

Flaxseed (Linseed) fibre – nutritional and culinary uses – a review

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Introduction

Flax (*Linum usitatissimum*) has a long history of use as a food, medicine, and textile fibre. The Latin name means “very useful”. Hippocrates used flax to treat abdominal pain. Originally cultivated in Mesopotamia, the use of flax has been documented as far back as 3000 BC (Cunnane & Thompson, 1995). This Flax differs in genera from the native New Zealand flax (*Phormium tenax and Phormium cookianum*) which was given the common name “flax” by settlers in reference to its use as a source of fibre for weaving (Cooper & Cambie, 1991). The seeds from the two genera differ markedly in their appearance, chemical composition, and use. Several companies produce flaxseed in the Canterbury region from *Linum usitatissimum* and their websites are given at the end of this paper.



What is flaxseed fibre?

Flaxseed fibre is a fine-milled flaxseed meal that is produced from the milling of flaxseed flake. Flaxseed flake is the product that remains after the cold extraction of the oil from flaxseed/linseed, and is sometimes referred to as de-fatted flaxseed. With the appearance of bran flakes, flaxseed flake can be milled to various degrees of coarseness, from a coarse meal to fine flour. Flaxseed fibre is a high quality, organic, natural, unrefined whole food product that is naturally gluten free with a shelf life of two years, as reported by the manufacturers.

High temperature screw press extraction of flaxseed on a large scale results in oil that is inedible and is used in paints and varnishes. The residual meal suffers from degradation of the proteins and oil. Low temperature gentle extraction produces good quality polyunsaturated oil (rich in the omega-3 alpha-linolenic acid) with a residual meal that contains high quality protein and un-oxidized oil which should be a significantly more stable food ingredient than whole flaxseed meal. This hypothesis needs to be borne out by scientific experimentation.

This paper summarizes on an introductory level, the nutritional attributes and reported health benefits of flaxseed fibre and lists its current potential applications in the food and dietary supplement industries.

Nutritional Content

	Quantity per serving (5g)	Quantity per 100g
Energy	82kj	1635 kj
Protein	1.6g	32g
Total Fat	0.5g	10g
Saturated	0.02g	0.4g
Monounsaturated	0.08g	1.5g
Polyunsaturated	0.35g	7g
Omega 3 (ALA)	0.25g	5g
Total Carbohydrate	2.18g	43.6g
Sugar	0.07g	1.4g
Dietary fibre	1.95g	39g
Soluble fibre	0.4g	8g
Insoluble fibre	1.55g	31g
Lignans	25-50mg.	500-1000mg

Table 1. Typical chemical analysis of flaxseed fibre. Data averaged from analyses undertaken by an independent NZ laboratory.

Health and nutritional benefits

The health benefits of flaxmeal are due to its alpha-linolenic acid (ALA), fibre and lignan content. The high omega-3 and protein content make flaxseed meal unique and superior to other fibre supplements and food ingredients.

Alpha-linolenic acid (Omega-3)

Dietary advice concerning fats and fatty acids has been consistent over the last 50 years. The main thrust has been to reduce trans and saturated fatty acids and replace them with unsaturated fatty acids. It is unfortunate that we have seen a subsequent increase in the intake of linoleic acid (omega-6) in response to this advice.

There is an optimal ratio of omega-6 to omega-3 in the human diet. Oils such as flaxseed, walnut, and canola help to maintain this balance. Whilst it is true that very little ALA converts to the long chain polyunsaturated omega-3 found in marine oils, it does have beneficial effects itself (Fitzpatrick, 2011). The benefits of ALA are seen at intakes as low as 1g/day and 2g/day is recommended for a cardio-protective effect (Rodriguez-Leyva et al., 2010). 2g of ALA is found in 30 g of flaxseed fibre.

The upper limit for linoleic acid (omega-6) intake is around 7g/day giving a favourable ratio of omega-6:omega-3 of 3.5:1 when 2g/day omega-3 is consumed. This approximates the healthy ratio seen in the traditional Japanese diet. This ratio is associated with reduced risk of cardiovascular disease, osteoporosis, rheumatoid arthritis and cancer (Simopoulos, 2002). There is a growing movement globally to restrict the level of omega-6 fatty acids in the human diet and replace with mainly monounsaturated fatty acids.

The major problem of incorporating high levels of ALA in our diet is that the fatty acid is extremely unstable and is prone to oxidation, giving rise to undesirable flavours in food products. Ground whole flax seed itself is unstable due to its high content of free oil. However, defatted flax seed meal is much more stable and resistant to oxidation. When stored under inert gas flaxseed fibre is reported to have a shelf life of two years.

Dietary fibre

Flaxseed meal is high in fibre, a significant amount of which is soluble (20%), in the form of gums and mucilages. In addition to accounting for the laxative effect of flaxmeal, soluble fibre is known to have potent cholesterol lowering qualities, therefore reducing a major risk factor for cardiovascular disease (Singh, Mridula, Rehal, & Barnwal, 2011). In Canada, where a great deal of research has been carried out, there is now an approved health claim for the use of ground flaxseed to lower cholesterol (Health Canada, 2014).

Insoluble dietary fibre reduces insulin resistance, is useful in treating constipation and helps maintain overall bowel health. Increased stool bulk, normalised bowel transit time, healthy gut flora, and production of short-chain fatty acids such as butyrate are all positive effects on the bowel of a high fibre diet (Cummings & Mann, 2012).

Low fibre diets are associated with many chronic diseases including inflammatory bowel disease, heart disease, obesity, diabetes and colorectal cancer (Cummings & Mann, 2012). The fibre content of flaxmeal makes it an ideal addition to a balanced diet aimed at reducing the risk of these chronic diseases.

Lignans

Flaxseeds are the richest food source of plant lignans. Lignans are polyphenolic compounds classed as phytoestrogens. The plant lignans found in flaxseed are converted to the enterolignans, enterodiol and



enterolactone by gut bacteria. Sometimes referred to as mammalian lignans, enterodiol and enterolactone exhibit antioxidant, weak estrogenic and anti-estrogenic activities and may prevent formation or reduce the size of estrogen-dependant cancers such as breast cancer (Linus Pauling Institute, 2010).

Population studies have shown an association between lignan consumption and a lower risk of cardiovascular disease, although it is unclear at this time as to whether lignans are responsible for this effect or whether the effect is due to other constituents found in high lignan foods (Peterson et al., 2010).

Culinary attributes

Flaxseed meal is gluten free and has a pleasant nutty flavour. The protein content, combined with the gelling/binding properties of the soluble fibre found in flaxseed meal, make it ideal for incorporating into gluten free baked goods, or as a gluten free thickening agent. One tablespoon of flaxseed meal combined with three tablespoons of water and allowed to gel can even be used as a substitute for an egg in baked goods. The flake is quite good combined with hot or cold breakfast cereals in the morning and is a good source of fibre.

Applications as a dietary supplement

- Isolated encapsulated lignan supplements.
- Fibre supplementation (bulk laxative with a demulcent action).
- As a component of protein powder blends.

Applications as a food ingredient

- Breads and other baked goods such as cookies and muffins including gluten free products. The incorporation into bread results in an improved texture and crumb structure. See photograph.
- Healthy functional snack foods such as high protein energy bars.

Formulae that use flaxseed meal			
Bread (2.0 g ALA)		Gluten free cookies	
Loaf weight	700g		
Ingredients		Ingredients	
High Grade Flour	200g		
Wholemeal flour	150g	Gluten free baking mix	244g
Oats	20g	Dairy free spread	160g
Flaxseed meal	30g	Brown sugar	100g
Dairy free spread	50g	Flaxseed meal	22g
Olive oil	5g	Desiccated coconut	16g
Salt	5g	Dried cranberries	13g
Brown sugar	10g	Dried apricots	32g
Sure bake yeast	5g	Vanilla essence	15g
Water	300g		

- Breakfast cereals.
- Niche gluten free products.

Companies producing flaxseed oil and flaxseed fibre in New Zealand

Bio Oils: bio-oils.co.nz Established 1987 in Ashburton

Oilseed Extractions: <http://www.osel.co.nz/> Established 2002

Waihi Bush organic farm: <http://www.waihibush.co.nz/> Functional Whole foods 1993

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