

## Research Studies Prove that Fish Oils/Omega-3's Do Not Impair Glycemic Control and Diabetes

### **Fish oils benefit women with diabetes**

BOSTON, MASSACHUSETTS. Several studies have found a clear inverse association between the consumption of fish and fish oils and the risk of coronary heart disease (CHD) and sudden cardiac death. However, it is not known whether this protective effect extends to diabetes patients. Researchers at the Harvard Medical School have just concluded a study to examine this. Their study included 5103 female nurses with diabetes, but free of cardiovascular disease and cancer at entry. Between 1980 and 1996 there were 362 cases of CHD (7.1%) and 468 deaths from all causes in the study group (9.2%). The causes of death were CHD or stroke – 161, cancer – 172, and other causes – 135.

Study participants completed detailed food frequency questionnaires in 1980, 1984, 1986, 1990 and 1994. The researchers noted a strong correlation between the risk of CHD and fish intake. Women who consumed fish once a week had a 40% lower risk of CHD than did women who consumed fish less than once per month. Eating fish 5 times per week reduced CHD risk by 64% and overall mortality by 52%. Only dark-meat fish (mackerel, salmon, sardines, bluefish, and swordfish) and shrimp, lobster and scallops showed a beneficial effect. The researchers also calculated the amount of fish oils (eicosapentaenoic acid and docosahexaenoic acid) obtained from the diet and found that study participants with an average intake of just 250 mg/day had a 31% reduction in CHD and a 37% reduction in death from all causes compared to participants with a low (40 mg or less) daily intake. **The researchers note that fish oil supplementation does not impair glycemic control and suggest that regular fish consumption should be considered as an integral part of a healthy diet for the management of diabetes.**

*Hu, Frank B., et al. Fish and long-chain omega-3 fatty acid intake and risk of coronary heart disease and total mortality in diabetic women. Circulation, Vol. 107, April 15, 2003, pp. 1852-57*  
*Grundy, Scott M. N-3 fatty acids: priority for post-myocardial infarction clinical trials. Circulation, Vol. 107, April 15, 2003, pp. 1834-36 (editorial)*

**Editor's comment:** Swordfish, bluefish and king mackerel have high levels of mercury or methyl mercury and should not be eaten regularly, if at all.

### **Fish oil supplementation is safe for diabetics**

PARIS, FRANCE. People suffering from type II diabetes often have high blood levels of triglycerides and are therefore prone to coronary heart disease. Fish oils are known to be effective in lowering triglyceride levels, but concern has been expressed that they may also increase low-density lipoprotein (LDL) levels and be deleterious to glucose control.

Medical researchers at the Hotel-Dieu hospital now report the results of a study designed to investigate these concerns. The study involved 10 men with type II diabetes (average age of 54 years). The men were randomized into two groups in the double-blind crossover study. Group 1 supplemented with 6 grams/day of fish oils (containing 320 mg of eicosapentaenoic acid [EPA] and 215 mg of docosahexaenoic acid [DHA]) for two months while group 2 supplemented with 6 grams/day of sunflower oil (containing 65% linoleic acid). At the end of the two months all participants went through a 2-month wash-out period and group 1 was then assigned to supplement with sunflower oil while group 2 was given fish oil supplements. All participants maintained their regular diet (55% carbohydrates, 15% protein, and 30% fat) and continued with their medications throughout the study except for cholesterol-lowering drugs which were discontinued 2 months before the start of the trial.

The researchers noted a considerable increase in both EPA and DHA content in blood plasma phospholipids and in red blood cell membranes after two months on the fish oil supplements.

Triglyceride levels and the level of plasma lipoprotein(a) were both significantly lowered following fish oil supplementation. No adverse effects on glucose control were observed; there was a small increase in the LDL level, but this was compensated for by a similar increase in the HDL (high-density lipoprotein) level so that the important LDL/HDL ratio remained unchanged. **The researchers conclude that fish oil supplementation is effective in lowering triglyceride levels in type II diabetics and has not adverse effects on glycemic control or overall cholesterol levels.** Luo, Jing, et al. *Moderate intake of n-3 fatty acids for 2 months has no detrimental effect on glucose metabolism and could ameliorate the lipid profile in type 2 diabetic men. Diabetes Care, Vol. 21, May 1998, pp. 717-24*

### **Fish oils and fiber benefit diabetics**

CLEVELAND, OHIO. Patients with non-insulin-dependent diabetes mellitus (NIDDM) often suffer from abnormal lipid (fat) and lipoprotein metabolism resulting in unfavourable cholesterol levels and an accompanying increase in the risk of heart disease. Numerous studies have shown that fish oil supplementation lowers the levels of very-low-density-lipoprotein (VLDL) and triglycerides (triacylglycerol), but has little effect on the levels of low-density-lipoprotein (LDL) and total cholesterol. There has also been some reports that fish oil supplementation may worsen glycemic (glucose) control. **Now medical researchers at the Case Western Reserve University report that adding soluble fiber to the fish oil supplementation regimen is highly beneficial.** Their experiment involved 15 non-obese NIDDM patients (12 men and 3 women) aged 32 to 74 years. For the first four weeks the patients received 20 grams of fish oil per day (equivalent to six grams of n-3 fatty acids). During the next four weeks all patients received the fish oil plus 15 grams/day of soluble apple pectin. During the final four weeks both supplements were withdrawn. The patients continued their usual diabetic diet and medication during the entire study period. Analysis of blood samples showed that fish oil supplementation alone lowered the levels of triacylglycerol and VLDL cholesterol by 41 per cent and 36 per cent respectively. No changes were observed in total cholesterol, LDL cholesterol or HDL cholesterol. When apple pectin was added to the treatment triacylglycerol and VLDL cholesterol levels were both lowered by 38 per cent, but in addition total cholesterol levels decreased by 13 per cent and LDL cholesterol by 7 per cent. There was no significant change in HDL cholesterol level. Fasting and two-hour postprandial plasma glucose concentrations were not affected by the fish oil or fish oil/pectin supplementation and no changes in serum levels of zinc, magnesium, and copper were observed. Plasma levels of triglycerides and cholesterol returned to pre-treatment levels four weeks after discontinuation of supplementation. **The researchers conclude that a combination of fish oil supplementation and increased fiber intake (up to 40 grams/day total) may be a beneficial addition to the conventional treatment of high cholesterol levels in NIDDM patients.**

*Sheehan, John P., et al. Effect of high fiber intake in fish oil-treated patients with non-insulin-dependent diabetes mellitus. American Journal of Clinical Nutrition, Vol. 66, November 1997, pp. 1183- 87*

### **Diabetics may benefit from fish oil supplementation**

NAPLES, ITALY. Animal studies have shown that fish oil supplementation has a beneficial effect on insulin resistance and can prevent its development in animals fed a high-fat diet. It is also known that a high fish intake can delay the development of diabetes in glucose-intolerant individuals. Researchers at the Federico II University recently set out to investigate if long-term supplementation with fish oils would improve insulin sensitivity in patients with non-insulin-dependent diabetes (NIDDM). The clinical trial involved 16 NIDDM patients (average age of 56 years) who, after a 3 week run-in period during which they received 3 olive oil capsules per day, were assigned to receive either fish oil capsules or olive oil capsules for a further 6-month period. For the first two months the participants received either 3 fish oil capsules daily (320 mg eicosapentaenoic acid [EPA] and 530 mg docosahexaenoic acid [DHA] per capsule) or 3 placebo capsules (each containing 1 gram of olive oil). During the last four months these dosages were reduced to 2 fish oil or 2 placebo capsules daily. The patients were evaluated at the beginning and end of the trial and maintained their usual diet and medications (except for cholesterol-lowering drugs) during the entire trial period.

The researchers concluded that fish oil supplementation induced a significant decrease in triglyceride concentrations particularly in the level of very-low-density lipoprotein (VLDL) triglycerides (a reduction of 45%). There was also a significant decrease in VLDL cholesterol levels (47% drop) and a 14% increase in LDL cholesterol. There was no significant change in blood glucose control and, contrary to expectations, no significant improvement in insulin resistance despite the fact that red blood cell levels of EPA and DHA increased significantly. The researchers conclude that long-term fish oil supplementation lowers triglyceride levels in NIDDM patients without adversely affecting blood glucose control. NOTE: This study was partially funded by Pharmacia, Farmitalia Carlo Erba, Milan, Italy.  
*Rivellese, Angela A., et al. Long-term effects of fish oil on insulin resistance and plasma lipoproteins in NIDDM patients with hypertriglyceridemia. Diabetes Care, Vol. 19, November 1996, pp. 1207-13*

### **Diabetes and fish oil supplementation**

EDMONTON, CANADA. Diabetics are at significantly increased risk for cardiovascular disease and any dietary intervention that could decrease this risk would be of great importance. **Studies have shown that fish oil supplementation lowers triglycerides, very low density lipoprotein (VLDL) levels, and blood pressure in non-diabetic individuals and thereby diminishes their risk of heart disease.** Unfortunately, some early experiments with fish oil supplementation in type II diabetics reported adverse effects on glycemic control and cholesterol levels.

Researchers at the University of Alberta have just released the results of a new study aimed at evaluating the overall effects of fish oil supplementation in type II diabetics. Eleven subjects with non-insulin- requiring type II diabetes took part in the randomized, double-blind, crossover study. All participants underwent a 3-month run-in period during which they supplemented with olive oil capsules (placebo). They were then randomized into two groups with one group supplementing with fish oil capsules (about 2.0 grams/day) and the other group supplementing with flax seed oil capsules. After 3 months the participants underwent a crossover to the alternative oil for a final 3 months of supplementation.

All study participants had acceptable blood levels of total cholesterol, triglycerides, high density lipoproteins, low density lipoproteins, and low density triglycerides prior to initiating supplementation with fish oil or flax seed oil. Supplementation did not change these levels except in the case of triglycerides which were markedly reduced after fish oil supplementation. Glycemic control was not adversely affected by supplementation with either oil and there was a trend towards decreased insulin sensitivity in the group taking fish oils. **The researchers conclude that fish oil supplementation is safe in type II diabetes and can help ameliorate cardiovascular disease risk factors such as high triglyceride levels.** They also conclude that flax seed oil supplementation, while having no adverse effects, is not of significant benefit in type II diabetes. NOTE: This study was partially funded by the Canadian Dairy Bureau.

*McManus, Ruth M., et al. A comparison of the effects of n-3 fatty acids from linseed oil and fish oil in well-controlled type II diabetes. Diabetes Care, Vol. 19, May 1996, pp. 463-67*

### **Fish oils recommended for diabetes and hypertension**

TROMSO, NORWAY. Fish and fish oils help protect against the development of atherosclerosis and heart disease. It is believed that fish oils exert their protective effect by lowering blood pressure and the levels of triglycerides and very-low-density lipoprotein (VLDL). Fish oils are also believed to reduce platelet aggregation and to suppress the growth of smooth-muscle cells in the arterial walls. Many people with hypertension also suffer from diabetes and there has been concern that fish oil supplementation may aggravate problems with glucose intolerance.

**Researchers at the University of Tromso now report that fish oil supplementation lowers blood pressure significantly in people with hypertension and has no effect on glucose control even in people with mild diabetes.** The study involved 78 obese volunteers with essential hypertension. The participants were randomly assigned to one of two equal-sized groups. The fish oil group received four fish oil capsules a day (containing a total of 3.4 grams of a mixture of

eicosapentaenoic acid and docosahexaenoic acid) for a period of 16 weeks. The control group received four corn oil capsules a day.

At the end of the test period the average (mean) systolic blood pressure had dropped by 4.4 mm Hg and the diastolic pressure by 3.2 mm Hg in the fish oil group. The average blood pressure in the control group did not change. The researchers also found that plasma triglyceride and VLDL levels in the fish oil group decreased significantly (by about 9 per cent) while they increased significantly (by about 12 per cent) in the control group. There were no changes in total or low-density-lipoprotein levels in either group. Extensive tests (oral glucose tolerance, hyperglycemic and hyperinsulemic clamps) were done to evaluate the effect of fish oil supplementation on glucose control. No adverse effects were found. An editorial accompanying the research report concludes that fish or fish oil is useful in the prevention of vascular disease in diabetics. Patients with diabetes should eat fish two to three times a week or, as an alternative, supplement with two to three one gram capsules of fish oil per day.

*Toft, Ingrid, et al. Effects of n-3 polyunsaturated fatty acids on glucose homeostasis and blood pressure in essential hypertension. Annals of Internal Medicine, Vol. 123, No. 12, December 15, 1995, pp. 911-18*

*Connor, William E. Diabetes, fish oil, and vascular disease. Annals of Internal Medicine, Vol. 123, No. 12, December 15, 1995, pp. 950-52*

### **Fish oil supplementation recommended for type II diabetics**

DALLAS, TEXAS. High cholesterol and triglyceride levels are common among diabetics and are major contributors to their increased risk of cardiovascular disease. Researchers at the Texas Woman's University and the University of Texas Medical Center now report that fish oil supplementation can markedly decrease cholesterol and triglyceride levels without adversely affecting glycemic control.

Their study involved 40 patients with non-insulin-dependent diabetes mellitus (NIDDM) who had abnormally high blood plasma levels of one or more of the following lipids: total cholesterol (greater than 5.17 mmol/L), LDL cholesterol (greater than 3.36 mmol/L), or triglycerides (greater than 6.47 mmol/L). After a four-week baseline phase during which cholesterol levels, weight, blood pressure, and diabetes control were assessed every two weeks the participants were randomly assigned to one of four groups - daily dose of 9 grams of corn oil (57% linoleic acid), 18 grams of corn oil, 9 grams of fish oil (29% EPA and 27% DHA), and 18 grams of fish oil. All participants were assessed every two weeks during the 12- week supplementation period.

A significant reduction in the levels of very-low-density lipoproteins, triglycerides and very-low-density triglycerides was observed among the participants supplementing with fish oils at both the 6-week and 12-week mark. There were no significant differences in the effect of 9 grams/day versus 18 grams/day supplementation. The level of LDL cholesterol increased temporarily at the 6-week mark, but this effect was no longer present at the 12-week examination. Neither fish oil nor corn oil supplementation produced any significant changes (over baseline values) in total cholesterol levels, HDL cholesterol levels, fasting plasma glucose, weight or blood pressure. A small increase in VLDL cholesterol was noted in the corn oil group at the end of the experiment.

The researchers conclude that fish oil supplementation is useful in lowering triglycerides in diabetics with excessive levels and has no deleterious effect on glycemic control.

*Morgan, Wanda A., et al. A comparison of fish oil or corn oil supplements in hyperlipidemic subjects with NIDDM. Diabetes Care, Vol. 18, January 1995, pp. 83-86*

Connor, W.E., et al. The hypotriglyceridemic effect of fish oil in adult-onset diabetes without adverse glucose control. **Annals of the New York Academy of Sciences**, No. 683, June 14, 1993, pp. 337-40

**Conclusion:** Fish oil supplementation over a 6-month period was found safe for diabetic patients.

## Additional References

1. Friedberg, C.E., et al. Fish oil and glycemic control in diabetes: a meta-analysis. **Diabetes Care**, Vol. 21, April 1998, pp. 494-500  
**Conclusion:** Fish oils effectively lower triglyceride levels in diabetics, but may increase LDL levels slightly. Fasting glucose level may increase in NIDDM patients, but not in IDDM patients.
2. Goh, Y.K., et al. Effect of omega-3 fatty acid on plasma lipids, cholesterol and lipoprotein fatty acid content in NIDDM patients. **Diabetologia**, Vol. 40, January 1997, pp. 45-52  
**Conclusion:** Modest, regular intake of fish will reduce plasma triglyceride level without affecting LDL or HDL cholesterol levels.
3. McVeigh, G.E., et al. Fish oil improves arterial compliance in non-insulin-dependent diabetes mellitus. **Arterioscler Thromb**, Vol. 14, September 1994, pp. 1425-29  
**Conclusion:** Fish oil supplementation favourably influence arterial wall characteristics in diabetics.
4. Axelrod, L., et al. Effects of a small quantity of omega-3 fatty acids on cardiovascular risk factors in NIDDM: a randomized, prospective, double-blind, controlled study. **Diabetes Care**, Vol. 17, January 1994, pp. 37-44  
**Conclusion:** Small quantities of omega-3 fatty acids or dietary fish are safe and potentially beneficial in NIDDM patients.
5. Kasim, S.E. Dietary marine oils and insulin action in type 2 diabetes. **Annals of the New York Academy of Sciences**, No. 683, June 14, 1993, pp. 250-57  
**Conclusion:** Fish oil supplementation worsens glycemic control in diabetics, but this may be a transitory phenomenon.
6. Pelikanova, T., et al. Metabolic effects of omega-3 fatty acids in type 2 (non-insulin-dependent) diabetic patients. **Annals of the New York Academy of Sciences**, No. 683, June 14, 1993, pp. 272-78  
**Conclusion:** Fish oil supplementation caused no adverse effects in mildly obese NIDDM patients treated with oral hypoglycemic agents.
7. Boberg, M., et al. Supplementation with n-3 fatty acids reduces triglycerides but increases PAI-1 in non-insulin-dependent diabetes mellitus. **Eur J Clin Invest**, Vol. 22, October 1992, pp. 645- 50  
**Conclusion:** Supplementation with fish oil caused a decline in levels of triglycerides and very low- density lipoprotein levels in diabetics.
8. Mori, T.A., et al. Comparison of diets supplemented with fish oil or olive oil on plasma lipoproteins in insulin-dependent diabetics. **Metabolism**, Vol. 40, March 1991, pp. 241-46  
**Conclusion:** Fish oil supplementation increases HDL levels in insulin-dependent diabetics.
9. Hendra, T.J., et al. Effects of fish oil supplements in NIDDM subjects: a controlled study. **Diabetes Care**, Vol. 13, August 1990, pp. 821-29  
**Conclusion:** Fish oil supplementation decreases triglyceride levels in diabetics, but increases glucose levels at least in the short term.
10. Friday, K.E., et al. Elevated plasma glucose and lowered triglyceride levels from omega-3 fatty acid supplementation in type 2 diabetes. **Diabetes Care**, Vol. 12, April 1989, pp. 276-81  
**Conclusion:** Fish oil supplementation reduces triglyceride and cholesterol levels, but increases glucose levels in diabetics.
11. Schectman, G., et al. Effect of fish oil concentrate on lipoprotein composition in NIDDM. **Diabetes**, Vol. 37, November 1988, pp. 1567-73  
**Conclusion:** Fish oil supplementation lowers triglyceride and very low-density lipoprotein levels in diabetics.