status, blood pressure, lipid profiles, and reductions in markers of oxidative stress as compared to a placebo group of type 2 diabetics (58).

- It's well established that the various types of fatty acids are clearly involved in the onset of chronic conditions (such as insulin resistance and obesity) characterized by inflammation. In overweight subjects, higher concentrations of saturated fats and omega-6 and lower concentrations of omega-3 fatty acids are significantly associated with higher concentrations of circulating interleukin-6 (IL-6), a marker of inflammation. Interestingly, though, these associations are not apparent in lean subjects (59).

- In a 14-year study of 84,204 female nurses ages 34-59, the risk of type 2 diabetes was significantly positively associated with high consumptions of trans fatty acids and cholesterol, whereas the condition was negatively associated with omega-3 and omega-6 polyunsaturated fatty acids. The investigators estimated that "replacing 2% of energy from trans fatty acids isoenergetically with polyunsaturated fat would lead to a 40% lower risk" of type 2 diabetes (60). I guess it's time to replace the doughnuts in the nurses' lounge with canned salmon. Or, you could contact Krispy Kreme about introducing the chocolate frosted sardine filled doughnut!

- Chicco et al (1996) found that low-dose fish oil supplementation in rats led to significant reductions in blood lipids and plasma insulin levels without changes in glucose tolerance. The investigators hypothesized that because no changes in pancreatic insulin content were apparent, the lower insulin levels may have been due to improvements in peripheral insulin sensitivity (61).

- Unfortunately, studies attempting to demonstrate these effects in humans have been less impressive (62-64). In spite of the fact that omega-3 consumption in the form of fish increased HDL cholesterol and improved overall dyslipidemia in overweight patients, Mori et al (1999) found no independent effect of fish consumption on glucose or insulin (62). Others have come to similar conclusions with actual fish oil supplementation (63,64).

Resting Metabolic Rate:
- Eric Noreen has done extensive work examining the effect of fish oil on resting metabolic rate (RMR). At the 2003 American College of Sports Medicine Annual Conference, Noreen presented the results of a study that compared RMR in subjects supplemented with 9g of safflower oil (predominately omega-6), 3, 6, or 9g of 60% concentrated fish oil. The fish oil groups saw daily RMR increases of 141 to 448 calories, whereas the safflower group's RMR actually decreased. As an added bonus, the fish oil group also lost a little bit of fat mass while gaining some lean body mass. (65)

Body Composition Regulation and Leptin:
• Leptin is a hormone released by adipocytes that has a great impact on body fat levels. In simple terms, the amount of leptin present in one's body serves as feedback to the brain about whether one is okay as far as nutritional status is concerned. As you get leaner, leptin levels drop; as you get pudgier, they go up. These are important responses, as high leptin concentrations are associated with decreased hunger and food intake and increased energy expenditure, all of which are important factors in getting and staying lean.

• Unfortunately, as you get leaner, leptin levels drop as your body essentially senses starvation-like conditions; this decrease makes it difficult to get and stay lean. Fish oil may be able to help with this problem, as rats fed high omega-3 diets demonstrate up-regulation in plasma leptin concentrations significantly above what is predicted based on body fat levels (66,67).

• In an overfeeding study of rats with 42% of their energy intakes as fish oil, safflower oil, olive oil, or beef tallow, the fish oil group had the greater lean body mass gains and the lowest fat mass gains (68). In other words, if you're going to stuff yourself, be sure to include some fish oil in the feast.

Psychological Disorders:
• Maes et al (1999) observed that there is a significant deficiency in omega-3 fatty acids serum phospholipids and red blood cell membranes in major depression. Furthermore, the deficiency is likely a result of abnormal omega-3 metabolism in depressed patients and may continue in spite of treatment with antidepressants (69). As such, fish oil treatment may serve as an important adjunct to or even a replacement for traditional antidepressant therapy.

• Hibbeln and Salem (1995) proposed that low concentrations of polyunsaturated fatty acids may be related to increased risks of suicide, depression, alcoholism, and post-partum depression (70).

• Four out of five trials of EPA in the treatment of schizophrenia have demonstrated significant reduction in patient episodes of severe mania and depression following supplementation (71).

• In an eight-week study of 28 clinically depressed patients receiving either 9.6 g omega-3 fatty acids per day or a placebo, there were significant decreases in scores on the Hamilton Rating Scale for Depression, an evaluative tool on which high scores indicate more severe feelings of depression (72).

• Zanarini and Frankenburg (2003) studied the effects of 1 g/day ethyl-EPA (or placebo) on thirty females with borderline personality disorder. The ethyl-EPA supplement proved "to be superior to placebo in diminishing aggression as well as the severity of depressive symptoms (73)."

• Attention-deficit/hyperactivity disorder (ADHD) may be related to an abnormality in polyunsaturated fatty acid metabolism. As such, both Richardson and Puri (2000) and Kidd (2000) have proposed that omega-3 fatty acid supplementation may have merits in the treatment of this condition, although more research is warranted in this regard (74,75).

The Response to Stress:
• Here's one for the Type As out there. Delarue et al (2003) studied seven subjects on two occasions separated by three weeks. In the first session, these seven individuals were subjected to mental stress in the form of mental arithmetic and the Stroop task, and measures of sympathoadrenal activation (plasma cortisol, catecholamines, energy expenditure, and adipose tissue lipolysis) were taken thirty minutes after the stress. After this mental stress challenge, each subject supplemented with 7.2 g fish oil/day for three weeks, at which point they took the battery of tests again. In this second session, plasma epinephrine, cortisol, energy expenditure, and plasma non-esterified fatty acids concentrations, were all significantly lower than in the initial session. The investigators
therefore concluded that omega-3 fatty acid supplementation “inhibits the adrenal activation elicited by a mental stress, presumably through effects exerted at the level of the central nervous system (76).” It appears that omega-3 fatty acids are able to partially inhibit the pro-inflammatory response to psychological stress (77). Ever get a racing heart or high blood pressure before a test, presentation, or job interview? Fish oil may be just what you need to get mellow!

Migraine Headaches:

• In a study of 27 adolescents with chronic migraines, supplementation with fish oil led to reductions of 87% in headache frequency, 74% in headache duration, and 78% in headache severity compared to a period prior to the study. Interestingly, olive oil (the placebo) produced similar results, although they were not quite as favorable (78).

Epilepsy:

• Many anticonvulsant medications for epileptics have highly undesirable side effects. In light of the profound roles of omega-3 fatty acids in immune and nervous system activities, Rabinovitz and colleagues (2004) compared the effects of carbamazepine (CBZ) and SR-3, a compound with a 1:4 omega-3: omega-6 ratio, on seizure control efficiency, and protection against cognitive impairment and cortisol elevation in rats. While the two treatments were equally effective in controlling seizures, SR-3 proved to be superior on the latter two measures (79). Treating epilepsy with omega-3 compounds is certainly a new frontier, so more research is warranted (especially in human subjects) to determine its true efficacy.

Chronic Fatigue Syndrome (CFS):

• The exact cause of CFS remains to be determined, but there is speculation that it could involve abnormalities at the immune, neuroendocrine, and autonomic levels. Because fish oil inhibits the production of certain pro-inflammatory substances, many experts believe that it holds great potential in the treatment of CFS. Research is ongoing (80).

Fibromyalgia:

• Several experts predict a role for omega-3 fatty acids in the treatment of fibromyalgia; anecdotal evidence supports this assertion, and further research is certainly warranted on this front (81).

Cirrhosis:

• In chronic liver disease, widespread inflammation can cause the liver to become fibrotic. In light of the known anti-inflammatory benefits of omega-3 fatty acids, Hayashi et al (1999) studied the effect of EPA and DHA supplementation on four patients with hepatitis B infection, one with hepatitis C virus cirrhosis, and one with alcohol-related cirrhosis. Subtle reductions were observed in globulin (a marker of liver pathology) with simultaneous increases in HDL cholesterol and various apolipoproteins (protective agents against hepatitis-related liver disease) (82).

Closing Thoughts

If you aren't taking fish oil, you’re an idiot. Seriously. Okay, I'll leave you with a bit more practical wisdom instead. The typical fish oil capsule you'll encounter is 1000 mg fish oil; we, however, are more concerned with the EPA and DHA content of that 1000 mg. In most cases, you'll find 180 mg EPA and 120 mg DHA per capsule. A good rule of thumb (especially based on the results of the clinical trials) is to consume 3-6 g combined EPA and DHA per day; at this capsule size, you'd need 10-20 capsules per day. For this reason, liquid fish oil is a great alternative.

A small percentage of people will suffer from fish burps with the EPA/DHA supplementation; if you're one of those individuals, I recommend you take all your fish oil with your last meal of the day. That way, if you
have salmon belches, they'll be in your sleep! Another alternative is to just eat fatty fish every day, but that can get old very quickly!

Finally, be patient! Read the finer details of all of the studies that I've outlined and you'll realize that the majority of them were at least 6-8 weeks in duration (usually longer). Your body needs time to make good use of these healthy raw materials, so count on a few months before you see noticeable results if you have one of the aforementioned conditions. For the rest of you, you probably won't notice much, but I guarantee that you'll be healthier in the long run.

References (continued)


