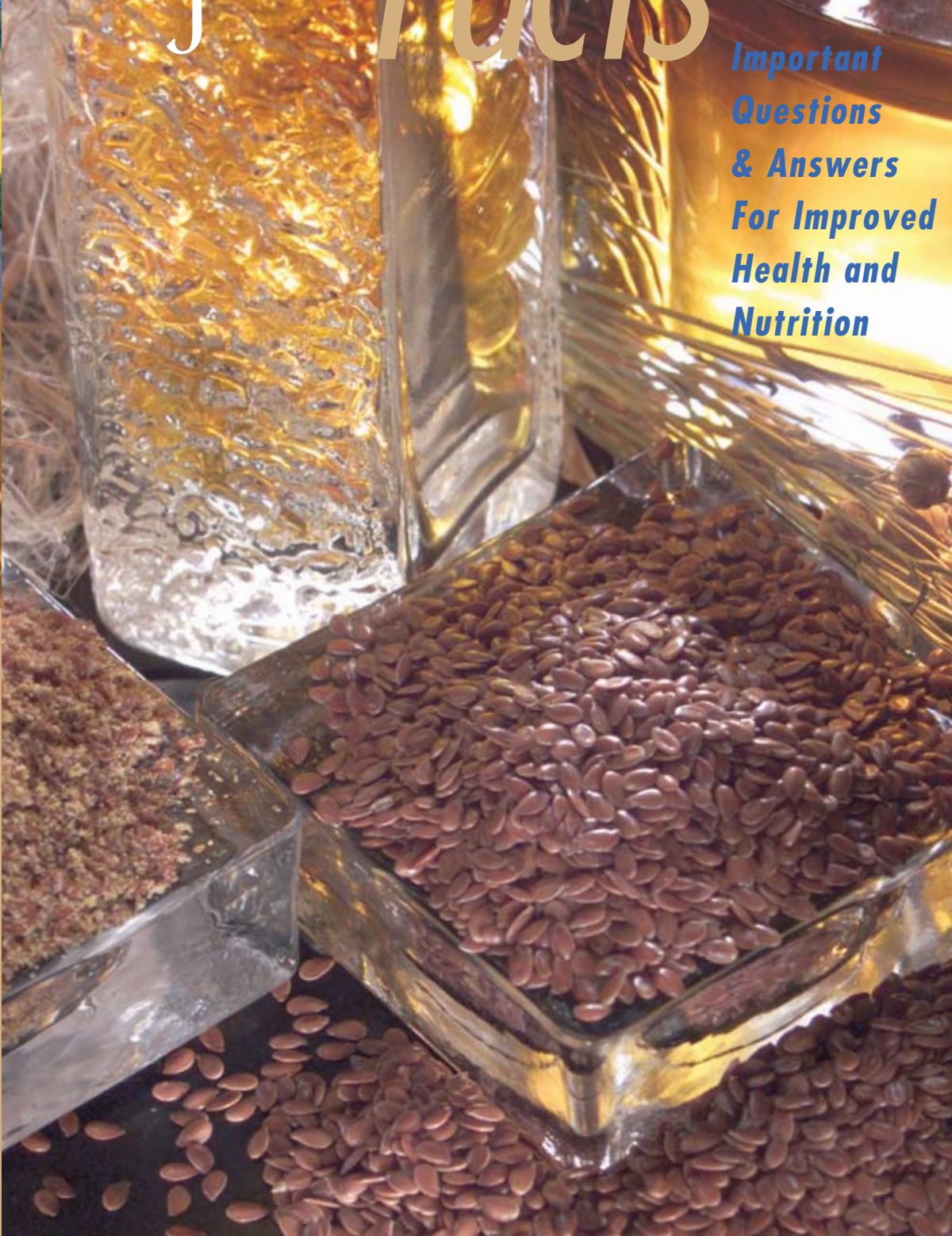


North America

flax **Facts**

**Important
Questions
& Answers
For Improved
Health and
Nutrition**



Ameri
Flax



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Flaxseed is a Rich Source of "Healthful Fats"

Flaxseed possesses a very healthy fatty acid profile. The oil from the seed is low in saturated fat (approximately 9%), contains moderate amounts of monounsaturated fat (approximately 18%), and is high in polyunsaturated fats (approximately 73%). Flaxseed oil does not contain *trans* fatty acids which have been implicated in significant increases in coronary heart disease risk. Of the nutritionally beneficial polyunsaturated fats, almost 16% belong to the omega-6 family primarily as linoleic acid (LA), whereas the remaining 57% belong to the omega-3 family

primarily as alpha-linolenic acid (ALA). Both

LA and ALA are essential fatty acids (EFAs). EFAs are termed essential

because they are "essential to life",

meaning they cannot be

produced by the body and

therefore must be obtained

from the diet. EFAs are

incorporated into the

membranes of our body

cells to keep them fluid. As

a result, they act as "gate-

keepers" to allow the entry

into cells of important nutri-

ents as well as the removal

of toxins. More importantly,

EFAs are converted to

hormone like substances

known as eicosanoids that

effect physiological functions such as cell growth and division, platelet aggregation (blood clotting), inflammatory responses, hemorrhage, vasoconstriction and vasodilation of blood vessels, blood pressure, and immune function. The activity of the eicosanoids impacts clinical conditions involved in cardiovascular health, inflammatory disorders, immunity, and certain cancers.

The Importance of an Optimal Omega-6 to Omega-3 Ratio

Critical for proper functioning of body cells is an optimal dietary ratio of omega-6:omega-3 fatty acids. This is because the omega-6 and the omega-3 fatty acid families form different eicosanoids with different activities and they compete with one another for the enzymes responsible for the synthesis of these eicosanoids. For instance, some eicosanoids stimulate pro-inflammatory and hypertensive events whereas other eicosanoids have opposite effects. Thus, a proper balance of essential fatty acids in the diet is important. For optimal health, Health Canada recommends an omega-6:omega-3 fatty acid dietary ratio of 4:1 to 10:1². The U.S. Food and Drug Administration has yet to set an official recommendation in this area.

It is speculated that in today's Western society the ratio of omega-6:omega-3 fatty acids may be as high as 20-30:1³. Today's elevated dietary omega-6:omega-3 ratio is largely attributed to the plethora of vegetable oils currently available and consumed that are high in the omega-6 fatty acid, LA. A distinction needs to be made, however, between LA, which is widely available, and another omega-6 fatty acid, gamma linolenic acid (GLA), which has numerous health benefits. GLA has been shown promise in the treatment and prevention of symptoms associated with rheumatoid arthritis, diabetes, skin problems and most recently, immune system disorders. A healthy body can convert LA into GLA, but due to a number of lifestyle (i.e. high meat intake) and environmental factors (i.e. pollution), this conversion is limited leaving many in today's society deficient in GLA.

Technological developments, such as food processing, have also depleted much of the ALA and omega-3 content from foods, which further contributes to an imbalanced omega-6:omega-3 ratio. Overall, we are consuming too much LA and not enough ALA and other omega-3 fatty acids, a situation that may negatively impact health.

A great deal of attention, therefore, has been focused on ALA and the omega-3 fatty acid family due to their deficiency in today's diet, as well as their beneficial effects in numerous clinical conditions.

Clinical Effects of ALA

• Cardiovascular Disease (CVD)

CVD is an area of research where the consumption of ALA appears to show the greatest potential for health benefit. Three distinct, but interdependent, pathological phenomena may occur that ultimately lead to CVD: thrombosis, fibrillation, and atherosclerosis. Various clinical manifestations such as stable angina

America
Flax

flax FACTS

Nutritional Properties of Flaxseed

Greek and Roman writings reference the healing properties of flax as far back as 650 BC. In fact Charlemagne, an 8th century emperor, considered flax so important for health that he passed regulations related to a requirement for flax consumption.

Typically flaxseed consists of approximately 40% fat, 28% dietary fiber, 21% protein, 4% ash, and 6% carbohydrates such as sugars, phenolic acids, lignans, and hemicellulose¹. Extensive scientific research over the past few decades has revealed numerous nutritional benefits of flaxseed due primarily to its fat, lignan, dietary fiber, and protein content.



SaskFlax

from atherosclerosis; infarction (obstruction of blood vessels) and stroke from thrombosis; and sudden death (cardiac arrhythmia) as a result of fibrillation, may result. Numerous intervention studies have established the beneficial effects of ALA on cardiac events.

- The Health Professional Follow-up Study⁴, which began in 1986 with a cohort of 51,529 health professionals, demonstrated that a 1% increase in ALA intake expressed as percent of energy was associated with a 40% reduction in the risk of non-fatal coronary heart disease (CHD).
- The landmark Lyon Diet Heart Study⁵ included participants who had previously survived a myocardial infarction. The experimental group consumed a typical Mediterranean style diet rich in ALA, whereas the control group consumed a typical Western-type diet low in ALA. Results demonstrated a 75% reduction in non-fatal myocardial infarction, and a 70% reduction in total death amongst the experimental group, in comparison to the control group.
- The Nurse's Health Study⁶ consisted of a 10-year follow-up of 76,283 women with no previously diagnosed cancer or CVD. After adjustment for age, standard coronary heart disease risk factors, and dietary intake, results demonstrated that a higher intake of ALA was associated with a lower relative risk of fatal and non-fatal myocardial infarction.
- In the Moselle study⁷, the diets of two groups of fifty Moselle farmers were analyzed for different constituents. It was reported that a lower dietary intake of LA, coupled with higher intakes of ALA (dietary LA:ALA ratio of approximately 5:1), markedly decreased platelet reactivity (i.e. the tendency of platelets to "clot").
- A recent review of studies focusing on flax and ALA⁸ concluded that the fatty acid can reduce ventricular fibrillation, and may be more effective than either eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) which are found in high levels in fatty fish and fish oils.
 - ALA has been shown to inhibit the growth of atherosclerotic plaques⁹.
 - Women who consumed 50 g of milled flaxseed a day for four weeks exhibited total blood and LDL-cholesterol ("bad" cholesterol) level reductions of 9% and 18%, respectively¹⁰. These effects were attributed to ALA as well as to the high amount of beneficial soluble fiber found in the flaxseed. Some research has indicated that ALA from flaxseed

FLAXSEED NUTRITIONAL ANALYSIS

Nutrients	as per 100 g	Minerals	mg/100g
Calories	492.0 kcal	Calcium	200.0 - 255.0
Total Fat	34.0 - 42.0 g	Copper	1.0
Saturated Fat	3.2 - 4.0 g	Iron	5.0 - 6.2
Polyunsaturated Fat	22.4 - 30.0 g	Magnesium	362.0 - 421.0
Linoleic	4.3 - 6.0 g	Manganese	2.5 - 3.2
Alpha - Linolenic	18.1 - 24.0 g	Phosphorus	498.0 - 642.0
Monounsatur. Fat as oleic	6.9 - 8.0 g	Potassium	681.0 - 831.0
Trans Fat	0.0	Sodium	27.0 - 34.0
Total Carbohydrate	30.0 - 38.0 g	Zinc	4.2 - 5.0
Dietary Fiber	28.0 g		microg/100 g
Protein	18.0 - 21.0 g	Selenium	5.0
			mg/kg
Vitamins		Aluminum	3.00
Tocopherols/vitamin E (mg ATE)	5.0	Barium	2.00
	mg/100g	Cadmium	0.25
Ascorbic acid/vitamin C	0.50 - 1.30	Chromium	<1.00
Thiamin/vitamin B1	0.17 - 0.53	Cobalt	0.17
Riboflavin/vitamin B2	0.16 - 0.20	Lead	<0.25
Niacin/nicotinic acid	1.40 - 3.21	Molybdenum	<0.50
Pyridoxine/vitamin B6	0.50 - 0.90	Nickel	1.70
Pantothenic acid	0.57 - 1.50	Tin	<3.00
	microg/kg		
Folate	112.0 - 278.0		
Biotin	6.0		

A range of values is provided which reflects differences in nutrient content of flaxseed due to environmental effects such as temperature and rainfall on seed development.

Vitamin E values are given in ATEs (Alpha-tocopherol equivalents):

1 mg alpha-tocopherol = 1 mg ATE x 0.8 mg alpha-tocopherol/mg ATE

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Adapted from:
USDA Nutrient Data Laboratory website -
<http://www.ars.usda.gov/nutrientdata>

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Flax Waffles

Favourite Cookies



Whole and milled flax are easily incorporated into breakfast, lunch or dinner fare.

may reduce serum triglyceride levels, another blood lipid associated with CVD, without altering HDL- cholesterol ("good" cholesterol) levels⁵. Altering lipid profiles is especially important in the prevention and management of CVD.

• The cardio-protective effects of ALA may be attributed to improvements in arrhythmia (abnormal heart rhythms) and to reductions in platelet aggregation (blood platelet stickiness).⁸

• **ALA and effects on inflammatory Biomarkers**

ALA may lower CHD risk through effects on inflammatory biomarkers - most notably C-reactive protein (CRP). Lowering blood levels of CRP which promotes arterial inflammation may be as important as reducing LDL cholesterol for preventing heart attacks and strokes¹². Half of all heart attacks and strokes in Canada and the United States occur in people with normal cholesterol levels, and 20% of all events occur in people with no major risk factors. It has been demonstrated that CRP levels, when added to the traditional ways of measuring risk, provide a better way of detecting who is a high-risk patient, than assessment of serum lipids alone.

In randomized, controlled, crossover studies (the "gold standard" for clinical research) conducted in hypercholesterolemic men and women, a diet high in ALA (from flaxseed oil and walnuts) dramatically decreased CRP¹³. Cross-sectional data from women involved in the Nurses' Health Study demonstrated an inverse association between ALA intake and plasma concentrations of CRP¹¹.

• **ALA impact on CVD**

A newly published report from the Harvard Medical School demonstrated that ALA may decrease the risk of fatal CHD through a reduction in fatal ventricular arrhythmias and sudden cardiac death (SCD)¹⁴. A negative association between ALA and the risk of SCD was found among 76,763 women participating in the Nurses' Health Study. The public impact of diets containing ALA in flaxseed oil which is low-cost and easily accessible could be significant.

Extensive research suggests that ALA shows potential in other clinical conditions:

• **Inflammatory Disorders**

ALA may have protective effects in inflammatory disorders such as rheumatoid arthritis¹⁵ and systemic lupus erythematosus¹⁶. The anti-inflammatory actions of ALA are attributed to its ability to inhibit the production of pro-inflammatory eicosanoids such as TXB2.

• **Immune Function**

ALA in flaxseed has been shown to have positive effects on immune function, which is the body's ability to defend itself against infection. This may be particularly important in the management of auto-immune disorders such as lupus nephritis¹⁸. In a 1995 study, nine patients were fed 15 g of flaxseed daily for four weeks¹⁷. The dosage was then increased to 30 g and then 45 g daily for subsequent periods of four weeks. The researchers concluded that 30 g of flaxseed showed benefit in terms of kidney function as well as other inflammatory parameters. The positive effects of ALA on immune function are believed to be due to its effects on membrane phospholipids, as well as eicosanoid and cytokine production⁹.

• **Cancer**

A review of the literature¹⁹ on the anti-carcinogenic properties of ALA and omega-3 fatty acids indicated an inhibitory effect of dietary ALA on tumor incidence and growth in animal models using chemically induced, transplantable and spontaneous tumors. These results have been reported for cancers of the breast, colon, pancreas, and splenocytes.

Flaxseed as the best choice for omega-3's from plants

Flaxseed oil contains more than three times as much omega-3 fatty acids than omega-6 fatty acids. The omega-6 to omega-3 ratio of flaxseed is 0.3:1²⁰. When comparing to other common plant based oils, corn oil has an omega-6:omega-3 ratio of 58:1, soybean oil 7:1, and canola oil 2:1²¹. Due to the current high dietary intake of the omega-6 fatty acid LA, coupled with the deficiency of omega-3 fatty acids in today's typical North American diet, flaxseed oil clearly provides the best overall dietary EFA ratio. Supplementing the diet with flaxseed provides a good source of the plant based omega-3 fatty acid ALA, low levels of LA as well as a healthy and optimal omega-6:omega-3 ratio.

Flaxseed as an excellent source of lignans

Flaxseed is one of the richest sources of lignans providing 75-800 times higher levels than other plant sources. Lignans represent approximately 0.7 to 1.5% of flaxseed²². Lignans are phytoestrogens – "phyto" meaning derived from plants, and "estrogen" referring to the hormone produced in the body. Phytoestrogens are beneficial

Curried Rice and
Grape Salad

Flax-topped
Pork Tenderloin



compounds that affect the metabolism of hormones such as estrogen in humans. The major lignan in flaxseed is seicoisolariciresinol diglucoside, commonly referred to as SDG²². Once ingested, SDG is converted in the colon to the mammalian lignans enterodiol and enterolactone, which are responsible for numerous beneficial biological properties.

- Lignans provide protection against certain forms of cancer due to estrogenic and anti-estrogenic activity in the body. Lignan consumption may be particularly beneficial in hormone sensitive cancers such as those of the breast, endometrium, and prostate²³. A recent clinical trial was conducted involving 50 women diagnosed with breast cancer²⁴. While waiting for surgery, half of the women received muffins containing 25 g of milled flaxseed daily while the other half received ordinary muffins. The women who received the flaxseed muffins had slower-growing tumors compared to the other group. A further study was conducted with 116 women suffering from cyclical mastalgia (breast pain)²⁵. Women were fed either a muffin containing 25 g of flaxseed or a placebo for 4 menstrual cycles. The women who received the flax muffins had significant reductions in breast swelling and pain. Mastalgia has been linked to the development of certain forms of breast cancer.
- Lignans from flaxseed exhibit strong antioxidant properties^{26,27} which may play a positive role in certain cancers. This characteristic of lignans may also be responsible for reductions in atherosclerotic plaque formation noted in animal studies²⁸.
- The development of both Type-1 and Type-2 diabetes has been shown to be due, in part, to oxidative stress. The flax lignan SDG has been found to be effective in lowering the onset of both types of diabetes due to its potent antioxidative ability^{28,29}.
- Flax lignans also have the ability to lower serum cholesterol, an effect believed to be due to a modulation of enzymes involved in cholesterol metabolism³⁰.

Flaxseed as an excellent source of dietary fiber

Flaxseed contains approximately 28% dietary fiber, with a ratio of soluble to insoluble fiber between 20:80 and 40:60³¹. The insoluble dietary fiber fraction plays an important role in the relief of constipation, a common problem among many individuals who consume low fiber diets, are inactive, or are using certain medications for other conditions but that may promote constipation. Diets high in insoluble fiber result in a healthy bacterial environment in the colon, which may have protective effects against colon cancer³². The soluble dietary fiber

fraction of flaxseed is found primarily as mucilage gums, which have been shown to play a role in lowering serum cholesterol levels³², an effect that ultimately benefits cardiovascular health.

Flaxseed as an excellent source of protein

The protein found in flaxseed is very similar to that of soybean protein, which is considered one of the most nutritious plant proteins. This is due to the type of amino acids present, which are the building blocks of protein. Flaxseed contains numerous "essential amino acids", which the body cannot produce and therefore must obtain from the diet. Flaxseed protein has significance to vegetarians relying on plant sources to meet their daily protein requirements.

Different forms of flax

Whole and Milled Flaxseed:

Both whole and milled flaxseed are rich in dietary fiber, lignans, protein, and the essential fatty acid, ALA. Careful chewing will break the seed coat of whole flaxseed to allow the release of nutrients contained within, whereas milled flaxseed is already pre-ground. It is a personal choice whether to use whole or milled flaxseed.

Flaxseed Oil:

Flaxseed oil results from pressing the oil from the seed. Flaxseed oil provides more ALA (approximately 55-58%) on a per weight basis in comparison to whole or milled seed (approximately 15-18%).

Flaxseeds' medicinal popularity through the ages is in part due to the many forms it was used in and continues to be utilized today.





Flax Tortillas

Flax Granola

Curried Couscous with Flax

Flax, a precious commodity in the ancient world, was prized for its multitude of uses. Today's research not only validates its historical worth, but promises a future of expanded utilization.

Stability of flaxseed

Baking:

Studies have shown that both the ALA and lignans in flaxseed remain stable under common baking temperatures of 178°C (350°F)³³. Muffins containing whole or milled (flour) flaxseed or oil (15g/kg) showed no differences in levels of lipid oxidation products (i.e. oxygen derived breakdown) when compared to muffins containing wheat flour with no flax ingredients³³. In baking, milled flax can be substituted for the fat used in recipes at a ratio of 3:1. For example, 375 mL (1½ cups) of milled flaxseed can replace 125 mL (½ cup) of butter, margarine, cooking oil, or shortening. Adding whole or milled flaxseed or oil to baked goods such as muffins and breads is an excellent way to obtain the healthy constituents found in flax.

Frying:

Using flax oil for frying is not recommended as once the oil is extracted from the seed, the polyunsaturated fatty acids may undergo thermal oxidation when exposed to the high temperatures used in food frying³⁴. This will give off flavors and odors to the finished product.

Storage:

Whole flaxseed can be stored at room temperature for up to one year. However, ground flaxseed is more susceptible to oxidation and therefore rancidity. As a result, grinding whole flaxseed in a coffee grinder just prior to use will ensure the highest quality. Ground flaxseed can be stored in an airtight, opaque container and refrigerated for up to 90 days, or frozen to ensure the preservation of quality³⁴. Similarly, once opened, flax oil should be kept in an airtight, opaque container and refrigerated.

Weight and calorie content of flaxseed (per specific measurement)

Ground Flaxseed

250 mL = 1 cup = 130 grams = 4.5 ounces = 585 calories

15 mL = 1 tbsp = 8 grams = .3 ounces = 36 calories

5 mL = 1 tsp = 2.7 grams = .1 ounces = 12 calories

Whole Flaxseed

250 mL = 1 cup = 180 grams = 6.3 ounces = 810 calories

15 mL = 1 tbsp = 11 grams = .4 ounces = 50 calories

5 mL = 1 tsp = 4 grams = .1 ounces = 18 calories

Recommended intake of flaxseed and flaxseed oil

At the present time, there is no Recommended Dietary Allowance (RDA) for EFAs in the United States³⁵. However, Health Canada has established a Recommended Nutrient Intake (RNI) for EFAs, specifying the minimum daily intake of ALA should be 0.5% of total energy³⁶. Similarly, the British Nutrition Task Force also recommends a minimum daily intake of 0.5% energy from ALA³⁶. In September of 2002, the National Academy of Sciences' Institute of Medicine (IOM) released recommendations for several dietary constituents directed towards reducing the onset of chronic disease³⁷. The Health and Human Service's Office of Disease Prevention and Health Promotion (U.S.) commissioned the report, "Dietary Reference intakes for Energy, Carbohydrates, Fiber, Fat, Protein and Amino Acids (Macronutrients), in collaboration with Health Canada. In this report, the IOM set an acceptable level of intake of ALA as 1.6 grams/day for men and 1.1 grams/day for women.

To put the Health Canada recommendation into perspective, based on an average intake of 2500 calories per day, the following forms of flax would provide the RNI for ALA:

Flaxseed oil: 2 to 3 grams of flaxseed oil, which is equivalent to 2 to 3 softgels (1000mg), or approximately 2 mL (½ tsp.) of oil.

Whole or milled flaxseed: Approximately 15 to 25 mL (1 – 2 tbsp.) of milled flaxseed (approximately 30g) may provide adequate supplementation of both ALA and lignans.

Difference Between Brown and Yellow Flaxseed, Solin, and Linola™

Brown and yellow flaxseed both contain the same nutritional benefits in terms of ALA, lignan, protein and dietary fiber content. It is a matter of personal choice which seed is consumed as both are rich in all the nutrients for which flax is known. It is important to note, however, there exists another type of flaxseed that closely resembles yellow flaxseed but is actually a derivative of flax known as Solin. Solin contains low levels of ALA (< 5%). Solin varieties, such as Linola™, are used to produce a vegetable oil that is used primarily for frying applications.

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www.saskflax.com

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