New FLAX FACTS

FLAX REDUCES INFLAMMATION LEADING TO ATHEROSCLEROSIS

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SUMMARY

The findings of one large cohort study – the Nurses' Health Study – and two clinical studies suggest that diets rich in flax omega-3 fat (ALA) decrease blood levels of cell adhesion molecules. Cell adhesion molecules are biomarkers of early events in the development of atherosclerosis or hardening of the arteries.

Flax is rich in alpha-linolenic acid (ALA), the essential omega-3 fatty acid, and lignans, which are phytoestrogens and antioxidants. These flax components decrease inflammatory factors associated with atherosclerosis – also called "hardening of the arteries" – and may help prevent heart attacks and strokes.

Role of Cell Adhesion Molecules in Atherosclerosis

Atherosclerosis begins in infancy and childhood when the earliest lesions, called fatty streaks, begin to develop in arteries.[1] In the early stages of fatty streak development, white blood cells (leukocytes) begin sticking to the inner lining of blood vessels (the endothelium).

The sticking of leukocytes to the endothelium is controlled by a group of compounds called cell adhesion molecules. Cell adhesion molecules are stirred into action in response to signals from pro-inflammatory compounds such as C-reactive protein (CRP) and cytokines such as tumor necrosis factor α (TNFα), interleukin-1β (IL-1β), and interleukin-6 (IL-6). CRP and cytokines are themselves released in response to inflammation.[2-4]

Refer to the Flax Council of Canada's fact sheet titled *Flax Favourably Affects the Immune System* for a review of how flax components decrease the blood levels of C-reactive protein and cytokines.

The actions of cell adhesion molecules enhance the formation of fatty streaks and plaques. Plaques are advanced lesions that can block the flow of blood in the artery. If a plaque ruptures, it can cause a thrombosis that may result in a heart attack (myocardial infarction) or stroke.[4] (Consult the table for a description of compounds that promote inflammation and atherosclerosis.)

Clinical Importance of Cell Adhesion Molecules

Cell adhesion molecules include E-selectin, vascular cell adhesion molecule type 1 (VCAM-1), and intercellular adhesion molecule type 1 (ICAM-1). They are responsible for attaching leukocytes tightly to the endothelium.[5]

Soluble forms of these adhesion molecules appear in the bloodstream. High blood levels of cell adhesion molecules occur in several inflammatory disorders. For example, blood levels of VCAM-1 and ICAM-1, but not E-selectin, were increased significantly in patients who had had an acute heart attack or who had either stable or unstable angina, but they were low in patients with normal coronary arteries.[6] Blood levels of VCAM-1 and ICAM-1 were increased significantly in patients with rheumatoid arthritis – who have a high risk of coronary events – compared with healthy adults.[7] (E-selectin was not measured in this study.) These and other findings suggest that blood levels of cell adhesion molecules may serve as important clinical biomarkers of inflammation and atherosclerosis.[6-8]

Table

Active Agents in Atherosclerosis

Agent	Actions
C-reactive protein (CRP)	An acute phase inflammatory protein; high blood levels of CRP indicate the presence of systemic inflammation or infection.[3]
Cytokines	Proteins released by immune cells; they both start and amplify inflammatory reactions.[1] Examples: interleukin-1β (IL-1β), interleukin-6 (IL-6), tumor necrosis factor α (TNFα)
Cell adhesion molecules	Respond to signals received from cytokines; they promote the sticking of white blood cells (leukocytes) to the inner lining of blood vessels (the endothelium) and their blood levels may help predict risk of heart attack and stroke.[6] Examples: E-selectin, vascular cell adhesion molecule type 1 (VCAM-1), intercellular adhesion molecule type 1 (ICAM-1)

ALA-Rich Diets Decrease Blood Levels of Cell Adhesion Molecules

Several recent studies suggest that flax and its essential omega-3 fatty acid, ALA, decrease the blood levels of soluble cell adhesion molecules. These findings provide evidence that diets containing flax may help prevent or slow the progression of atherosclerosis.

Cohort Study. In the Nurses' Health Study, a cohort of 727 women reported their usual dietary intake and provided a blood sample in 1989-1990. The Nurses' Health Study is a prospective cohort study that began in 1976; follow-up data have been collected every 2 years since then.

In these women, plasma concentrations of VCAM-1 and E-selectin tended to decrease as ALA intake increased. Plasma concentrations of E-selectin, ICAM-1, and VCAM-1 were all inversely related to the intake of total omega-3 fatty acids. Plasma VCAM-1 concentrations were lowest in women with ALA intakes of 1.2-2.4 g/day or total omega-3 fat intakes of 1.4-3.3 g/day.[9] [An ALA intake of 1.2-2.4 g/day can be achieved by eating 2-4 tsp of milled flax or 1/2-1 tsp of flax oil daily.]

Clinical Studies. In a clinical study, men and women with moderate hypercholesterolemia were assigned to eat 3 test diets on a rotating basis. One diet was an average American diet; one diet was rich in ALA provided by a combination of walnuts, walnut oil, and flax oil; and one diet was rich in linoleic acid, the essential omega-6 fatty acid. The ALA-rich diet significantly decreased serum ICAM-1, E-selectin, and VCAM-1 concentrations compared with the average American diet. In this study, the ALA-rich diet had the largest beneficial effects on these markers of endothelial activation.[10] However, the ALA intake in this clinical study was high – 6.5% of energy or about 17 g ALA/day. [This intake level can be achieved by consuming flax oil, which provides 8 g ALA/tbsp, in addition to other ALA-containing foods.]

A clinical study conducted in Greece recruited 90 men with high blood cholesterol who ate a typical Greek diet. They were randomized to eat for 12 weeks a diet rich in ALA obtained from flax oil or a diet rich in linoleic acid obtained from safflower oil. The ALA diet decreased VCAM-1 levels 18%.[2]

Regular Flax Consumption May Help Prevent Atherosclerosis

New research suggests a role for flax in reducing blood levels of cell adhesion molecules. Blood levels of cell adhesion molecules may predict risk of heart attacks and stroke.[6] A regular intake of flax may help prevent heart attacks and stroke by reducing inflammatory reactions associated with atherosclerosis.

References

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