as Functional Food for People...

and as Feed for Other Animals...

FLAXSEED
FLAXSEED for food contains . . .

- Large amounts of OMEGA 3 fatty acid, alpha linolenic acid (ALA) an ESSENTIAL FATTY ACID, (EFA), that our bodies can’t make from other foods . . . and
- Very high amounts of DIETARY FIBER, both SOLUBLE and insoluble, similar to dietary fiber in other GRAINS, for example, oats, wheat, corn, rice, dry beans, soybeans, etc.
- the PHYTOCHEMICALS, called LIGNANS, having apparent anticarcinogenic action in animals....and
- other NUTRIENTS such as proteins, carbohydrates, minerals – flaxseed is very HIGH IN POTASSIUM and
- Flaxseed has a pleasant, nutty flavor – TASTES GOOD!!

<table>
<thead>
<tr>
<th>Fiber Component</th>
<th>Flax Seed</th>
<th>Oat Bran</th>
<th>Oat Bran Meal</th>
<th>Wheat Bran</th>
<th>Corn Bran</th>
<th>Rice Bran</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total dietary fiber</td>
<td>40</td>
<td>17</td>
<td>11</td>
<td>49</td>
<td>78</td>
<td>75</td>
</tr>
<tr>
<td>Soluble fiber</td>
<td>10</td>
<td>8</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Insoluble fiber</td>
<td>30</td>
<td>8</td>
<td>6</td>
<td>43</td>
<td>76</td>
<td>71</td>
</tr>
</tbody>
</table>

*All data are from Dietary Fiber Guide, and/or Cereal Foods World 38(10):755-59.1993
Some Apparent Health Benefits to people consuming flaxseed are reported in the scientific literature*:

- Reduction of LDL cholesterol and triglycerides . . . and may reduce heart arrhythmia during “coronary events” (Bierenbaum and Alexander)
- Anti-inflammatory effects . . . (Zurier and Kelly)
- Natural laxative effects of the dietary fiber . . . (Cunnane)
- Helps glucose control in diabetics . . . (Cunnane)
- Softens skin and improves coat (fur) of animals . . . (Simopoulos)
- Reduces some psoriasis in people and other animals . . . (Simopoulos)
- Ameliorates renal disease (Lupus nephritis) with favorable effects on plasma lipids and blood pressure (Clark, Parbtani)

* Citations available if requested.

Where to Get Flaxseed and Prepare It for Food

**What is a Daily “Dose”?**

- Flaxseed and cold-pressed flaxseed oil may be purchased at most “HEALTH FOOD STORES” in the United States, or see North Dakota sources in this publication.

- Flaxseed must be GROUND to get maximum benefits of the OMEGA 3 oil and dietary fiber. One can grind flaxseed with a coffee grinder – the Braun Model KMM30 is a very good grinder with both an inlet and outlet. Ground flaxseed may be kept for many months in the refrigerator or deep freeze. Whole flaxseed keeps for several years in clean, dry storage at below zero F to 80 F.

- A DAILY DOSE of ground flaxseed is about ¼ cup or 35 grams or 3 heaping tablespoons, depending on fineness of grind. Ground flaxseed can be stirred into orange or other juices, into SMOOTHIES, or added to about any baked product, See RECIPES. A daily DOSE of flaxseed oil is 1 to 3 tablespoons.

- The omega 3 alpha linolenic acid, ALA, in flaxseed is an ESSENTIAL FATTY ACID for humans which is used in the body in neural tissues, retina of the eye, in cell walls of brain and other neural tissue.

- Dietary fiber in flaxseed adds bulk to waste products in the gut and increases bile movement in the gastrointestinal system.
FLAXSEED OIL is another product from flaxseed which is COLD-PRESSED with a screw press at temperatures not to exceed 100 F. No external heat is used and NO SOLVENT is used to extract oil left in the seed after screw pressing.

Cold-pressed flaxseed oil usually is ORGANIC and is sold in “health food” stores or via mail order direct in 8 ounce brown bottles with expiration dates of about four months from pressings. Store in the refrigerator. Flaxseed oil is composed of plant (vegetable) oil – 50-55% of which is the omega 3 alpha linolenic fatty acid type.

Flaxseed oil is used in home-made salad dressing, drizzled on cooked vegetables, included in smoothies, and can be used in stir-frying at moderate temperatures. Flaxseed oil has a desirable ratio of several fatty acids as shown in the table below. Some flaxseed oils have the LIGNANS added back after the pressing is completed and before bottling.

Another product which is source of omega 3 fatty acids is so-called HIGH OMEGA 3 eggs from laying hens fed flaxseed and/or a combination of other omega 3 sources. The eggs contain ALA and another omega 3 fatty acid, DHA, found in eggs from hens fed flaxseed or in cold water fish.

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage, range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>7.1 - 8.3</td>
</tr>
<tr>
<td>Lipids (dm basis)</td>
<td>31.9 - 37.8</td>
</tr>
<tr>
<td>Protein</td>
<td>26.9 - 31.6</td>
</tr>
<tr>
<td>Total dietary fiber</td>
<td>36.7 - 46.8</td>
</tr>
<tr>
<td>Insoluble</td>
<td>30% ± S.E.</td>
</tr>
<tr>
<td>Soluble</td>
<td>10% ± S.E.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fatty acid composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palmitic, C(_{16:0})</td>
</tr>
<tr>
<td>Stearic, C(_{18:0})</td>
</tr>
<tr>
<td>Oleic, C(_{18:1})</td>
</tr>
<tr>
<td>Linoleic, C(_{18:2})</td>
</tr>
<tr>
<td>Linolenic, C(_{18:3}) (Omega 3)</td>
</tr>
</tbody>
</table>

\( ^a \) Adapted from Hettiarachchi and coworkers.  
\( ^b \) Standard error.
# Nutritive Value of Omega-3 Eggs from Hens Fed Flaxseed Compared to Standard Eggs

<table>
<thead>
<tr>
<th></th>
<th>Omega-3 Egg</th>
<th>Standard Egg</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 g - large egg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calories</td>
<td>75.0</td>
<td>75.0</td>
</tr>
<tr>
<td>Protein</td>
<td>6 grams</td>
<td>6 grams</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>.6 grams</td>
<td>.6 grams</td>
</tr>
<tr>
<td>Total Fat</td>
<td>6.0 grams</td>
<td>6.0 grams</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>1.5 grams</td>
<td>2.2 grams</td>
</tr>
<tr>
<td>Polyunsaturated Fat</td>
<td>1.35 grams</td>
<td>.90 grams</td>
</tr>
<tr>
<td>n-6 Fatty Acids (Linoleic)</td>
<td>750 mg</td>
<td>800 mg</td>
</tr>
<tr>
<td>n-3 Fatty Acids</td>
<td>350 mg</td>
<td>60 mg</td>
</tr>
<tr>
<td>C18:3 (ALA)</td>
<td>250 mg</td>
<td>40 mg</td>
</tr>
<tr>
<td>C22:6 (DHA)</td>
<td>100 mg</td>
<td>20 mg</td>
</tr>
<tr>
<td>n-6:n-3 Ratio</td>
<td>2.6</td>
<td>13.0</td>
</tr>
<tr>
<td>Monounsaturated Fats (Oleic)</td>
<td>2.8 grams</td>
<td>2.4 grams</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>180 mg</td>
<td>210 mg</td>
</tr>
</tbody>
</table>

*Adapted from Leaflet NF97-354, INAR, University of Nebraska, Lincoln, NE.*
Historically, flaxseed has been used for food and feed for animals for several thousand years in Europe, Asia and Africa, and more recently in Canada and the United States. Oil pressed from flaxseed also has been a basic cooking oil in China and other countries for centuries.

So-called LINSEED OIL pressed from flaxseed is an “industrial” oil that is used for paints, coatings, linoleum, and many other products. Linseed oil is pressed and further extracted from flaxseed with a petroleum solvent. Industrial linseed oil is not useable for food or feed, although the linseed oil meal remaining after linseed oil extraction is used for animal, principally dairy, feed.

Fiber in the stem of flax plants is used for producing linen sheets, napkins, table cloths and clothing, and for FINE PAPERS, like bible paper, other parchment paper, and cigarette paper. The early pioneers to North America brought flax with them for linen production. Flax production moved westward, at first for linen production and later as a seed crop for linseed oil production. Competition from cotton, synthetic fibers and, cheaper vegetable oils and petroleum substitutes reduced the need to produce flaxseed for linseed oil or fiber.

Flaxseed is now produced primarily in North Dakota in the United States. Flax acreage is increasing in recent years because of increased use for food, and feed for PETS, SHOW ANIMALS, and other COMPANION ANIMALS. Some yellow flaxseed also is exported to Europe for food.

Such improved flax VARIETIES as yellow or golden OMEGA, and brown-seeded types like LINTON, NECHE, PEMBINA, CATHAY AND FLOR have been developed by North Dakota State University and USDA for production in North Dakota and nearby. Yellow and brown flaxseed have the same nutritive/chemical characteristics. Some RECIPES for baked products containing ground FLAXSEED are provided. Flaxseed can be added to almost any baked product, sprinkled on salad or cereal, cooked in oatmeal or the oil used in salad dressing or in stir-frying.

Flaxseed is 35-40% oil so a similar amount may be omitted from any recipe requiring oil, that also includes ground flaxseed. Similarly, 15 grams of ground flaxseed steeped in 45 ml. water for 2 minutes will substitute for one egg in recipes. Flaxseed contains NO GLUTEN for those with gluten allergy.

Flaxseed in vegetarian diets is a good source of essential fatty acids, protein, carbohydrates, the phytochemical LIGNAN, potassium and other nutrients.
Recipes Using Flaxseed as an Ingredient

Yeast Bread
Makes 4 - 1½ lb. loaves

2 cups Whole wheat, strong gluten flour, semolina grind, entire kernel
½ cup Rye flour
1 cup Ground flax (use OMEGA yellow flax for nice color, blend into bread, no “dark specks”)
6-7 cups Dakota Maid or Dakota State or strong gluten “bread” flour or to desired dough consistency; (Add 4-5 Tbsp. vital gluten if bread flour alone does not give good loaf volume after baking)
⅛ cup Sugar
⅛ cup Molasses
⅓ cup Canola oil
1 Tbsp. Dry yeast
1 Tbsp. Salt
3½-4 cups Warm water

• Combine ingredients in usual way, start yeast in ¼ cup water if wish, but not necessary.
• Bake in 375°F oven for 35-40 minutes, more or less, until loaves are browned and slightly loose in pan.
• Double recipe if wish for 8 loaves (6 loaves in Bosch mixer or 3 loaves in Kitchen Aid Mixer are about maximum capacity).

Pancake or Waffle Mix

1½ cup Whole wheat, semolina grind
½ cup Ground flax seed (contains 35% oil)
1½ cup Pancake mix or all purpose flour
¼ tsp. Baking powder
¼ tsp. Baking soda —— double if use flour, not mix
1 Tbsp. Sugar
¼ tsp. Salt
2 Tbsp. Olive or canola oil
1 Egg or 2 egg whites to reduce cholesterol and saturated fat
3-4 cups (Approx.) Buttermilk to preferred consistency

BAKE on griddle or electric skillet at 375° to 400°F, or cook waffles on waffle iron.
Muffins or Quick Bread *

4 cups All-purpose flour or sub. 2 cups whole wheat or cake flour for 2 cups of all-purpose, if wish, reduces and increases muffin volume, resp.

2 cups Ground flax seed**

½ tsp Vanilla extract
1 tsp Salt
1 tsp each Baking soda and baking powder
1 tsp Cinnamon

4 Egg whites or 2 eggs, “flax eggs” if available
Grated peel from two lemons, save lemons for juice, remove seeds
½ cup Sugar, honey or molasses, or combination.

Add 1 cup Applesauce or ripe banana to wet ingredients, and add ½ cup ± flour to compensate, if desired.

1 cups Raisins or chopped prunes or dates added to liquid ingredients or best are chopped date pieces, or frozen blueberries, added last so they don’t “bleed”, folded in carefully

2 cups Lemon juice and add buttermilk to make 2 cups liquid or slightly more for desired consistency.

**One cup of ground flaxseed weighs approximately 120 grams; if 24 muffins are made from this recipe, containing 240 grams of flaxseed, each would contain about 10 gms of flax (35% fiber) or three/day should be consumed for a 30 gm “dose.” (Ground flaxseed can be calculated to 30 gm/day, ¼ cup, “dose” or as desired up to 50 gm/day.)

MUFFINS: Use medium size, Teflon pans, sprayed lightly with PAM; don’t use paper liners, dough sticks; beat eggs (whites) and sugar before adding lemon juice and buttermilk to liquid ingredients; avoid over mixing; stir or mix dry ingredients into liquid ingredients just enough to dampen dry ingredients, leaving batter slightly rough and lumpy; mix additives like dry fruit into liquids, just before adding dry ingredients.

*Makes 24 medium muffins, or BAKE in small loaf pans, 3” x 7” approx., or as wish, for 35-40 minutes at 375°F.
Recipies for Automatic Bread Machines
Using Flax Seed As An Ingredient

One 1½ lb. Loaf (dough weight before baking)

2/3 cup Whole wheat, strong gluten bread flour, semolina grind or as available. (Add 1 Tbsp. of vital gluten for ideal loaf volume.)

1/6 cup Rye flour

5 tsps.(level) Ground flaxseed (At 2 grams/tsp. there is one gram flaxseed/2 slices bread in 20 slice loaf.)

1 ½ cups Dakota Maid or Dakota State bread flour or a strong gluten bread flour, (increase slightly, maybe 1 Tbsp., if dough is sticky).

2 Tbsp. Sugar
2 Tbsp. Molasses
2 Tbsp. Canola oil
1 tsp. Salt
1 tsp. Dry yeast
¾ cup Warm water

Combine ingredients in usual way; if person baking wishes to try “manual” first, use dough hook in mixer; add water, oil, salt, sugar, molasses, ground flaxseed, whole wheat, yeast; mix a short time and then add Dakota Maid bread flour; mix for 5-6 minutes to develop the dough; let rise once in pan, mix down again and “pan”; let rise and bake at about 375°F for about 40 minutes until browned and slightly loose in pan.

If loaf is dense from the machine, setting machine on double knead cycle may be helpful to lighten loaf.

NOTE: Several packages of the dry ingredients for one loaf could be mixed in advance, including the ground flaxseed, and stored in freezer until used. Allow mix to come to room temperature before using in bake machine. Add yeast, oil, water, and molasses just before machine is “loaded.”
**“Whole Wheat” Bread** for Automatic Bread Machines

- 1 cup Dakota Maid or Dakota State white bread flour
- 1 cup Stone-ground or any *whole wheat* flour
- 1 Tbsp. Butter
- 2 Tbsp. Wheat germ
- ¼ cup Ground flaxseed
- ¼ tsp. Salt
- 1 Tbsp. Vital gluten
- 2 Tbsp. Honey, sugar or molasses
- 1 Tbsp. Dry milk powder
- 7/8 cup Water
- 1 ½ tsp. Active dry yeast

Combine ingredients in usual way; if person baking wishes to try “manual” first, use dough hook in mixer; add water, oil, salt, sugar, molasses, ground flaxseed, whole wheat, yeast; mix a short time and then add Dakota Maid bread flour; mix for 5-6 minutes to develop the dough; let rise once in pan, mix down again and “pan”; let rise and bake at about 375°F for about 40 minutes until browned and slightly loose in pan.

**Flax Cookies**

- 1 cup Ground Omega flaxseed
- 1½ cups All purpose flour
- 3 cups Quick Quaker oats
- 1 cup Raisins, and chocolate chips, if desired
- 1 cup Brown sugar
- ½ cup Granulated sugar
- 1 tsp. Cinnamon
- 1 tsp. Baking soda
- ½ tsp. Salt
- 1 tsp. Vanilla extract
- 2 eggs Or 4 egg whites
- ½ cup Canola or olive oil
- ½ cup Applesauce
- 1 cup Buttermilk

Mix and beat all wet ingredients with sugar, salt, soda and cinnamon. Add raisins and chips, then add flour, flaxseed and quick oats. If necessary, gradually add more milk or water to get a “flowing” dough. Drop on cookie sheet and bake 15-18 minutes in actual 350°F oven (thermometer).
Where to Buy FLAXSEED?

• any health food store and some grocery stores.
• seed or cold pressed oil from yellow OMEGA or brown-seeded varieties from**:
  • Red River Commodities, Box 3022, Fargo, ND 58108
    phone 701-282-2600
  • Reimers Seed Co., 7074 Hwy 9, Carrington, ND 58421
    phone 701-652-3322
  • SK Foods, Box 1236, Wahpeton, ND 58074
    phone 701-642-3929
  • T-Bar-T Ranch, 1255 82nd Ave. NE, Grace City, ND 58445, phone 701-674-3119
  • North Dakota Natural Oils, Eversco, Ltd., Box 153, Tappen, ND 58487, phone 800-752-9934
  • Flax Marketing Consultant, Kaye Effertz, Mandan, ND
    Keffertz@msn.com, phone 701-663-9798

**Other flaxseed or flaxseed oil sources are available, but these companies are known to be able to deliver good quality flaxseed or oil at competitive prices. They also have whole seed or ground seed in some cases.

Some websites on Flaxseed for food and feed are:

www.ndsu.nodak.edu/flaxinst
www.randburg.com/li/linuva.html
hre.com/totalhealth/flax.html
sunsite.unc.edu/london/althealth/nutrition/flax.seeds-oil
www.agric.gov.ab.ca/crops/flax/seed03.html
www.crest.org/efficiency/strawbale-list-archive/9609msg00371.html
www.flax.com
barleans.com
www.flaxcouncil.ca/
www.montana.com/arbidar/fiber.html
www.foodbydesign.com
www.mayohealth.org/mayo/askdiet/htm/new/qd000419.htm