**An Overworked Organ**

The liver has an enormous list of responsibilities to maintain the biochemical integrity of the living system. These duties include processing all the foods, beverages, drugs, and rubbish we humans choose to put into our mouths and inject into our bodies every day. This is a gargantuan burden and few human beings pay any attention as to how their habits and lifestyle choices affect the liver. They only become aware of the liver and its premier role in long-term health when something goes wrong after the liver has been overwhelmed by burdens it was never designed to manage.

**Fatty Degeneration of the Liver**

By its very nature, the liver attempts to manage excess [blood](http://omegascience.org/organ_systems/cardiovascular.aspx)sugar and dietary calories. For this reason, obesity and diabetes are associated with the harmful accumulation of fat (steatosis) in the liver. (A good way to conceptualize this state is to recall the French food ingredient called *foie gras*, fatty liver created by force-feeding a duck or goose with grain to the point where the liver has so much fat that it has the consistency of soft butter. The same thing happens when humans force-feed themselves.) A similar state can arise from alcohol abuse. Obviously, it is imperative that the lifestyle choices that led to liver damage must be replaced by more healthful choices. However, in addition to changing habits, you can consider, in consultation with your health care provider, some nutritional supports which may be helpful.

**Flaxseed Oil and Fatty Liver**

Enzymes in the liver turn excess blood sugar into triglyceride fat, some of which is deposited as fat tissue within the liver itself. This phenomenon is a major cause of fatty liver. In head-to-head laboratory studies, comparing the vegetable oil omega-6 linoleic acid to alpha-linolenic acid (ALA), the [flaxseed oil](http://omegascience.org/product_ingredients/flaxseed_oil.aspx) omega-3 fatty acid, it has been discovered that ALA is superior in reducing fat accumulation in the liver. Researchers believe this effect arises from an inhibiting influence [ALA](http://omegascience.org/product_ingredients/flaxseed_oil.aspx) has on the triglyceride-building enzymes in the liver.[[1](http://omegascience.org/organ_systems/liver.aspx%22%20%5Cl%20%22ftn)]

**Milled Flaxseed, Flaxseed Lignans, and Fatty Liver**

Lignan fiber-rich [milled flaxseed](http://omegascience.org/product_ingredients/milled_flaxseed.aspx/) has been studied in laboratory experiments in head-to-head trials with soy protein concentrate to determine effects on blood triglycerides and cholesterol, as well as effects on fat accumulation in the liver. Investigators have discovered that [milled flaxseed](http://omegascience.org/product_ingredients/milled_flaxseed.aspx/) is superior to soy protein in reducing blood triglycerides and cholesterol and in reducing liver fat accumulation in obese and lean laboratory animals.[[2](http://omegascience.org/organ_systems/liver.aspx%22%20%5Cl%20%22ftn)]

**Chemical Damage to the Liver**

**Flaxseed Lignan Concentrate and Liver Protection**

The liver has to bear the brunt of exposures to environmental chemicals, food additives, pollutants, pharmaceutical drugs, and recreational drugs. Some chemicals are so damaging, they can induce inflammation in the liver (chemical hepatitis). Several natural substances are known to help protect the liver from the ravages of chemical insult. These natural protective agents are:

* Silymarin extract from milk thistle *(Silybum marianum)*
* Alpha-lipoic acid, a nutrient used in diabetes
* Curcumin (yellow pigment from the spice turmeric, derived from the root of the plant *Curcuma longa*)

To this list we can now add [flaxseed lignan concentrate](http://omegascience.org/product_ingredients/lignans.aspx)milled flaxseed.

Laboratory experiments to determine the liver-protective effects of substances have commonly used as the offending agent carbon tetrachloride (a solvent used in the past in dry cleaning, but later abandoned due to its liver-toxic effects). If laboratory animals are pre-treated with [flaxseed extract](http://omegascience.org/product_ingredients/flaxseed_oil.aspx), they appear to be protected from liver tissue damage, exhaustion of liver cell antioxidants, and DNA strand breaks within liver cells.[[3](http://omegascience.org/organ_systems/liver.aspx#ftn)],[[4](http://omegascience.org/organ_systems/liver.aspx#ftn)]Anyone who has any risk of exposure to harmful chemical agents needs to be aware of the protective benefits of [flaxseed concentrate](http://omegascience.org/product_ingredients/flaxseed_oil.aspx) and other liver-protective natural preparations.

* [1] Buang Y, Cha JY, Nagao K, Wang YM, Inoue N, Yanagita T. Alleviation of fatty liver by alpha-linolenic acid. J Nutr Sci Vitaminol (Tokyo). 2004 Aug;50(4):272-6.
* [2] Bhathena SJ, Ali AA, Haudenschild C, Latham P, Ranich T, Mohamed AI, Hansen CT, Velasquez MT. Dietary flaxseed meal is more protective than soy protein concentrate against hypertriglyceridemia and steatosis of the liver in an animal model of obesity. J Am Coll Nutr. 2003 Aug;22(4):326-7; author reply 327-9.
* [3] Endoh D, Okui T, Ozawa S, Yamato O, Kon Y, Arikawa J, Hayashi M.Protective effect of a lignan-containing flaxseed extract against CCl(4)-induced hepatic injury. J Vet Med Sci. 2002 Sep;64(9):761-5.
* [4] Hemmings SJ, Song X. The effects of dietary flaxseed on the Fischer 344 rat. III. Protection against CCl(4)-induced liver injury. Cell Biochem Funct. 2005 Nov-Dec;23(6):389-98.

**Fiber and Phytoestrogens**

One of the enormous deficiencies in the diet of people in modern industrialized nations of the West is the lack of adequate quantities of a wide range of dietary fiber found in whole organic plant foods. Plant fiber is comprised of the many complex carbohydrates in plant cell walls that cannot be digested by human digestive enzymes. (The only carbohydrates human digestive enzymes can digest are sugars and starches.) Lignins are fiber compounds found in most whole plant foods. Lignans are fiber compounds found in oily seeds – [flaxseed](http://omegascience.org/product_ingredients/milled_flaxseed.aspx/), pumpkin seeds, sesame seeds, etc. [Flaxseed](http://omegascience.org/product_ingredients/milled_flaxseed.aspx/) is our best commercial source of lignans.

In addition to the benefits of fiber discussed later in this article, lignans also act as phyto-estrogens. Phyto-estrogens are plant compounds that have very mild estrogenic effects that can be used to modulate the influence of the body’s estrogenic hormones on body tissues. The three main families of compounds that act as phyto-estrogens are lignans, isoflavones (found in soy), and other flavonoids.

**Conversion of Flaxseed Lignans into Mammalian Lignans**

When we consume milled flaxseed or flaxseed lignan concentrate, bacteria in the colon convert the plant lignans into compounds known as “mammalian lignans” (enterolactone and enterodiol). The mammalian lignans are absorbed from the colon into the [bloodstream](http://omegascience.org/organ_systems/cardiovascular.aspx) for circulation to sites in the body where they are needed. (Herbivorous animals, those that live on [green vegetation](http://omegascience.org/product_ingredients/greens.aspx), have large amounts of these compounds in circulation.)

**Major Benefits of Flaxseed Lignans**

By increasing the levels of mammalian lignans in circulation, flaxseed lignans:

* Modulate the effect of human estrogens in men, as well as women.
* Support more beneficial pathways for metabolism of human estrogens than soy does.
* Induce incapacitation of excess estrogens by a liver protein (sex hormone binding globulin).
* Inhibit the enzyme (estrogen synthase) in fat tissue that manufactures undesirable excess female hormones (estrogens) out of circulating male hormones (androgens).
* Act as antioxidants more powerful than vitamin E.
* Bolster the body’s ability to sustain [breast health](http://omegascience.org/organ_systems/breasts.aspx).
* Reinforce the health of the inner lining (endometrium) of the uterus.
* Help to maintain the integrity of [prostate gland tissue](http://omegascience.org/organ_systems/prostate.aspx).
* Support the health of the inner lining of the colon.
* Help to improve the body’s management of [blood sugar](http://omegascience.org/organ_systems/cardiovascular.aspx).
* Help to protect the liver from the adverse effects of obesity and overeating. The protection provided by [flaxseed](http://omegascience.org/product_ingredients/milled_flaxseed.aspx/) lignans is superior to the effects of soy.
* Support [cardiovascular health](http://omegascience.org/organ_systems/cardiovascular.aspx).
* Support normal [blood pressure](http://omegascience.org/organ_systems/cardiovascular.aspx).
* Support integrity of the inner lining of arteries.
* Reinforce the body’s ability to maintain healthful levels of HDL and LDL cholesterol.
* Support male reproductive fertility.

**Flaxseed Lignans and Breast Health**

Along with [flaxseed oil](http://omegascience.org/product_ingredients/flaxseed_oil.aspx), flaxseed lignans are among the best nutritional friends of [breast tissue](http://omegascience.org/organ_systems/breasts.aspx). The higher the level of dietary lignans and blood levels of mammalian lignan, the lower the risk of breath health issues. Even if breast health issues arise, the effect of high levels of lignans can reduce the intensity and severity of those breast health issues.

Why do [flaxseed](http://omegascience.org/product_ingredients/flaxseed_oil.aspx) lignans have such beneficial effects on breast tissue health?

* Blood levels of mammalian lignans can serve as predictors of[breast health](http://omegascience.org/organ_systems/breasts.aspx) risk.
* [Flaxseed](http://omegascience.org/product_ingredients/flaxseed_oil.aspx) and its lignans protect cell chromosomes (strands of DNA in the cell nucleus) from damage and undesirable mutation. The protective effects of flaxseed are superior to those of fruits, vegetables, and whole grains associated with reduced cancer risk.
* Lignans can reduce the adverse effect of toxic substances on[breast tissue](http://omegascience.org/organ_systems/breasts.aspx).
* Lignans can modulate the cell multiplying / proliferating effects of estrogenic hormones and similar compounds. This includes estrogens produced by the ovaries in women, by fat tissue in women and men, and foreign estrogenic compounds (xeno-estrogens) in our polluted environment.
* Lignans inhibit the production of undesirable excess estrogens from fat tissue in men, as well as women. Fat tissue cells have an enzyme (estrogen synthase) that converts circulating male hormones (androgens, such as testosterone) into female hormones (estrogens).
* Lignans encourage the liver to produce more estrogen binding protein to prevent excess estrogens from having adverse effects on body tissues.

The combined influence of these benefits provides wide-ranging protection for better long-term [breast health](http://omegascience.org/organ_systems/breasts.aspx).

**Flaxseed Lignans and Prostate health**

Just as long-term estrogen exposure can have adverse effects on [breast health](http://omegascience.org/organ_systems/breasts.aspx), so also can estrogens have adverse effects on the tissue of the prostate gland. For example, estrogens prime the [prostate tissue](http://omegascience.org/organ_systems/prostate.aspx) to be very responsive to DHT (dihydrotestosterone), a modified version of the male hormone testosterone that has a greater stimulating effect on prostate tissue. DHT activates receptors on prostate cells, primed by estrogens, to produce growth factors that trigger prostate enlargement (BPH or benign prostatic hyperplasia).

Lignans reduce the adverse impact that estrogens have on[prostate tissue](http://omegascience.org/organ_systems/prostate.aspx). And these benefits occur in a fashion similar to the protective effects on [breast tissue](http://omegascience.org/organ_systems/breasts.aspx). Lignans reduce the effect of estrogens on prostate cell receptors. Lignans also reduce the production of excess undesirable estrogens from fat tissue on men. (Estrogens released into circulation from fat tissue increase the risk for BPH among obese men.) By these means, [flaxseed](http://omegascience.org/product_ingredients/flaxseed_oil.aspx)lignans in the diet can help reduce the harmful effects of estrogens on the prostate gland.

There is also evidence that [milled flaxseed](http://omegascience.org/product_ingredients/milled_flaxseed.aspx/) may help reduce risk for prostate malignancy.

**Flaxseed versus Soy**

Although soy products have become very popular in recent years, [flaxseed meal](http://omegascience.org/product_ingredients/milled_flaxseed.aspx/) (milled/ground flaxseed) has demonstrated health benefits superior to soy protein during head-to-head studies.

* Flaxseed offers superior protection against the deposition / accumulation of fat in the [liver](http://omegascience.org/organ_systems/liver.aspx) in the context of obesity.
* [Milled flaxseed](http://omegascience.org/product_ingredients/milled_flaxseed.aspx/) is superior to soy in shunting the processing of estrogens by the liver toward a more desirable benign pathway that produces non-toxic by-products (metabolites), rather than another pathway that produces metabolites that increase [breast cancer risk](http://omegascience.org/organ_systems/breasts.aspx).

**Are people in Western civilization suffering from the consequences of a lignan deficiency?**

A deficiency of fiber in the Western diet has been linked for decades to many ailments of modern living, including[cardiovascular](http://omegascience.org/organ_systems/cardiovascular.aspx)disease, obesity, diabetes, and cancer. As already stated, lignans are fiber compounds. Because people in Western industrialized nations, including the USA, are not eating enough whole organic plant foods, they are not eating enough lignans to maintain adequate levels of blood mammalian lignans to be protective against the wide range of health issues listed above.

There is evidence that the blood levels of mammalian lignans needed for real protection are ten times the levels typically found among people in Western industrialized nations. As many researchers, nutritionists, and nutritional biochemists have been saying for decades, the people of Western civilization have been suffering the consequences of a deficiency in dietary fiber. Lignans are major missing fiber compounds that need to be restored to ensure improved protection for [breast](http://omegascience.org/organ_systems/breasts.aspx), [prostate](http://omegascience.org/organ_systems/prostate.aspx), colon, and other tissues in the body.