



## Flaxseed and Cardiovascular Disease

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Flaxseed is rich in omega-3 fatty acids, soluble fibre, and lignans that promote cardiovascular health.

Regular consumption of flaxseed as part of a healthy diet reduces serum total and LDL cholesterol.

Health Canada has permitted the use of blood cholesterol lowering claim for ground flaxseed.

Cardiovascular disease (CVD) includes all diseases of the heart and vasculature and has been the leading cause of mortality during the past decade.<sup>1</sup> An estimated 9 in 10 Canadians have at least one CVD risk factor, with over 40 percent of individuals aged 20 to 79 having elevated levels of total cholesterol.<sup>2</sup> In the United States, CVD accounts for approximately one out of every three deaths, with more than 2,150

Americans dying each day.<sup>3</sup> Many of the factors that contribute to the development of atherosclerotic CVD can be altered by lifestyle modification, including dietary choices. In fact, nutritional factors have been estimated to be responsible for as much as 40% of all CVD.<sup>4</sup>

Flaxseed contains three components associated with improved cardiovascular health: the omega-3 polyunsaturated fatty acid alpha-linolenic acid (ALA, 20% of dry weight); the plant lignan secoisolariciresinol diglucoside (SDG, 1% of dry weight); and soluble fibre (6% of dry weight).<sup>5</sup> These constituents can positively affect blood lipid levels, blood pressure, endothelial function, and inflammation to mitigate CVD risk.

### Alpha-Linolenic Acid: A Heart-Healthy Essential Omega-3 Fatty Acid

Omega-3 ALA and omega-6 linoleic acid (LA) are the two essential fatty acids required in the human diet since they cannot be endogenously synthesized. Flaxseed is the richest plant source of ALA. A meta-analysis of 27 prospective and retrospective studies reported that each 1 g/d increment of ALA intake was associated with a 10% lower risk of death from heart disease.<sup>6</sup> Higher intakes have also been associated with lower risk of myocardial infarction (MI). A large study in 3,638 men and women reported a strong negative correlation between ALA status, measured in adipose tissue, and corresponding intakes of 1.8 g ALA/day with nonfatal myocardial infarction (MI).<sup>7</sup> And men who consumed more than 1 g ALA/day had a 35 to 50 per cent lower risk of stroke after 8 to 13 years of follow up in a study of 20,069 people<sup>8</sup>. Individuals with low ALA intakes (less than 1 g/day) may experience the greatest cardiovascular benefits from increasing intakes.<sup>7</sup>



Omega-3 fatty acids are typically low in the diet of North Americans. The minimum recommended Daily Value for ALA Omega-3 is 1,600-mg per day.<sup>9</sup> As well, the American Heart Association recommends eating sources of ALA, including flaxseed and its oil, due to large epidemiologic studies suggesting that people at risk for coronary heart disease benefit from consuming both plant and marine sources of omega-3 fatty acids.<sup>10</sup> The Academy of Nutrition and Dietetics recommends that ALA provide 0.6 to 1.2 percent of energy intake.<sup>11</sup>

Greek Oat Bread recipe at HealthyFlax.org



The ratio of omega-6 to omega-3 fatty acids may also be important for optimal health. The Institute of Medicine recommends an omega-6 to omega-3 ratio of 5:1 to 10:1.<sup>9</sup> However, this ratio may be as high as 17:1 in Western-type diets.<sup>12</sup> Flax contains more than three times as much omega-3 as omega-6 fatty acids, giving a ratio of only 0.3:1. ALA is the dietary precursor for the longer chain omega-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which are found in seafood.<sup>13</sup> The rate of ALA conversion varies between individuals and can be impaired by a diet high in omega-6 LA.<sup>13</sup> EPA is further metabolized to hormone-like substances called eicosanoids. The eicosanoids produced from EPA possess anti-inflammatory properties that help protect against CVD, whereas eicosanoids produced from metabolites of LA have pro-inflammatory characteristics. Low ALA intake supports the production of omega-6 eicosanoids at the expense of omega-3 eicosanoids, which has negative implications for cardiovascular health.





YELLOW FLAXSEED



YELLOW GROUND FLAXSEED



BROWN FLAXSEED



BROWN GROUND FLAXSEED



Serum levels of inflammatory proteins were reduced after dietary supplementation with ALA from walnuts, walnut oil, and flaxseed oil.<sup>14</sup> Using cultured peripheral blood mononuclear cells from these same subjects, the diet high in ALA inhibited the production of pro-inflammatory agents including IL-6, IL-1 $\beta$ , and TNF- $\alpha$  production.<sup>15</sup>

On the basis of a review of numerous studies which focused on ALA, Fleming and Kris-Etherton conclude that there is evidence demonstrating a beneficial role of ALA for the primary and secondary prevention of CVD. Further, it was recommended that ALA intake be increased to 2 to 3 g/day to reduce risk of CVD.<sup>16</sup>

As a plant source of omega-3 fatty acids, flaxseed is a renewable and sustainable source of this essential fatty acid.<sup>17</sup>



Oat and Apple Pancake recipe at HealthyFlax.org

### Flaxseed is a Rich Source of Soluble Fibre and Lignans

Flaxseed contains mucilage gums, a type of soluble dietary fibre. Increased consumption of soluble fibre can reduce the risk of CVD by reducing LDL cholesterol.<sup>18</sup> Soluble fibre binds bile acids in the intestine thereby increasing fecal excretion. Since cholesterol is a precursor for bile acids, increased excretion causes decreased circulating cholesterol levels.<sup>18</sup> Soluble fibre may also help to lower serum cholesterol levels as a result of fermentation in the large intestine and production of short-chain fatty acids that lower pH and inhibit cholesterol synthesis.<sup>18</sup> In addition to improving serum lipid levels, dietary fibre lowers blood pressure and reduces inflammation to help prevent CVD.<sup>19</sup> The Institute of Medicine has set the Adequate Intake for total dietary fibre at 14 g per 1000 kcal, or about 25 g/day for women and 38 g/day for men.<sup>19</sup>

Lignans are phytoestrogens – compounds in plants that possess estrogen-like properties. Flaxseed has up to 800 times more active lignans compared to vegetables, fruits, legumes, cereals, or seeds. SDG is the major lignan found in flaxseed. Once ingested, SDG is converted to active mammalian lignans, enterodiol and enterolactone.

Oxidative stress and inflammation contribute to an atherogenic environment that promotes the development of CVD. Flaxseed SDG and its metabolites possess potent antioxidant properties, thereby reducing oxidative stress and protecting against CVD.<sup>5</sup> In addition, flax lignans have been shown to reduce the progression of atherosclerosis and improve blood pressure.<sup>5</sup>

Recent science is supporting even further positive effects of flaxseed. A double blind randomized controlled trial that fed participants 30 g/day of ground flaxseed for six months found increased plasma levels of ALA and enterolignans.<sup>4</sup> In the group that received ground flaxseed, systolic blood pressure decreased by 10 mm Hg and diastolic blood pressure decreased by 7 mm Hg compared to placebo.<sup>4</sup> This is one of the most potent antihypertensive effects observed as the result of a dietary intervention and is even more significant than some common drugs used to treat the disease.<sup>4</sup>

## A Health Claim for Flaxseed

In 2014, Health Canada approved a health claim linking ground whole flaxseed to blood cholesterol lowering, a major risk factor for CVD.<sup>20</sup> The claim – only one of eleven approved in Canada – was based on seven clinical research trials of normal and hypercholesterolemic males and females aged 8 to 75 years who consumed 30 to 50 g/day of ground flaxseed. The primary endpoints in these studies were total cholesterol and low density lipoprotein (LDL) cholesterol, recognized risk factors for CVD. The pooled results from these studies found that compared to baseline, total cholesterol levels decreased by 0.21 mmol/L (- 0.56 to - 9.01 percent) and LDL decreased by 0.22 mmol/L (- 3.42 to -14.94 percent).<sup>20</sup> A reduction of 1 percent in total cholesterol levels is related to a 2 percent reduction in risk of CVD. Therefore, according to these studies, flaxseed intake may decrease the risk of CVD between 1 and 18 percent.

*The “daily amount” referred to in the claim is 40 g (5 tablespoons) of ground whole flaxseed to be consumed over three eating occasions in the day.*

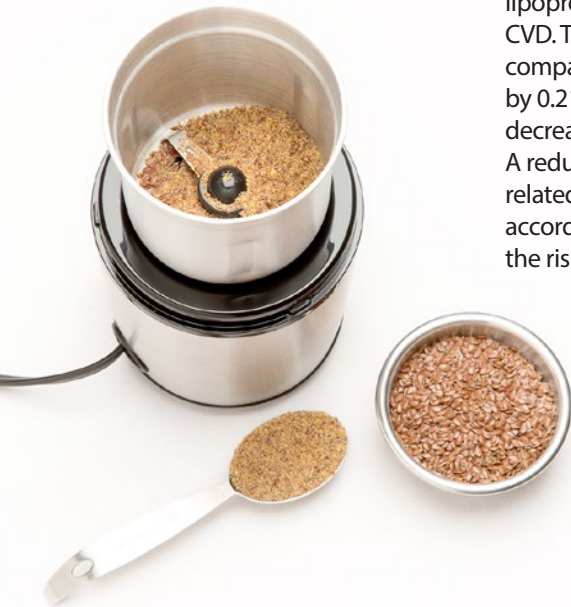
An example of the permitted claim for ground flaxseed is: “16 g (2 tablespoons) of ground flaxseed supplies 40% of the daily amount shown to help lower cholesterol”. In addition to this primary statement, the following additional statements may be used:

- Ground (whole) flaxseed helps reduce/lower cholesterol
- High cholesterol is a risk factor for heart disease
- Ground (whole) flaxseed helps reduce/lower cholesterol, (which is) a risk factor for heart disease

Flaxseed has been consumed for centuries due to its desirable flavor and nutritional properties. In recent years, as people have become more concerned about health, demand for flaxseed in food and beverages has risen dramatically. Scientific research and now regulatory approval supports the heart health benefits of flaxseed, particularly due to ALA, fibre and lignan contents.

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HealthyFlax.org is the source of information on the health benefits and uses of whole flaxseed, ground flaxseed and flaxseed oil. Our website includes recipes, nutritional evidence, facts and news about flaxseed in all its forms. HealthyFlax.org is supported by Canada's flax growers, processors, food manufacturers and governments. For more information, email us at [info@healthyflax.org](mailto:info@healthyflax.org)



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