

Flaxseed

An

Ancient Grain

Rich in

Health &

Culinary

Benefits

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An ancient grain rich in health and culinary benefits

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Flaxseed has been cultivated as far back as 5,000 B.C. Its botanical name, *Linum usitatissimum* L. means “the most useful”. Flaxseed is grown for both fibre and food. Varieties which produce tall plants with long fibres are used in the textile and paper industries whereas the short fibre varieties are grown for food use.

Flaxseed, also referred to as linseed, has either a yellow or brown seed coat and is flat and oval shaped. The colour of the seed coat does not affect the nutritional composition of the seed. Flaxseeds are rich in omega-3 fatty acid, protein, fibre and antioxidants which are important for good health. In addition, flaxseed contributes to the texture of foods and adds a nutty flavour when added to food formulations.

## Canadian Flaxseed Production

Canada is the largest producer of flaxseed accounting for approximately 25% of the world's production in 2012.<sup>1</sup> Most of the flaxseed produced in Canada is for food use. As a top flaxseed producer in the world, Canada has ideal growing conditions for producing high quality flaxseed especially in the cool, northern climate of the Prairies.



## Nutrient Composition of Flaxseeds

About 42% of flaxseed is oil and more than 70% of that oil is comprised of healthy polyunsaturated fatty acids. Flaxseed contains 55-57% of the essential omega-3 fatty acid, alpha-linolenic acid (ALA) and approximately 28% total dietary fibre including both soluble and insoluble fibre. Soluble fibre can lower blood cholesterol levels and help moderate blood sugar, while insoluble fibre moves the stool through the colon more quickly, helping bowel movements and improving laxation.<sup>2</sup>

Flaxseed is one of the richest plant sources of lignans, providing up to 800 times more lignans than most other foods. Lignans are phytoestrogens – compounds that have been shown in studies of animals and in early human clinical trials to help protect against certain kinds of cancer, particularly cancers of the breast and colon, by blocking tumour formation.<sup>2</sup> Flaxseed contains about 20% protein and has an amino acid profile similar to that of soybean protein which is considered to be one of the most nutritious of the plant proteins.<sup>3</sup> Flaxseed, like other oilseeds is gluten-free.

## Health Claim for Flaxseed

The health-promoting components in flaxseed are associated with improved cardiovascular health. In 2014, Health Canada approved a health claim which links eating ground whole flaxseed to blood cholesterol lowering, a major risk factor for heart disease.<sup>4</sup> The claim is only one of eleven approved in Canada. 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". 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.

## Flaxseed Ingredients

Flaxseed is available as whole seed, oil and as milled or ground whole flaxseed. The residual product remaining after oil extraction and containing about 8-10% oil is referred to as flaxseed meal and is also found in the food market.

Flaxseed oil is produced by cold-pressing the seeds to remove the oil. By controlling the temperature during processing the oil maintains its freshness. The oil is sold in brown bottles to further maintain quality. It is important to use the oil before its expiry date and once opened it should be refrigerated and used according to manufacturer's recommendation, usually within 6 weeks. High lignan flaxseed oil is also available which has some of the partially defatted flaxseed meal added back to the oil. By combining the two fractions, the health benefits of both ALA and lignin are present in the product.

Despite the high level of ALA in flaxseed, research has shown that ground flaxseed can be stored at room temperature for at least 4 months.<sup>5</sup> In a follow-up study, it was found that ground flaxseed showed remarkable stability when stored at ambient temperatures for 20 months, indicating the presence of a strong protective system preventing oxidation.<sup>6</sup> The stability of ground flaxseed has been attributed in part to the lignans since both secoisolariciresinol and enterodiol, the lignans found in flaxseed, exhibit greater antioxidant activity than Vitamin E.<sup>3</sup>

For optimum freshness, manufacturers package ground flaxseeds in airtight, opaque packaging material. Once opened, close attention should be paid to the manufacturer's recommendations for storage and the product should be used prior to its expiry date. Similar to other whole grain flours or raw nuts, the freshness of milled flaxseed can be prolonged by storing in the refrigerator or freezer. Whole flaxseed can be stored at room temperature for up to two years provided it is clean, dry and of good quality.

Although flaxseed contains low levels of cyanogenic glucosides and the enzyme linase which can hydrolyze the glucosides, pre-treating flaxseed for at least 10 minutes thermally decomposes the linase.<sup>7</sup> Furthermore, no evidence has been found concerning the adverse effects of consuming flaxseed.<sup>8</sup>

## APPLICATIONS FOR FLAXSEED OIL

Flaxseed oil is best used in applications that do not require heat. Flaxseed oil should not be used for frying or baking since the oil is too delicate to be exposed to the high temperatures used in these applications.



## APPLICATIONS FOR WHOLE FLAXSEEDS

Whole flaxseed can be used in whole grain porridges and sprinkled on salads and on rolls, muffins, bagels, and breads prior to baking to give a pleasing appearance and added crunch. Whole flaxseed can also be folded into bread doughs before baking. Commercial bakers often condition the seeds by soaking in water for 10 minutes or up to 2 hours before adding to the flour mixture.<sup>3</sup>

## APPLICATIONS FOR GROUND FLAXSEED

Ground flaxseed is available in different particle sizes depending on the manufacturer. In general, finely ground flaxseed is better suited for use in beverages, breads and pasta whereas, coarsely ground flaxseed may contribute visual appeal to products like snack bars, bagels and muffins. Research conducted by the Food Development Centre (Portage la Prairie, MB) found that bread made with a more coarsely ground flaxseed (milled to pass through a 12-14 mesh screen) had a higher volume than bread made with a finer ground flaxseed (milled to pass through a 20 mesh screen) (Personal communication, 2015).

Flaxseed meal is also available in the marketplace, which is produced after the flaxseed are pressed to extract the oil. It has a lower oil content than ground flaxseed but still contains high levels of lignans, protein and fibre.

Research has shown that levels of ALA and lignans in whole milled flaxseed, are stable in baked products under typical baking conditions.<sup>9,10</sup> Levels of lignans have also been shown to be stable in pancakes<sup>11</sup> after cooking and level of ALA remain unchanged in pasta<sup>12</sup> after boiling.

### Baked Goods

When incorporating ground flaxseed into baked goods, formulation and processing conditions may require modification due to the high levels of protein, fibre, and fat found in the flaxseed. For example, when adding ground flaxseed to baked goods, the amount of fat in the formula may need to be reduced to compensate for the fat contributed by the flaxseed<sup>13</sup> otherwise the resulting baked product may have an oily mouthfeel and decreased overall acceptance.<sup>14</sup> For muffins, to calculate the amount of fat reduction required, subtract 35% of the total flaxseed weight from the total amount of fat called for in the formula.<sup>15</sup> Reducing the fat in bread however, is not recommended as it has been found to result in a stiff dough and a dry bread crumb.<sup>14</sup>

Bread products containing ground flaxseed typically require 25% more yeast to maintain the same proof time and the amount of water should be increased by an amount equal to 75% of the weight of the flaxseed incorporated, due to the high levels of fibre present in the ground flaxseed.<sup>13</sup> When formulating bagels with 23% ground flaxseed in the formula (43% on flour weight), yeast, vital wheat gluten, and water were all increased to achieve an optimal product.<sup>16</sup> The addition of dough conditioners can also be used to optimize dough handling properties and end-product quality. Furthermore, mixing speed and time, as well as floor time may require modification to allow for full hydration of the dough and changes in dough handling properties. It may also be necessary to make adjustments to the sheeter and molder. Decreasing the relative humidity and increasing proof time during fermentation is another strategy that can be used to improve the volume of fibre enriched bread doughs.<sup>17</sup> To prevent too much browning it is recommended that baking temperatures be reduced by ~25°F and a slightly longer bake time be used.<sup>17</sup>

The addition of 15% ground flaxseed on flour weight in baked goods has been recommended.<sup>13,18</sup> More recent studies have found bread containing 30% ground flaxseed on flour weight had better overall acceptability scores than breads made with 15 and 25% ground flaxseed<sup>14</sup> and oatmeal bread containing 20-25% ground flaxseed was found to have excellent flavour and texture but reduced loaf volume.<sup>19</sup> Flaxseed breads have been found to be moister than a whole wheat control bread and had a stronger, nuttier flavour.<sup>14</sup> Due to flaxseed's high water absorption properties, flaxseed enriched baked products tend to remain moist during storage.<sup>20</sup>

Although flaxseed has a pleasing, nutty flavour, a slightly bitter taste can be imparted depending on the level of inclusion. This can be attributed to the presence of peptides (cyclolinopeptide E) in flaxseed.<sup>21</sup> It may be necessary therefore, to adjust the level of sweetener used or to add other ingredients to optimize the flavour profile of the final product. For example, in a study incorporating 23% ground flaxseed in bagels (43% on flour weight), the addition of cinnamon and raisins resulted in bagels that were sweeter and had a less intense flaxseed flavour than plain flaxseed bagels or flaxseed bagels containing sunflower and sesame seeds.<sup>16</sup>










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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## Muffins

When formulating muffins containing ground flaxseed achieving good batter viscosity and flavour balance are important considerations. Muffins containing 50% ground flaxseed on flour weight have been shown to have better overall acceptability scores than muffins containing 33% and 66% ground flaxseed.<sup>14</sup> In addition the muffins containing 33% and 50% ground flaxseed were found to be more tender and moister than the whole wheat control muffins. In a different study, muffins containing 16-17% ground flaxseed (48.6% on flour basis) had lower sweetness and vanilla aroma and flavour scores compared to the control muffins.<sup>22</sup> The flaxseed muffins formulated with an apple spice flavouring were found to give the best flavour profile of all the flavourings used. In the formulation of bran muffins containing 10% ground flaxseed of the total weight of ingredients, vegetable oil could be reduced by 40% and the addition of applesauce and honey were required to achieve a good batter viscosity and to retain moisture, respectively.<sup>19</sup>

## Snack Bars

Unbaked snack bars made with 14-15% ground flaxseed have been shown to have good acceptability.<sup>23,24</sup> When higher levels of ground flaxseed are added, the sensory quality of snack bars has been shown to improve if the bars are baked (Personal communication, Food Development Centre, Portage la Prairie Manitoba, 2015). Similar to what has been reported for muffins and bagels, when ground flaxseed was added to baked snack bars at levels of ~32%, the bars which were highly flavoured were found to give the best flavour profile.<sup>22</sup>

## Beverages

The solubility, hydration rate, and thickening properties of ground flaxseed are important considerations when adding flaxseed to beverages. Because of the high levels of protein, fat and fibre in flaxseed, formulating beverages with good shelf stability can present several challenges. For example, the addition of 2.5% finely ground flaxseed to a chocolate flavoured milk resulted in a beverage that had greater viscosity than the control milk and it continued to thicken over the two week storage period even though it showed no separation and had good compositional stability.<sup>25</sup> The increase in viscosity of the beverage was attributed to the colloidal dispersion created by the high fat and the absorption of free water due to the higher fibre content.

No known studies have been conducted on the optimal pH and/or temperature for incorporating ground flaxseed into beverages. However, flaxseed proteins are only 20-24% soluble between pH 2-6 but in the presence of sodium chloride the solubility is altered.<sup>26</sup>

## Summary

Adding flaxseed to a food formulation is an excellent choice to enhance the nutritional content of the product. Rich in protein, fibre, lignans, and ALA, flaxseed has much to offer including its own health claim. Flaxseed also enhances the flavour and texture of foods and can be used in a variety of applications.

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