

New FLAX FACTS

FLAX HELPS PREVENT HEART ATTACKS AND STROKE

by Dr. Diane H. Morris

Flax helps protect against heart attacks and stroke by lowering blood lipids, maintaining healthy blood vessels, and decreasing inflammation. The main nutrients in flax – namely, alpha-linolenic acid (ALA), the essential omega-3 fat; dietary fibre; and the lignan secoisolariciresinol diglucoside (SDG) – all contribute to its heart healthy effects.¹ Milled flax and whole flax seeds contain ALA, dietary fibre and lignans. Flax oil is very rich in ALA but contains virtually no dietary fibre and lignans.

Risk Factors for Cardiovascular Disease

The term cardiovascular disease (CVD) refers to all diseases of the blood vessels and circulation system, including heart attacks and stroke.^{2,3} CVD is the result of atherosclerosis or “hardening of the arteries,” an inflammatory disease that begins in childhood and involves unhealthy changes in the lining of blood vessels or endothelium, as it is called.⁴

Diet and lifestyle factors such as smoking, diabetes, high blood pressure, and high blood cholesterol can promote undesirable changes such as increased oxidative stress and inflammation in the endothelium. When the endothelium becomes inflamed, cholesterol and other lipids accumulate in blood vessel walls. Eventually, blood platelets clump together and plaques form in blood vessel walls. If a plaque ruptures and blocks blood flow to the heart, it can cause a heart attack; if it blocks blood flow to the brain, it can cause a stroke.

Cardioprotective Effects of Flax

Flax helps lower CVD risk. In clinical studies, the heart healthy benefits of flax were achieved by consuming 15 to 50 g (2-6 tbsp) of milled flax or between 2 mL (1 tsp) and 35 mL (2 1/2 tbsp) of flax oil daily.¹ Flax favourably affects the following risk factors associated with increased CVD risk:

Blood Lipids. Eating 2-6 tbsp (15-50 g) of milled flax daily for as little as 4 weeks decreased blood total and LDL-cholesterol significantly in clinical studies. (LDL-cholesterol is the so-called bad cholesterol.) Blood total cholesterol decreased 6-13% and LDL-cholesterol decreased 9-18% in studies of healthy young adults,^{5,6} men and women with moderately high levels of blood cholesterol,⁷ and other groups.⁸⁻¹¹ HDL cholesterol (the so-called good cholesterol) and triglycerides did not change in these studies.

The beneficial effect of milled flax and whole flax seeds⁸ may be due in part to the dietary fibre in flax. Flax contains mucilage gums, which are a type of soluble dietary fibre. Soluble dietary fibre helps lower blood cholesterol levels.¹² In a study of 29 adults with high blood cholesterol levels, blood total cholesterol decreased about 5.5% and LDL-cholesterol decreased 9.7% when the volunteers

ate muffins made with partially defatted flax for 3 weeks compared with when they ate muffins made from wheat bran for 3 weeks. (Partially defatted flax contains less than 10% fat, compared with regular milled flax, which contains about 41% fat.) These findings suggest a role for flax mucilage gums in lowering blood lipids.¹³

Clinical studies show no effect of flax oil on blood total and LDL-cholesterol levels. Even so, flax oil is a rich source of ALA, reducing inflammatory reactions and having beneficial effects on blood vessels.¹

A flax lignan complex providing 500 mg of SDG daily did not lower blood lipids in one clinical trial,¹⁴ although it decreased total and LDL-cholesterol by 20% and 14%, respectively, and increased HDL-cholesterol by 30% in a rabbit study.¹⁵ Research regarding flax lignans and heart health is in its infancy, and too few human studies have been conducted to provide guidance on the role of lignans in decreasing CVD risk. Nonetheless, SDG is a powerful antioxidant.¹⁶ It may help protect against oxidative stress,¹⁷ which contributes to atherosclerosis.¹⁸

All together, most clinical studies suggest that consuming milled flax, whole flax seeds or partially defatted flax decreases total cholesterol and LDL-cholesterol levels without decreasing HDL-cholesterol.

Blood vessels. When the lining of the blood vessels – the endothelium – becomes inflamed, it loses its ability to work properly. In other words, it becomes dysfunctional. Studies measuring endothelial function in adults with type 2 diabetes¹⁹ and in obese adults²⁰ have found that consuming flax oil, ALA-rich vegetable oils and omega-3 fats in general improves endothelial function and blood flow.²¹⁻²³ In one study, a diet providing 3.7-6.0 g of ALA from walnuts, walnut oil and flax oil increased blood flow (vasodilation) by 64% compared with an olive oil diet.²⁴

Another outcome of endothelial dysfunction is a tendency for white blood cells, called leukocytes, to stick to the endothelium. This process is controlled by cell adhesion molecules, which increase inflammatory reactions and the progression of atherosclerosis; a high level of soluble cell adhesion molecules in the bloodstream is associated with increased CVD risk.²⁵ In a study of Greek men with abnormal blood lipids, consuming 15 mL (1 tbsp) of flax oil daily for 12 weeks reduced the concentration of one type of cell adhesion molecule by 18.7%.²⁶

Inflammation. ALA-rich diets decrease the production of inflammatory compounds such as eicosanoids and cytokines. For example, cytokine levels decreased 26-28% when volunteers consumed flax oil for 4 weeks.²⁷

ALA-rich diets are also associated with lower blood levels of C-reactive protein (CRP). CRP is a protein released by the liver in response to infection or injury; it is strongly linked with clinical signs of CVD.²⁸ In a clinical study, CRP levels



decreased 75% when 23 men and women consumed a diet rich in ALA obtained from a combination of walnuts, walnut oil, and flax oil for 6 weeks.²⁹ A community study in Tuscany, Italy, found that adults with low plasma ALA levels – indicating low dietary intakes of ALA – had significantly higher levels of blood CRP.³⁰

Population Studies Show Heart Healthy Effects of ALA

Several large-scale population or epidemiologic studies, listed in the table, suggest a role for ALA in decreasing CVD risk. The studies involved hundreds or even thousands of men and women living in various countries. Twelve studies found that diets rich in ALA were inversely associated with fatal ischemic heart disease, risk of heart attack, risk of recurrent heart attack and death, risk of stroke, and risk of death from CVD and all causes. In other words, the higher the ALA content of the diet, the less the risk of having or dying from a heart attack or stroke. Only one study – the Zutphen Elderly Study conducted in The Netherlands – failed to find a cardioprotective effect of ALA.¹

Table

Summary of Population Studies of ALA and Cardiovascular Diseases*

Studies Suggesting a Benefit of ALA

Alpha-Tocopherol Cancer Prevention Study
Cardiovascular Health Study
Costa Rica Study
EURAMIC Study
Family Heart Study
Health Professionals Follow-up Study
India Study
Lyon Diet Heart Study
MARGARIN Study
Multiple Risk Factor Intervention Trial (MRFIT)
Nurses' Health Study
Singapore Heart Study

Study Suggesting No Benefit of ALA

Zutphen Elderly Study

*Complete citations for these studies can be found in *Flax—A Health and Nutrition Primer*, pages 66-67. (1)

More information about flax, alpha-linolenic acid (ALA), inflammation, atherosclerosis and coronary heart disease can be found in the Flax Council of Canada's book, *Flax—A Health and Nutrition Primer*. The book is located under the Nutrition tab on the Council's website at <http://www.flaxcouncil.ca>

Flax and Heart Health

Including flax in the daily diet helps lower blood lipids, reduce inflammation and enhance the health of blood vessels. These actions help reduce CVD risk.

References

- Morris DH. *Flax – A Health and Nutrition Primer*. Winnipeg, MB: Flax Council of Canada; 2007.
- Rosamond W, for the Writing Group Members. *Circulation* 2007;115: e69-e171. [cited 2008 Feb 25] Available from: <http://circ.ahajournals.org/content/vol115/issue5/>
- Heart and Stroke Foundation of Canada. 2003. [cited 2008 Feb 25] Available from: <http://ww2.heartandstroke.ca>
- Ross R. *N Engl J Med*. 1999;340: 115-126.
- Cunnane SC, et al. *Br J Nutr*. 1993;69: 443-453.
- Cunnane SC, et al. *Am J Clin Nutr*. 1995;61: 62-68.
- Bierenbaum ML, et al. *J Am Coll Nutr*. 1993;12: 501-504.
- Arjmandi BH, et al. *Nutr Res*. 1998;18: 1203-1214.
- Lucas EA, et al. *J Clin Endocrinol Metab*. 2002;87: 1527-1532.
- Clark WF, et al. *Kidney Int*. 1995;48: 475-480.
- Demark-Wahnefried W, et al. *Urology*. 2001;58: 47-52.
- Institute of Medicine. *Dietary Reference Intakes, Part I*. Washington, DC: National Academies Press, 2002, pp. 7-1 – 7-69.
- Jenkins DJA, et al. *Am J Clin Nutr*. 1999;69:395-402.
- Hallund J, et al. *J Nutr*. 2006;136: 112-116.
- Prasad K. *Atherosclerosis*. 2005;179: 269-275.
- Prasad K. *Mol Cell Biochem*. 1997;168: 117-123.
- Kinniry P, et al. *J Nutr*. 2006;136: 1545-1551.
- Esper RJ, et al. *Cardiovasc Diabetol*. 2006;5: 4 (DOI 10.1186/1475-2840-5-4).
- West SG, et al. *Diabetologia*. 2005;48:113-122.
- Nestel PJ, et al. *Arterioscler Thromb Vasc Biol*. 1997; 17: 1163-1170.
- West SG. *Curr Atheroscler Rep*. 2001;3: 446-455.
- Goodfellow J, et al. *J Am Coll Cardiol*. 2000;35: 265-270.
- Leeson CPM, et al. *Eur Heart J*. 2002;23: 216-222.
- Ros E, et al. *Circulation*. 2004;109: 1609-1614.
- Brevetti G, et al. *Vasc Med*. 2006;11:39-47.
- Rallidis LS, et al. *Atherosclerosis*. 2004;174: 127-132.
- Caughey GE, et al. *Am J Clin Nutr*. 1996;63:116-122.
- Wilson AM, et al. *Int J Cardiol*. 2006;106: 291-297.
- Zhao G, et al. *J Nutr*. 2004;134: 2991-2997.
- Ferrucci L, et al. *J Clin Endocrinol Metab*. 2006;91: 439-446.