

Fish Oils and Heart Health

Summaries of the latest research concerning fish oils and heart health

Review supports benefits of omega-3 fatty acids for prevention of heart disease

ATLANTA, GEORGIA. Omega-3 polyunsaturated fatty acids (n-3 PUFAs) have been linked to lower mortality from coronary heart disease (CHD) in several, but not all, observational studies on the topic. Prevention trials of n-3 PUFAs have also supported a role in CHD prevention, but several different varieties of n-3 PUFAs were used. Now, researchers from Emory University School of Medicine have reviewed the data from randomized controlled clinical trials on n-3 PUFAs and CHD. The studies were divided into those using plant-based n-3 PUFAs (alpha-linolenic acid, ALA), fish-based n-3 PUFAs (eicosapentaenoic acid, EPA, and docosahexaenoic acid, DHA), and fish consumption in the diet. Fourteen randomized clinical trials were included in the review, six of which were of fish oil, including one large trial of 10,000 participants. The researchers report a clear trend suggesting that there are important differences in CHD outcomes when using fish-based EPA or DHA compared with plant-based ALA. Most of the fish oil trials suggest a significant reduction in total mortality and CHD deaths and a possible strong antiarrhythmic effect. The dietary fish trials also suggest a reduction in mortality and reduced arrhythmia, supporting the theory that fish-based n-3 PUFAs may impart their cardioprotective effect by acting as an antiarrhythmic agent. They may do so by stabilizing the electrical activity of heart muscle cells or by decreasing the heart rate. The trials of ALA supplements and ALA-enriched diets, including walnut, soybean, or flaxseed oil, were less reliable, but showed possible benefits in reducing mortality. The review concludes that the evidence suggests a role for fish oil (EPA, DHA) or fish in secondary prevention, as clinical trial data demonstrate a significant reduction in total mortality, coronary heart disease death, and sudden death. However the data on ALA is limited by studies of limited quality. Several previous studies have suggested that n-3 PUFAs reduce heart attack risk through benefiting endothelial function (cells of blood vessel walls), reducing inflammation, and the risk of thrombosis (blood clotting). The American Heart Association has published guidelines for patients with CHD recommending a consumption of fish and fish oil, totaling 1g/day of EPA and DHA. *Harper, C.R. and Jacobson, T.A. Usefulness of Omega-3 Fatty Acids and the Prevention of Coronary Heart Disease. American Journal of Cardiology, Vol. 96, December 2005, pp. 1521-29/*

Omega-3 fatty acids may reduce mortality from heart disease

BASEL, SWITZERLAND. Hyperlipidemia, or excess levels of fats in the blood, is associated with increased risk of cardiovascular disease. Many lipid-lowering agents exist for both primary and secondary prevention of cardiovascular disease. To determine the overall benefit of these agents on mortality, a group of researchers at the University Hospital Basel reviewed the most reliable published studies. They searched for good-quality randomized, controlled trials between 1965 and 2003, comparing lipid-lowering drugs or dietary interventions against placebo. This process left them with 35 trials on statins, 17 on fibrates, 8 on resins, 2 on niacin, 14 on omega-3 fatty acids, and 17 on other dietary interventions. This produced a total of 137,140 participants in treatments groups and 138,976 in control groups. A combined analysis showed that treatment with omega-3 fatty acids (fish and flaxseed oils) reduced overall risk of death by 23 per cent as compared to placebo. Treatment with statin drugs, on the other hand, only reduced overall mortality by 13 per cent as compared to placebo. Fibrates (gemfibrozil, fenofibrates), bile acid resins (cholestyramine, colestipol), niacin and dietary interventions showed no statistically significant differences from results obtained in the control groups. Deaths from cardiovascular

causes were 32 per cent lower in the omega-3 fatty acid groups than in control (placebo) groups. Statin drugs reduced cardiovascular mortality by 22 per cent and the use of bile acid resins were associated with a 30 per cent decline in cardiovascular mortality. When death from non-cardiovascular causes was considered, none of the interventions were significantly linked to reduced mortality. However, fibrates were linked to a 13 per cent increased risk of death. The effects on mortality tended to be more pronounced in longer studies and those with patients whose cardiovascular disease was well established, say the authors. Regarding n-3 fatty acids, they speculate that the reduction in mortality risk does not occur through a reduction in cholesterol but by other means, possibly antiarrhythmic, antithrombotic or anti-inflammatory effects. The trials of n-3 fatty acids used different dietary and supplement sources; nevertheless, the authors conclude that this study adds to the positive evidence for n-3 fatty acids. They suggest that further trials be carried out to examine the effects of combined treatment with n-3 fatty acids and statins. / *Studer, M., et al. Effect of different antilipidemic agents and diets on mortality. Archives of Internal Medicine, Vol. 165, April 2005, pp. 725-30/*

Eating fish may lower inflammation in the blood vessels

ATHENS, GREECE. Consuming fish has long been thought to help protect against heart disease, possibly through reducing inflammation in blood vessels. However, study results on the effects of fish on inflammatory markers are mixed, so a team of researchers from Harokopio University set out to examine the relationship in a population-based group of men and women free of heart disease. They gathered data on 1,514 men and 1,528 women aged 18 to 89, taking part in the ongoing ATTICA study into the benefits of a Mediterranean diet on heart health. Compared to those who did not eat fish, those who ate the most (10.5 ounces per week or more) had an average 33 per cent lower level of C-reactive protein, a widely-used marker for inflammation. They also had a 33 per cent lower level of interleukin-6, another inflammatory marker found in the plasma. This group had 21 per cent lower tumor necrosis factor-alpha, which affects lipid metabolism, coagulation, and insulin resistance, and 28 per cent lower serum amyloid A, a blood protein increased by inflammation. Significantly lower levels of these markers were also found in people who ate about 5 to 10 ounces of fish per week. This clear and strong inverse association between fish consumption and inflammatory markers may help explain why people who eat fish tend to have lower rates of heart disease, say the authors. The benefits remained once many risk factors were taken into account and were observed even in people with high blood pressure or diabetes, but not high cholesterol. Nevertheless, it was a cross-sectional study which did not follow people over time, so cannot prove causation. These results support recommendations that people eat more fish, the authors write, particularly oily fish with their high levels of omega-3 fatty acids. One or two portions per week may be sufficient, but the fish should not be fried. In some cases, omega-3 fatty acid supplements may be appropriate to achieve an optimal intake of 0.6 grams of omega-3 fatty acids per day. *Zampelas, A. et al. Fish consumption among healthy adults is associated with decreased levels of inflammatory markers related to cardiovascular disease: The ATTICA Study. Journal of the American College of Cardiology, Vol. 46, July 2005, pp. 120-24/*

Polyunsaturated fatty acids don't compete over benefits

BOSTON, MASSACHUSETTS. Polyunsaturated fatty acids (PUFAs) are effective at reducing heart disease risk, but fears have been raised that n-6 PUFAs may interfere with the metabolism of n-3 PUFAs. However, new evidence from Harvard Medical School will help put these fears to rest. Researchers studied the links between various PUFA intakes and the incidence of coronary heart disease (CHD) in 45,722 men enrolled in the Health Professionals Follow-up Study. A reliable food-frequency questionnaire was given at the start and completed every four years to determine PUFA intakes. During the 14 years of follow-up, there were 218 sudden deaths, 1,521 nonfatal myocardial infarctions (MIs) and 2,306 total CHD events (combined sudden death, other CHD deaths, and nonfatal MI) among the participants. Dietary analysis showed that both

seafood-derived long-chain and plant-derived intermediate-chain n-3 PUFA intakes were linked to a reduced CHD risk, regardless of n-6 PUFA intake. Men who consumed more than 250 mg seafood-based n-3 PUFA per day had a 40-50 per cent lower risk of CHD. The researchers also looked at the relationship between seafood-based n-3 PUFAs and plant-based n-3 PUFAs. They found that when seafood-based n-3 PUFA intake is low (less than 100 mg per day), plant-based n-3 PUFAs are particularly effective at reducing CHD risk. For every additional 1 g of plant-based n-3 PUFA per day, MI risk was reduced by 58 per cent and total CHD risk was reduced by 47 per cent. Contrary to previous findings, this study found no links between overall CHD risk and intake of n-6 PUFAs. The results suggest that a modest dietary intake of seafood (250 mg, equaling around 1-2 oily fish meals a week) may lower the risk of CHD, irrespective of n-6 PUFA intake. The authors concluded that plant sources of PUFAs are especially important in populations with limited access to, or consumption of seafood. *Mozaffarian D et al. Interplay between different polyunsaturated fatty acids and risk of coronary heart disease in men. Circulation, Vol. 111, January 2005, pp.157-164/*

Determination of omega-3 fatty acids in heart tissue

KANSAS CITY, MISSOURI. There is overwhelming evidence that omega-3 fatty acids or, more specifically, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), the main components of fish oils, are highly effective in preventing sudden cardiac death, death from heart disease, and certain arrhythmias. Investigations involving individual heart cells have shown that EPA + DHA prolong the refractory state of the cells by interacting with fast-acting sodium channels and L-type calcium channels. It is thus clear that the cardioprotective effect of EPA + DHA is intimately associated with the degree to which these two fatty acids are actually incorporated into the heart tissue (myocardium). The ultimate test of the extent of incorporation is, of course, analysis of the heart tissue itself; however this, for obvious reasons, is not terribly practical. Researchers at the Mid America Heart Institute now report that the EPA + DHA content of red blood cells (RBCs) almost exactly mirrors the concentration in the myocardium. Their study involved 20 heart transplant patients whose EPA + DHA level was measured in heart tissue and red blood cells. The researchers found an almost perfect correlation ($r = 0.82$) between the content in cardiac tissue and the content of RBCs. In a subsequent experiment involving 25 heart transplant patients, the researchers measured EPA + DHA in biopsied myocardial tissue, plasma lipids, cells scraped from the cheek (buccal tissue), and red blood cells before and after 6 months of supplementation with 300 mg EPA + 200 mg DHA. The supplementation resulted in a 272% increase in EPA and a 94% increase in DHA in the heart tissue itself. The corresponding increases in plasma lipids, buccal tissue, and RBCs were 365% and 104%, 124% and 95%, and 279% and 84% respectively. The best correlation was between myocardial tissue and RBCs followed by myocardial tissue and buccal tissue. The researchers conclude that EPA and DHA levels in RBCs give an accurate indication of the content in heart cells. Buccal tissue is also a good indicator, but more cumbersome and exacting to obtain than a blood sample. The researchers also point out that RBC content is a good indicator of long-term intake, whereas plasma lipids vary depending on the food consumed on the day immediately preceding the test. *Harris, WS, et al. Omega-3 fatty acids in cardiac biopsies from heart transplantation patients: correlation with erythrocytes and response to supplementation. Circulation, Vol. 110, September 21, 2004, pp. 1645-49/*

Fish oils recommended for heart disease prevention

DALLAS, TEXAS. The American Heart Association has reviewed the benefits of regular consumption of fish and fish oils. The review concludes that fish and fish oils help prevent cardiovascular disease including fatal and non-fatal heart attacks, strokes, sudden cardiac death, and coronary artery disease (angina). The reviewers believe that the mechanisms by which fish oils exert their protective effect include: * Reduction in susceptibility to ventricular arrhythmia * Decrease in platelet aggregation * Reduction in triglyceride levels * Retardation of atherosclerosis

* Lowering of blood pressure * Promotion of nitric oxide induced endothelial relaxation * Anti-inflammatory effects. Fish and fish oils contain long-chain polyunsaturated omega-3 fatty acids, more specifically, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). The average American diet contains only about 100-200 mg/day of EPA and DHA. The diet also contains about 1.4 grams/day of alpha-linolenic acid mainly from canola and soybean oils. Alpha-linolenic acid can be converted in the body to EPA and DHA, but not in amounts sufficient to make a significant impact. Some studies have shown that alpha-linolenic acid, on its own, may have heart-protective effects, but other studies have failed to confirm this. NOTE: Flax seed oil is a particularly rich source of alpha-linolenic acid. The American Heart Association recommends that people increase their intake of long-chain polyunsaturated omega-3 oils from fish or directly from fish oil supplements. Healthy people should consume oily fish at least twice a week. Patients with heart disease should eat enough oily fish on a daily basis to obtain about 1 gram per day of EPA and DHA combined or take a fish oil supplement providing 1 gram per day of EPA + DHA. Patients with high triglyceride levels should receive 2-4 grams/day of EPA+DHA under the care of a physician. The reviewers point out that many fish species contain significant amounts of methylmercury, polychlorinated biphenyls (PCBs), dioxins, and other environmental contaminants and therefore must be consumed in moderation, if at all, especially by children and pregnant and lactating women. Poorer quality fish oils may also contain these contaminants, so it is important to only supplement with highly purified, pharmaceutical grade oils. *Kris-Etherton, PM, et al. Fish consumption, fish oil, omega-3 fatty acids, and cardiovascular disease. Circulation, Vol. 106, November 19, 2002, pp. 2747-57/*

Antiarrhythmic properties of fish oils

CHIETI, ITALY. Several large clinical trials have confirmed the ability of fish oils to prevent sudden cardiac death in both presumably healthy subjects as well as in patients having suffered a heart attack (myocardial infarction). Considering that sudden cardiac death, largely caused by ventricular fibrillation, accounts for somewhere between 250,000 and 300,000 deaths every year in the US alone, it is clearly highly significant that a diet rich in oily fish or fish oil supplements may reduce the incidence of sudden cardiac death by up to 45%. Researchers at the universities of Chieti and Pisa recently published a review of the current "state-of-the-art" in regard to fish oils and arrhythmias. Highlights are: * Supplementation with fish oils shows its beneficial effect within a few weeks. * It is unlikely that the biological effects of fish oils would vary depending on source (oily fish or fish oil supplement). * Animal experiments have shown that fish oils act on individual myocytes (heart cells) to inhibit the excitatory Na⁺ current, stabilize the inactivated state of the Na channel, and prolong the effective refractory period of the cardiac cycle. The L-type Ca⁺⁺ current is also inhibited by fish oils and the outward flow of K⁺ is reduced. All effects which would reduce the tendency to arrhythmia either by decreasing automaticity or by interfering with re-entry circuits. * Two small trials have shown a reduction in PVCs (premature ventricular complexes) with fish oil supplementation. In one of these trials 34 participants with frequent PVCs, but no life-threatening arrhythmias were given 2.4 grams/day of fish oils while the control group was given sunflower seed oil which is rich in linoleic acid (an omega-6 fatty acid). PVCs decreased by 48% in the fish oil group as compared to 25% in the sunflower seed group. * Fish oils have been shown to decrease heart rate variability and there is some suggestion that they may also reduce sympathetic and increase parasympathetic (vagal) activity in the autonomic nervous system. * Prostaglandins and thromboxane A₂, produced from arachidonic acid, are mostly proarrhythmic so a high intake of omega-6 fatty acids may be detrimental. Although most research, so far, has focused on the effect of fish oil on life-threatening ventricular arrhythmias it is likely that many of the findings may also be applicable to atrial fibrillation. *De Caterina, Raffaele, et al. Antiarrhythmic effects of omega-3 fatty acids: from epidemiology to bedside. American Heart Journal, Vol. 146, September 2003, pp. 420-30/*

Fish consumption lowers heart rate

LILLE, FRANCE. There is increasing evidence that an elevated heart rate is associated with an increased risk of sudden cardiac death. In the Paris Prospective Study, which included more than 7700 men followed up for 23 years, the mean difference between controls and patients who died suddenly from cardiac arrest was 4.1 beats per minute. A group of European researchers now reports that regular fish consumption can lower heart rate by as much as 2 bpm. Their study included 9758 men aged 50 to 59 years from four European cities (Belfast, Lille, Strasbourg, and Toulouse). Twenty-seven per cent of the men consumed fish less than once per week, 47% consumed fish once a week, 20% twice a week, and the remaining 6% more than twice a week. The average heart rate (adjusted for age, physical activity, smoking, alcohol consumption, etc) was 67.5 bpm in men consuming fish less than once per week and 65.6 bpm in men consuming fish more than twice per week. Fish consumers also had lower triglyceride levels, lower blood pressure (both systolic and diastolic), and higher levels of beneficial HDL cholesterol than did non-consumers. The erythrocyte content of DHA (docosahexaenoic acid) in the blood was found to be inversely correlated with heart rate. The researchers point out that there is considerable evidence that omega-3 fatty acids such as those found in fish and fish oils stabilize the electrical activity of heart cells by elevating the action potential threshold and prolonging the relative refractory time. There is also evidence that a high omega-3 content of blood cells and serum cholesterol esters is associated with increased heart rate variability. A higher heart rate variability has been associated with a decreased risk of cardiac disease and a longer lifespan.

Dallongeville, Jean, et al. Fish consumption is associated with lower heart rates. Circulation, Vol. 108, August 19, 2003, pp. 820-25/

Fish oils benefit the heart

SOUTHAMPTON, UNITED KINGDOM. It is well established that populations with a high consumption of oily fish have a lower incidence of heart disease and several studies have confirmed that fish oils (eicosapentaenoic acid [EPA] and docosahexaenoic acid [DHA]) are the protective components. There is also impressive evidence that they help prevent atherosclerosis, lower blood pressure, reduce triglyceride levels, and are highly protective against both fatal and non-fatal heart attacks. Fish oils also have antiarrhythmic effects and help prevent blood clotting. Recent research concludes that perhaps the most important effect of fish oils, when it comes to preventing cardiovascular disease, is their ability to stabilize atherosclerotic plaque by reducing the infiltration of inflammatory and immune cells (lymphocytes and macrophages) into the plaque. Heart attacks are now believed to involve the rupture of an atherosclerotic plaque. These plaques come in two main varieties, those with a thin, unstable fibrous cap and those with a thick, stable fibrous cap. A recent study showed that supplementation with 1.4 grams/day of fish oil significantly reduced macrophage infiltration and resulted in a substantial shift towards a preponderance of stable, thick-capped plaques. At least two studies have shown that the beneficial effects of fish oils on heart health become clear after about 2 months. *Calder, Philip C. New evidence in support of the cardiovascular benefit of long-chain n-3 fatty acids. Italian Heart Journal, Vol. 4, July 2003, pp. 427-29 /*

Fish oils help prevent stroke and heart attacks

SOUTHAMPTON, UNITED KINGDOM. Atherosclerosis increases the risk of stroke and heart attack because part of the atherosclerotic buildup (plaque) on the inner wall of arteries may dislodge and block smaller arteries in the brain and heart respectively and thus cut off the vital supply of oxygenated blood. Depending on its tendency to break loose from the artery wall plaque is classified as either stable or unstable with the stable form being the least likely to cause problems. Researchers at the University of Southampton have just completed a clinical trial to see if fish oil supplementation would improve plaque stability and thus help prevent heart attack and stroke. Their study involved 162 patients who were awaiting carotid endarterectomy (an

operation involving the removal of atherosclerotic deposits from the carotid artery feeding the brain). The patients were randomly allocated to receive a placebo, fish oil (omega-3 polyunsaturated fatty acid) or sunflower oil (omega-6 polyunsaturated fatty acid) daily from the time they entered the study until the endarterectomy during which atherosclerotic plaque was removed for analysis. The placebo capsules contained an 80:20 blend of palm and soybean oils (a composition which closely matches that of the average UK diet); the sunflower oil capsules contained 1 gram of sunflower oil plus 1 mg of vitamin E (alpha-tocopherol); the fish oil capsules contained 1 gram of fish oil and 1 mg of vitamin E. The participants took 6 capsules daily providing a total to 3.6 grams linoleic acid (in the sunflower oil capsules) or 850 mg EPA (eicosapentaenoic acid) + 500 mg of DHA (docosahexaenoic acid) in the fish oil capsules. The duration of supplementation varied between 7 and 189 days with the median being 42 days. Upon analysis of the removed plaque the researchers found that the supplemented fish oil (EPA and DHA) had been readily incorporated into the plaques and had resulted in favourable changes. Plaque from fish oil treated patients tended to have thick fibrous caps and no signs of inflammation indicating more stability. Plaques from the control and sunflower oil groups, on the other hand, tended to have thin fibrous caps and signs of inflammation indicating less stability. The number of macrophages (large scavenger cells) in the plaque of fish oil treated patients was also significantly less than the number observed in the control and sunflower oil groups. The researchers conclude that the increased plaque stability observed in the fish oil treated patients could explain the reduction in fatal and non-fatal heart attacks and strokes associated with an increased intake of fish oils. *Thies, Frank, et al. Association of n-3 polyunsaturated fatty acids with stability of atherosclerotic plaques: a randomised controlled trial. The Lancet, Vol. 361, February 8, 2003, pp. 477-85/*

Older people benefit from fish oils

SEATTLE, WASHINGTON. There is abundant evidence that a diet rich in fatty fish is highly protective against death from heart disease in people 65 years of age and younger. Now researchers at the University of Washington and the Fred Hutchinson Cancer Research Center have extended the evidence to include people with an average age of 78 years. Their study included 54 men and women who had suffered a fatal heart attack or other fatal ischemic heart disease event, 125 people who had suffered a non-fatal heart attack, and 179 matched controls. All study subjects had blood samples drawn about 2 years prior to the cardiovascular event. The phospholipid phase of the blood plasma was isolated and analyzed for its contents of the fatty acids eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), alpha-linolenic acid (ALA), and linoleic acid (LA). EPA and DHA are the main constituents of fish oil, ALA is found in canola, flax and soybean oils, and LA is a main constituent of safflower and cottonseed oils. The researchers found that subjects with a high phospholipid content of EPA + DHA had a 70% lower incidence of fatal heart disease than did those with a lower level (4.1% versus 3.3% of total fatty acids). Participants with a high level of ALA had a 50% reduced risk of fatal heart disease. Subjects with a high level of LA, on the other hand, had a 2.4 times higher incidence of fatal heart disease than did those with a lower level. There was no association between the levels of the fatty acids and the incidence of non-fatal heart attacks. The researchers ascribe this to the fact that EPA and DHA (and perhaps ALA) are known to prevent ventricular arrhythmias the main factor in sudden cardiac death. Ventricular arrhythmias are not involved in non-fatal heart attacks. The researchers conclude that their findings lend further support to the recommendation from the American Heart Association to consume 2 fish meals (preferably fatty fish) per week. Dr. William Harris of the University of Missouri, in commenting on the results, suggests that a combined daily intake of 1 gram of EPA + DHA is both safe and prudent, but that supplementation with fish oil capsules may be required to achieve this goal. / *Lemaitre, RN, et al. n-3 polyunsaturated fatty acids, fatal ischemic heart disease, and nonfatal myocardial infarction in older adults: the Cardiovascular Health Study. American Journal of Clinical Nutrition, Vol. 77, February 2003, pp. 319-25 Harris, WS. n-3 long-chain polyunsaturated fatty acids reduce risk of coronary heart disease death: extending the evidence to the elderly. American Journal of Clinical Nutrition, Vol. 77, February 2003, pp. 279-80 (editorial)/*

Fish oils for heart health

The American Heart Association has acknowledged that the omega-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are essential for heart health. They now recommend that people without heart disease eat fish 2 or more times per week and consume a diet rich in alpha-linolenic acid. Heart disease patients should consume about 1 gram of EPA and DHA daily. Patients with high triglyceride levels may benefit from supplementing with 2 to 4 grams of EPA plus DHA per day in capsule form. EPA and DHA are the main components of fish oils. *Arteriosclerosis, Thrombosis and Vascular Biology, Vol. 23, February 2003, pp. e23-e31, 151-52/*

Fish oils protect women against heart disease

BOSTON, MASSACHUSETTS. There is ample evidence that frequent fish consumption or supplementation with fish oils markedly reduces the risk of coronary heart disease, sudden cardiac death, and heart attacks in men. Up until now there has been little work done to see if the same holds true for women. Researchers at the Harvard Public School of Health have just released the results of a major study aimed at remedying this situation. The study involved 84,688 female nurses who were enrolled in 1970. All participants completed food frequency questionnaires in 1980, 1984, 1986, 1990 and 1994. In the 16-year period between 1980 and 1996 a total of 1513 women either died from coronary heart disease (484) or suffered a non-fatal heart attack (1029). After adjusting for age, smoking and other known cardiovascular risk factors the researchers conclude that women who eat fish once a week have a 34 per cent lower incidence of death from heart disease and a 25 per cent lower incidence of non-fatal heart attacks. They also conclude that the protective effect of fish consumption is entirely due to the content of omega-3 fatty acids (fish oils) in the fish. They also note that both fish and fish oil consumption were associated with a decreased risk of dying from any cause. The researchers believe that fish oils reduce the incidence of heart disease through their antiarrhythmic effects and their reduction of platelet aggregability and triglyceride levels. They conclude that their findings lend further support to the benefits of twice weekly fish consumption. *Hu, Frank B., et al. Fish and omega-3 fatty acid intake and risk of coronary heart disease in women. Journal of the American Medical Association, Vol. 287, April 10, 2002, pp. 1815-21/*

Fish oils protect against sudden death

BOSTON, MASSACHUSETTS. Sudden cardiac death kills about 250,000 Americans every year and half of them have no known cardiovascular disease when they are suddenly struck down. Researchers at Brigham and Women's Hospital and the Harvard School of Public Health now report that men with a high intake of oils from fatty fish (eicosapentaenoic acid [EPA] and docosahexaenoic acid [DHA]) have an 81 per cent lower risk of sudden cardiac death than do men with a low intake. Their study involved a group of 15,000 male physicians aged 40 to 82 years when they enrolled in the study. Over a 17-year follow-up period 94 men with no known cardiovascular disease died suddenly from heart failure (sudden cardiac death). Blood samples taken from the men at enrollment were analyzed for fatty acids and the results compared to those obtained from 184 controls. The average age of both controls and cases was 58 years. The researchers found that men whose blood levels of EPA and DHA constituted 6.87 per cent or more of their total fatty acid concentration had an 81 per cent lower risk of sudden cardiac death than did men whose level was 3.58 per cent or less. This correlation remained after adjusting for confounding factors such as diabetes, hypertension, exercise, aspirin usage, cholesterol levels, alcohol consumption, etc. The researchers conclude that their findings support the hypothesis that fish oils (EPA and DHA) are responsible for the inverse association between fish consumption and sudden death. Dr. Irwin Rosenberg, MD of Tufts University comments that the study is further proof that striving for a daily intake of 1 gram per day of fish oils (from fatty fish) helps protect against sudden cardiac death. *Albert, Christine M., et al. Blood levels of long-chain*

n-3 fatty acids and the risk of sudden death. New England Journal of Medicine, Vol. 346, April 11, 2002, pp. 1113-18 Rosenberg, Irwin H. Fish: food to calm the heart. New England Journal of Medicine, Vol. 346, April 11, 2002, pp. 1102-03/

Trans-fatty acids implicated in sudden death

SEATTLE, WASHINGTON. Almost two thirds of deaths from heart disease are sudden and almost half of all heart disease deaths occur before the patient reaches the hospital. What is perhaps even more disturbing is that 50 per cent of people dying suddenly from cardiac arrest never knew they had a heart problem. It is clear that finding the cause(s) of sudden cardiac death is a high priority. Researchers at the University of Washington now report that high levels of trans-fatty acids are strongly associated with an increased risk of sudden cardiac death. Their study involved 179 sudden death victims between the ages of 25 and 74 years and 285 age- and sex-matched controls. Both cases and controls had blood samples drawn and analyzed for fatty acid levels in red blood cell membranes. The researchers found that cardiac arrest victims tended to have significantly higher overall levels of trans-fatty acids than did the controls. Specifically, they had higher levels of 18:1 (oleic) and 18:2 (linoleic) trans-fatty acids and significantly lower levels of beneficial long chain omega-3 fatty acids (EPA and DHA). After adjusting for EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) and other factors which could affect heart disease risk they concluded that people with a high 18:2 (linoleic) trans-fatty acid level had a three times higher risk of sudden cardiac death than did people with lower levels. High levels of 18:1 (oleic) trans-fatty acids were not associated with increased risk. Linoleic trans-fatty acids are formed when vegetable oils are partially hydrogenated or used for frying and are also found in beef and chicken. Commercially prepared pizza and cookies are other potent sources of 18:2 acids. *Lemaitre, Rozenn N., et al. Cell membrane trans-fatty acids and the risk of primary cardiac arrest. Circulation, Vol. 105, February 12, 2002, pp. 697-701 Katz, Arnold M. Trans-fatty acids and sudden cardiac death. Circulation, Vol. 105, February 12, 2002, pp. 669-71 (editorial)/*

New risk factor for sudden death

PARIS, FRANCE. Sudden cardiac death is a common occurrence in industrialized countries. There is evidence that a high level of free fatty acids in the blood plasma is an independent risk factor for ventricular arrhythmias and sudden death in people who have suffered a heart attack. Medical researchers at the University of Paris now report that a high level of circulating free fatty acids (non- esterified) is also a potent risk factor for sudden death in men without cardiovascular disease. The study involved 5250 men, aged 42 to 53 years at the start of the study in 1967-72. All participants were free of cardiovascular disease at the time of entry. The men were followed for an average of 22 years during which 1601 deaths occurred ? 91 of them were classified as sudden cardiac deaths and 145 as fatal heart attacks. Analysis of test data showed that the level of free fatty acids circulating in the blood plasma is a potent risk factor for sudden death. Men with a high level had a 70 per cent higher risk than did men with a low level. Surprisingly, high fatty acid levels were not a risk factor for fatal heart attack. Other prominent risk factors for sudden death were parental sudden death, parental heart attack, smoking, high systolic blood pressure, and high body mass index (obesity). High cholesterol levels increased the risk of sudden death by a relatively modest 18 per cent. The researchers and Dr. Alexander Leaf, MD of the Harvard Medical School point out that not all fatty acids are detrimental. There is ample evidence that the omega-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), the main components of fish oil are actually highly protective against sudden cardiac death. Dr. Leaf believes that it is the omega-6 fatty acids found in vegetable oils (corn, safflower, sunflower, and peanut) that are responsible for initiating the arrhythmias leading to sudden death. Fish oils, on the other hand, exert a protective effect in amounts as low as 600-1000 mg/day (EPA+DHA). Dr. Leaf points out that government agencies and heart associations have long been advocating an increased intake of polyunsaturated fatty acids without making any distinction between omega-6 essential fatty acids which appear to promote sudden death and omega-3 fatty acids (EPA and

DHA) which prevent it. *Jouven, Xavier, et al. Circulating nonesterified fatty acid level as a predictive risk factor for sudden death in the population. Circulation, Vol. 104, August 14, 2001, pp. 756-61 Leaf, Alexander. Plasma nonesterified fatty acid concentration as a risk factor for sudden cardiac death: the Paris prospective study. Circulation, Vol. 104, August 14, 2001, pp. 744-45 (editorial)/*

Fish oils prevent sudden cardiac death

AALBORG, DENMARK. Sudden cardiac death is the most common cause of death in Western countries and accounts for about 50% of all deaths from heart disease. In other words, 50% of all people with heart disease have their condition ?diagnosed? by suddenly dying from it. It is clear that anything that might help to prevent sudden cardiac death (SCD) would be of immense benefit. Several clinical trials have concluded that eating fish regularly or supplementing with fish oils can reduce the risk of SCD by as much as 50%. Other studies have found that wine drinking also has a protective effect. Danish researchers now report that fish oils markedly increase heart rate variability and conclude that this is probably the explanation for their protective effect. Their study involved 291 patients who had been referred for coronary angiography because of suspected heart disease. The participants completed food questionnaires including a question about wine consumption and had their blood cell (granulocytes) and fat tissue level of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) determined. The participants also had their heart rate variability (HRV) measured over a 24-hour period. The researchers found an excellent correlation between the reported intake of fish and fat tissue levels of EPA and DHA. They also noted a distinct association between high EPA/DHA levels and high HRV. Patients with a high wine intake also had high HRV values, but further analysis showed that these patients also had a high fish intake. When corrected for this confounding variable there was no correlation between wine consumption and HRV. There also was no correlation between the intake of beer and HRV. The researchers conclude that high body levels of EPA and DHA can markedly reduce the risk of sudden cardiac death and ascribe this protective effect to the increased heart rate variability associated with increased fish or fish oil consumption. *Christensen, Jeppe Hagstrup, et al. Marine n-3 fatty acids, wine intake, and heart rate variability in patients referred for coronary angiography. Circulation, Vol. 103, February 6, 2001, pp. 651-57 Bigger, J. Thomas and El-Sherif, Tarek. Polyunsaturated fatty acids and cardiovascular events: a fish tale. Circulation, Vol. 103, February 6, 2001, pp. 623-25 (editorial)/*

Increased fish intake combats heart disease

DALLAS, TEXAS. The American Heart Association (AHA) has just released its most recent guidelines for reducing the risk of cardiovascular disease by dietary and other lifestyle practices. The AHA clearly endorses the consumption of fish or fish oils as a means of preventing and treating heart disease. The guidelines point to the growing body of evidence indicating that foods rich in omega-3 fatty acids, specifically eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), provide significant protection against heart disease. Among the benefits of EPA and DHA, the main components of fish oils, are: * Lower risk of arrhythmias * A reduction in the risk of sudden cardiac death * Lower plasma triglyceride levels * Reduced blood clotting tendency The guidelines recommend that the current intake of omega-3 fatty acids be increased and specifically recommend at least 2 servings of fish per week. The AHA is even more enthusiastic about fish oils when it comes to protecting patients with existing heart disease against further deterioration or death. They refer to numerous studies which have found that supplementing with 850 mg to 2.9 grams/day of fish oils is highly beneficial for heart disease patients. A recent large-scale trial found that patients with coronary heart disease who supplemented with 850 mg/day of EPA plus DHA reduced their risk of sudden death by 45% and their overall risk of death by 20%. The AHA guidelines conclude that ?Consumption of 1 fatty fish meal per day (or alternatively, a fish oil supplement) could result in an omega-3 fatty acid intake (i.e. EPA and DHA) of about 900 mg/day, an amount shown to beneficially affect coronary heart disease mortality rates in patients

with coronary disease. Other major AHA guidelines for heart disease prevention are: * Eliminate smoking and moderate intake of sugar, salt, alcohol, trans-fatty acids, saturated fatty acids, and cholesterol * Increase intake of fruits, vegetables and whole grains * Match energy (food) intake to energy needs so as to maintain a healthy body weight * Exercise more and spend less time on watching television and other sedentary activities. *Krauss, Ronald M., et al. AHA Dietary Guidelines - Revision 2000: a statement for healthcare professionals from the Nutrition Committee of the American Heart Association. Circulation, Vol. 102, October 31, 2000, pp. 2284-99/*

Fish consumption reduces heart disease risk

LISBON, PORTUGAL. Several studies have concluded that consumption of fish and fish oils reduces the risk of coronary artery disease. Researchers at the University of Lisbon now add further weight to this conclusion through their publication of a study designed to evaluate the differences in heart disease between a fishing village and an inland rural village on the island of Madeira. The mortality rate from heart disease in Camara de Lobos (the fishing village) was 310/100,000 men during the period 1990 to 1997 as compared to 1205/100,000 men in Curral (the rural village). Fifty men (aged 25 to 65 years) from the fishing village and 37 men from the rural village participated in the study. They all had fasting blood samples drawn and had their food intake evaluated by 2 nutritionists using a food frequency questionnaire. The men from the fishing village consumed 8 times more fish than did the men in the rural village and as a result had much higher levels of EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) in their blood than did the men in the rural village. The researchers observed a good correlation between fish intake and blood levels of EPA and DHA. They also found that the fishing village men had lower levels of triglycerides (28% lower) and total cholesterol (10% lower) than did the men from the inland village. Of particular note was the finding that the ratio of EPA to arachidonic acid in the blood was twice as high in the fishing village as in the rural village. A high ratio has, in other studies, been linked to a lower incidence of blood clots. The researchers conclude that regular fish consumption is associated with higher blood levels of EPA and DHA, lower triglyceride and cholesterol levels, and a 4 times lower mortality from coronary heart disease. *Torres, Isabel C., et al. Study of the effects of dietary fish intake on serum lipids and lipoproteins in two populations with different dietary habits. British Journal of Nutrition, Vol. 83, 2000, pp. 371-79/*

The ultimate supplement for heart health

KANSAS CITY, MISSOURI. Researchers at the Mid America Heart Institute have come out strongly in favor of routine fish or fish oil supplementation for heart patients and people at risk for heart disease. The researchers summarize the results of a large number of clinical trials which have clearly shown that fish oil supplementation or increased fish consumption can reduce the risk of dying from heart disease by 20- 50% or more. They believe that fish oils (eicosapentaenoic acid and docosahexaenoic acid) exert their protective effect by preventing fatal ventricular arrhythmias, by increasing heart rate variability, decreasing fibrinogen and platelet counts (important in preventing blood clotting) and by reducing blood pressure. A recent trial found that fish oils are highly effective in reducing ventricular premature complexes (missed heart beats) and they have also been found to counteract the arrhythmia-inducing properties of eicosanoids derived from arachidonic acid. The US Food and Drug Administration recently reviewed the safety profile of EPA and DHA and concludes that a combined daily intake of these two essential fatty acids of up to 3 grams per day is safe. The Heart Institute researchers point out that fish oils are effective in relatively small doses (approximately 1 gram/day) and have no adverse interactions with other heart drugs. They conclude "After 25 years of research, we believe that sufficient evidence is now available to recommend not only fish for cardiac patients, but also specifically EPA and DHA." *O'Keefe, Jr., James H. and Harris, William S. Omega-3 fatty acids: time for clinical implementation? American Journal of Cardiology, Vol. 85, May 15, 2000, pp. 1239-41* *O'Keefe, Jr., James H. and Harris, William S. From Inuit to implementation: omega-3*

fatty acids come of age. Mayo Clinic Proceedings, Vol. 75, June 2000, pp. 607-14 [85 references]
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Fish consumption and coronary heart disease

BILTHOVEN, THE NETHERLANDS. Several studies have found a correlation between fish consumption and death from coronary heart disease (CHD). By far the majority of the studies concluded that fish consumption reduces the risk of dying from CHD, but a few found no such effect and one even found a negative effect. A team of researchers from Finland, Italy, and the Netherlands believes they have found the reason for the differing results. Their study involved 2738 men who were aged 50 to 69 years at the start of the study in 1970. After 20 years of follow-up 242 (22.2%) of the Finnish men, 116 (10.6%) of the Italian men, and 105 (19%) of the Dutch men had died from CHD. The researchers found no correlation between total fish consumption and CHD mortality. They also failed to confirm a correlation between the consumption of lean fish (plaice, codfish, bream, perch, pike) and the risk of dying from CHD. However, when looking at the consumption of fatty fish (mackerel, herring, eel) the researchers found a clear protective effect. Men who habitually consumed fatty fish had a 34% lower risk of dying from CHD than did men who did not eat fatty fish. This correlation held true even after adjusting for other variables commonly associated with an increased risk of death from CHD. The researchers point out that while 15 grams of lean fish provides only about 50 mg of omega-3 fatty acids, 15 grams of fatty fish provides about 400 mg. They suggest that the oils in fatty fish (eicosapentaenoic acid and docosahexaenoic acid) prevent death from CHD through their inhibition of platelet aggregation, their antiarrhythmic properties, and their tendency to increase heart rate variability. The researchers believe that the reason why one study found a higher mortality from CHD among Finnish men consuming lean fish was that the fish from the area under study was heavily contaminated with mercury. *Oomen, Claudia M., et al. Fish consumption and coronary heart disease mortality in Finland, Italy, and the Netherlands. American Journal of Epidemiology, Vol. 151, May 15, 2000, pp. 999-1006 /*

Eat fish and live longer

BOSTON, MASSACHUSETTS. There is a growing consensus that regular fish consumption protects against heart disease. There is, however, still controversy as to whether this protection applies to all forms of heart disease and it is also not clear how fish exerts its protective effect. Some studies have found that fish consumption protects only against sudden cardiac death while others have found that it protects only against nonsudden death. Now researchers at the Harvard Medical School and the Brigham and Women's Hospital weigh in with a comprehensive new study which concludes that even modest fish and shellfish consumption protects against sudden cardiac death in men and significantly reduces total mortality. The study involved over 20,000 male American physicians who were between the ages of 40 and 84 years in 1982 when the study commenced. Food frequency questionnaires were administered after 12 and 18 months and again in 1988. By December 1995 133 of the participants had died from a sudden cardiac event (death occurring within one hour from onset of symptoms). Analysis of the collected data showed that the men who consumed fish once or more each week had a 52 per cent lower risk of dying from a sudden cardiac event than did the men who ate fish less than once a month. This lower risk applied after adjusting for all other known risk factors. The estimated dietary intake of marine n-3 fatty acids also correlated well with the risk of sudden cardiac death with an intake of more than 300 mg/month providing significant protection. The extent of protection did not increase significantly with greater fish or marine n-3 fatty acid intake indicating that eating fish once a week is sufficient to provide worthwhile protection. Fish consumption was not associated with the risk of nonsudden death, total myocardial infarction or total deaths from cardiovascular diseases. There was, however, a 30 per cent decrease in the overall mortality among the men consuming fish once or more each week as compared to the men eating fish less than once per month. The researchers speculate that fish consumption may exert its protective effect by

preventing fatal arrhythmias. They suggest that the n-3 fatty acids found in fish and shellfish (eicosapentaenoic acid and docosahexaenoic acid) are responsible for the antiarrhythmic properties and point out that alpha-linolenic acid, an n-3 fatty acid found in flax oil and nuts, also has antiarrhythmic properties. They did not investigate the benefits of fish oil supplements and purposely excluded 777 physicians from the study who were taking fish oil supplements. The researchers conclude that eating fish once per week may substantially reduce the risk of sudden cardiac death. In an accompanying editorial Dr. Daan Kromhout of the Dutch National Institute of Public Health concurs with this conclusion and adds that patients already suffering from cardiac disease should be advised to eat fish twice a week. *Albert, Christine M., et al. Fish consumption and risk of sudden cardiac death. Journal of the American Medical Association, Vol. 279, January 7, 1998, pp. 23-28* Kromhout, Daan. *Fish consumption and sudden cardiac death. Journal of the American Medical Association, Vol. 279, January 7, 1998, pp. 65-66 (editorial)*

Vegetable oils don't affect beneficial effects of fish oils

BATON ROUGE, LOUISIANA. Unsaturated fatty acids from fish and fish oils (eicosapentaenoic acid and docosahexaenoic acid) are highly effective in preventing death from cardiovascular disease. Fish oils have strong antiarrhythmic properties and help prevent death from ventricular fibrillation; they also help prevent blood clotting and lower cholesterol and triglyceride levels. Fish oils (n-3 polyunsaturated fatty acids) and n-6 polyunsaturated fatty acids (from vegetable oils) are metabolized in a similar way and n-3 polyunsaturated fatty acids (n-3 PUFAs) have been shown to block the conversion of linoleic acid, the major n-6 PUFA in vegetable oils, to arachidonic acid. These interactions and competitive metabolic pathways have raised concerns that the benefits of fish oil consumption may be reduced if the diet is high in n-6 PUFAs from vegetable oils. Researchers at the Louisiana State University have just released the results of a major study aimed at addressing these concerns. Their study involved 68 healthy men and women between the ages of 18 and 49 years. The participants consumed diets containing varying amounts of fish oils and vegetable oils for an eight-week period. The researchers found that fish oil supplementation lowered the blood plasma levels of triglycerides and arachidonic acid independent of the level of n-6 PUFAs in the diet. They conclude that vegetable oil in the diet does not reduce the benefits of fish oil in lowering the risk of death from heart disease. They also conclude that the fish oil intake required to effectively reduce triglyceride levels is less than six grams/day and that higher intakes do not confer added benefits. The daily intake required to affect a meaningful reduction in fibrinogen concentration (an indicator of blood clotting tendency) is less clear; it may be as low as 1.3 grams/day or as high as 15 grams/day. Further work is required to settle this question. [30 references] *Hwang, Daniel H., et al. Does vegetable oil attenuate the beneficial effects of fish oil in reducing risk factors for cardiovascular disease? American Journal of Clinical Nutrition, Vol. 66, July 1997, pp. 89-96* Connor, William E. *Do the n-3 fatty acids from fish prevent deaths from cardiovascular disease? American Journal of Clinical Nutrition, Vol. 66, July 1997, pp. 188-89 (editorial)*

Omega-3 fatty acids help protect against heart disease

SAN FRANCISCO, CALIFORNIA. Researchers at the Veterans Affairs Medical Center report that docosapentaenoic acid and docosahexaenoic acid (a main component of fish oil) provide significant protection against the development of coronary heart disease (CHD). Their study involved over 6,000 middle-aged men who had samples of their blood taken between 1973 and 1976. During the next seven years, 94 of these men had a heart attack or died suddenly due to heart disease. The 94 men were matched with 94 healthy men and the fatty acid profile of their blood samples compared. The researchers found that the 94 men with heart disease tended to have a higher serum level of the saturated fatty acid palmitic acid and conclude that a high level of this acid increases the risk of CHD by 68 per cent. Palmitic acid is the main saturated fatty acid in most diets. This acid is known to cause an increase in both total cholesterol and low-density cholesterol levels; the researchers, however, found that the detrimental effect of a high intake of

palmitic acid persisted even after allowing for its cholesterol- increasing effect. The researchers also determined that men with a higher blood level of the omega-3 unsaturated fatty acids, docosapentaenoic acid and docosahexaenoic acid had an almost 50 per cent lower risk of developing heart disease than did men with lower levels. The researchers also found that men with CHD tended to have a higher serum level of omega-6 fatty acids derived from linoleic acid, but were unable to confirm previous reports that these acids are linked to an increased risk of CHD. *Simon, Joel A., et al. Serum fatty acids and the risk of coronary heart disease. American Journal of Epidemiology, Vol. 142, No. 5, September 1, 1995, pp. 469-76/*

Docosahexaenoic acid fights depression

ROCKVILLE, MARYLAND. Researchers at the National Institute of Alcohol Abuse and Alcoholism believe that the increasing rates of depression seen in North America over the last 100 years are due to a significant shift in the ratio of n-6 (arachidonic acid, linoleic acid) to n-3 (docosahexaenoic acid, linolenic acid) fatty acids in the diet. The human race evolved on a diet having a ratio of about 1:1 of these acids; it is now estimated to be between 10:1 and 25:1. Docosahexaenoic acid (DHA) is a main component of the synaptic membranes and a lack of it has been linked to depression. Fish oils are a rich source of DHA and it can also be biosynthesized in the body from linolenic acid. The researchers speculate that the depressions which often accompany alcoholism, multiple sclerosis, and childbirth (postpartum depression) are all due to a lack of DHA and can be corrected by increasing the dietary intake of DHA or linolenic acid (flax seed oil). They also point out that depression and coronary *heart disease* are strongly associated and that a low intake of n-3 fatty acids has been linked to both. *Hibbeln, Joseph R. and Salem, Norman. Dietary polyunsaturated fatty acids and depression: when cholesterol does not satisfy. American Journal of Clinical Nutrition, Vol. 62, July 1995, pp. 1-9/*

Fish is good for you

TROMSO, NORWAY. Norwegian researchers now offer conclusive evidence that eating fish, particularly fatty fish like mackerel, herring, and salmon will significantly reduce the risk of heart disease. As little as one serving of 300 gram per week will provide the benefit. Fish are rich in eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) and it is these polyunsaturated fatty acids which provide protection. It is suggested that the minimal dietary requirement for EPA and DHA should be about 200 mg/day and this amount can be obtained from eating fish once a week. *Nordoy, Arne. Is there a rational use for n-3 fatty acids (fish oils) in clinical medicine? DRUGS, Vol. 42, No. 3, 1991, pp. 331-42/*

Consuming freshwater fish may lower risk of heart disease

KUOPIO, FINLAND. A 15-week experiment involving 62 students was carried out to determine if a regular diet of freshwater fish affects coronary heart disease risk factors. The students were divided into three groups: a fish eating group who made no other changes to their diet, a fish eating group who also decreased their overall fat intake and a control group (19 students) who ate a typical western diet. The special diet consisted of one fish meal a day (in addition to the regular diet) and provided about 0.25 g/day of eicosapentaenoic acid and 0.55 g/day of docosahexaenoic acid. Serum cholesterol was found to decrease in fish eaters who also decreased their lipid intake but not in the other groups. Blood triglyceride levels decreased significantly in the fish eating groups, but not in the control group. Levels of apolipoproteins A1 and B were lowered in both fish eating groups as was the formation of thromboxane B2 during incubation of whole blood. In the fish eating groups, the proportion of omega-3 fatty acids increased significantly in erythrocyte ghosts and platelets at the expense of omega-6 fatty acids. The results of the study support the contention that moderate fish consumption has a protective effect against coronary heart disease. / *Agren, J.J., et al. Boreal freshwater fish diet modifies the*

plasma lipids and prostanoids and membrane fatty acids in man. LIPIDS, Vol. 23, No.10, October 1988, pp. 924-29/ Coromega *Additional References* 1. Mori, T.A., et al. Interactions between dietary fat, fish, and fish oils and their effects on platelet function in men at risk of cardiovascular disease. *Arterioscler Thromb Vasc Biol*, Vol. 17, February 1997, pp. 279-86 *Conclusion:* Fish oil supplementation reduces platelet aggregation in men with increased risk of cardiovascular disease. 2. Kinsella, J.E., et al. Dietary n-3 polyunsaturated fatty acids and amelioration of cardiovascular disease: possible mechanisms. *American Journal of Clinical Nutrition*, Vol. 52, July 1990, pp. 1- 28 *Conclusion:* Review of the mechanisms whereby fish oils reduce the risk of cardiovascular disease. *OILOFPISCES.COM* *INTERNATIONAL HEALTH NEWS* Copyright © 2006 by Hans R. Larsen Oilofpisces.com does not provide medical advice. Do not attempt self-diagnosis or self-medication based on our reports. Please consult your health-care provider if you wish to follow up on the information presented.