Sugar Beet Fibre
Physiological effects & Clinical studies
What is Fibrex®?

Fibrex is a dietary fibre product from sugar beet, cultivated in the fields of southern Sweden. Sugar beets consist of about 75% water, 18% sugar and approximately 5% cell walls. After the sugar is extracted, remaining cell wall material – the sugar beet pulp – is used to produce the sugar beet fibre Fibrex.

Production
During the sugar production the sugar beets are washed, thinly sliced, and the sugar is extracted from the beets by hot water. The water-sugar solution obtained in this process is then further process to crystallize pure sugar. The remaining beet pulp leaves the sugar production at this point. Freshly pressed pulp is transported to our dedicated plant where it is further sieved, controlled and dried at high temperature and pressure. The result is Fibrex, a natural dietary fibre with high fibre content.
**Composition**

The dietary fibre content in Fibrex is approximately 73% of the product, or almost 80% of dry matter, when calculating the fibre as the difference after analysis of all other substances (as per 100 g; protein 8 g, sugar 6 g, fat 1 g and ash 4 g). The main fibre types in sugar beet fibre are insoluble hemi cellulose and soluble pectin, but also small amounts of cellulose and lignin. When measured with the AOAC method, the total fibre content is 67% of the product as not all small fiber fractions is caught.

**Dietary fibre in general**

Dietary fibre is a generic term that characterises carbohydrate components (non-starch polysaccharides) which are neither digested nor absorbed in the human small intestine, and pass to the large intestine practically unaffected. The EU definition today also includes non-digestible carbohydrates with 3 to 9 monomeric units, like fructooligosaccharides, polydextrose and resistant dextrins=starch. Examples of common fibres are pectin, cellulose and hemicellulose.

The importance of dietary fibre for the bowel function has been known for a long time. However, research during the past decades has shown that food rich in fibre is not only important in maintaining a normal bowel function and preventing gastrointestinal symptoms, such as constipation – it can also affect our metabolism. There is convincing evidence that an increased intake of dietary fibre has a protective effect against several present-day lifestyle-associated diseases.

The structural properties of different fibres are of importance for their physiological effects. Viscous, water-soluble fibres may reduce or delay the uptake of carbohydrates and cholesterol, which can prevent or have beneficial effects on cardiovascular disease and type 2 diabetes. Soluble fibres can also be fermented by health-promoting bacteria in the colon, leading to protection against inflammation and colorectal cancer. Insoluble dietary fibres are mainly associated with a healthy bowel function by accelerating the passage of foods through the digestive system and by increasing stool weight.
Authorities in most industrialized countries are recommending an almost doubled target intake of dietary fibre. The European Food Safety Authority has set a daily target intake of 25 grams based on the evidence on bowel function but also acknowledges that there are health benefits associated with a higher intake through fibre such as reduced risk of coronary heart disease, type 2 diabetes and weight management and the U.S. Department of Agriculture and the U.S. Department of Health and Human Services recognize that dietary fibre naturally occurring in plants is important in promoting a healthy laxation and helps to provide a feeling of fullness and recommend a daily intake of 25 grams for women and 38 grams for men.

**Advantages with Fibrex**

Compared to many conventional natural sources of dietary fibre, such as cereal products and fruits.

- Fibrex has higher content of dietary fibre, with a perfect balance of 2/3 insoluble fibre.
- Fibrex contains no phytic acid. Cereal products, such as bran and flour, contain phytic acid which forms strong chemical complexes with iron and zinc and consequently impair or reduce the natural absorption of these essential minerals in the human body.
- Fibrex is by nature free from gluten, which means it is an excellent dietary fibre source for people suffering from gluten intolerance.

**Physiological effects of sugar beet fibre**

The high dietary fibre content in sugar beet fibre in combination with water absorption leads to low energy density, thus reducing the energy content of a meal. The fibres provide increased bulk which promotes digestive health, contributes to satiety and can prevent or reduce obesity.

**The soluble fibre pectin**

Sugar beet fibre contains approximately 22% of the water soluble fibre pectin. Pectin is recognised for its potential to give health effects in the body, such as lowering blood cholesterol and leveling out the blood-glucose curve. These effects are likely to depend on the ability of pectin to form viscous solutions. An increased viscosity in the small intestine slows down the mixing and diffusion of intestinal contents. This can, in turn, reduce or delay the uptake of carbohydrates which leads to lower blood concentrations of glucose and consequent insulin after a meal. It can also reduce cholesterol uptake, or the re-absorption of bile acids from cholesterol and hence reduce the level of bad (LDL) cholesterol in the blood.
Non-lignified cell walls and water holding

The cell wall material of the sugar beet has, due to its function in the plant, characteristics different from those of cereal bran fibres. Since the task of cells in bran is to protect the seeds, these are hard and lignified (Figure 1). On the opposite, the cells walls in sugar beets are mainly assigned to store nutritional reserves, and are not lignified to the same extent (Figure 2). These differences in cell structure give sugar beet fibre not only a unique fibre composition, with 1/3 soluble and 2/3 insoluble fibres, but also interesting physical properties, like thermostable water holding.

In the drying process of Fibrex the cell structure collapses. When water again is added, the cells resume their original form, taking up water and retaining it within the cell wall structure (Figure 3). The water uptake capacity is approximately 7-8 g per gram of Fibrex. That is the amount of water absorbed by Fibrex, if it is allowed to soak in water, and retained, when the fluid has been allowed to drain off. The water holding capacity (water retained at a pressure of 10 kPa) is approx. 3.5-4 g per gram of Fibrex. That is how much water Fibrex retains in most foodstuffs, where several components “compete” for the water.
The water holding properties of sugar beet fibre contribute to increased viscosity. In the gastrointestinal tract, the viscosity may decrease or delay nutrient uptake, leading to normalised blood glucose levels after a meal and healthy cholesterol levels in the body.

**Clinical studies with sugar beet fibre**

*Fibrex helps to promote digestive health*

**Transit time**

The physical properties of sugar beet fibre – water holding capacity and stimulation of microbiological growth – give the intestines a healthy bulk to work with and reduce transit time through the digestive system. The reduction in transit time is also motivated by mechanical or chemical stimulation of the colon. A study conducted in France on healthy subjects demonstrated that a daily addition of 30 g sugar beet fibre to a fibre-depleted diet resulted in a 25% reduction in transit time (Cherbut et al -91). For the consumer this is beneficial since it promotes regularity and counteracts constipation which contributes to overall well-being. Sugar beet fibre “cleans” the intestinal system which might prevent other diseases such as colon cancer.

**Faecal bulk and consistency**

Increased faecal bulk is proven in several clinical studies to give improved bowel function, regularity and prevention of constipation to mention a few. Many large bowel disorders may be attributed to lack of faecal bulk (Kritchevsky 2001).

In one study (Castiglia et al -98 Figure 4), wet faecal weight increased by 55% and dry weight by 35% by consuming 50 g sugar beet fibre daily during a 28-day period. In another study (Giacosa et al 1990 Figure 5), all subjects had severe or moderate constipation before the intervention. They were given 7 g of sugar beet fibre per day, and after a 30-day period 85% of the subjects had normal stool and faecal frequency.

The subjects in the studies vary from healthy people, constipated persons and subjects with ileostomy. These effects are for people who want to maintain or improve the bowel function, as well as people suffering from constipation or celiac disease.

The daily intake in the above mentioned studies varies between 7 g and 50 g per day. This can be achieved by consuming a meal with high (15-20%) sugar beet fibre content, a ready product or added on the side to a muesli or cereal. Naturally it can be divided into separate meals during the day – all to achieve the positive effects in the daily life.

The effective dose depends upon the individual’s physical characteristics. For a normal person, 7 g sugar beet fibre per day is sufficient. However, in some cases 15-35 g per day might be necessary to get the claimed effect on digestive health. No negative physical side effects were observed in any of the clinical studies during the intake of sugar beet fibre.
EFSA (European Food and Safety Authority) concludes in their Scientific Opinion released in December 2011 that a cause and effect relationship has been established between the consumption of sugar beet fibre and increasing faecal bulk. The following wording reflects the scientific evidence: “Sugar beet fibre increases faecal bulk”. The mechanisms by which components of sugar beet fibre exert the claimed effect have been established. The insoluble components of fibre increase faecal bulk by absorbing water in the large intestine. The soluble components are fermented by bacteria in the large intestine leading to an increase in bacterial mass.

In order to bear the claim a food should be at least “high in fibre” as per Annex to Regulation (EC) No 1924/2006.

**Final approval of the 13.5 claim came in January 2014. Technical wording is "Sugar beet fibre contributes to increased faecal bulk".**
Fibrex maintains healthy cholesterol levels
The risk of cardiovascular diseases depends partly on the blood lipid content, particularly cholesterol. There are two main types of cholesterol, low-density cholesterol (LDL) or so called “bad” cholesterol, and high-density cholesterol (HDL) or “good” cholesterol. A lower amount of LDL and a low LDL/HDL ratio imply less risk of harmful effects.

The effect of Fibrex on blood lipid levels has been tested in several clinical studies, for example in a study at Skåne University Hospital in Sweden where 28 women participated (Israelsson 93). The subjects lowered the cholesterol levels initially by 9% through an improved diet. Subsequently, a double-blind cross-over study of 4 + 4 weeks was conducted with Fibrex and a similar product with low fibre content (placebo). During the “fibre weeks”, when 30 g of Fibrex was taken per day, total cholesterol levels decreased markedly. This was especially seen for the “bad” LDL cholesterol, whereas the amount of “good” HDL cholesterol tended to rise. The LDL/HDL ratio changed in a favourable direction, which means a lower risk of cardiovascular diseases (Figure 6).

![Figure 6: LDL/HDL ratio](image)

A clinical study at Sahlgrenska University Hospital in Gothenburg, Sweden, reported that an intake of 30 g Fibrex per day decreased the cholesterol absorption from the small intestine (Langkilde 93). The results of both studies indicate a probable viscous effect of the sugar beet fibre, which can lead to decreased cholesterol uptake from the gastrointestinal tract and thereby lowering the blood cholesterol levels.

The daily intake of 30 g sugar beet fibre in these two studies gives a daily intake of 6 g pectin.

**Fibrex maintains normal blood-glucose levels**
Diabetics have for long been instructed to select primarily carbohydrates that yield a slow increase in blood sugar, so-called “slow carbohydrates” with low glycemic index, GI. This kind of diet demands less insulin, which is important to diabetics. Also non-diabetics will benefit from slow carbohydrates and a low insulin level may contribute to a lowered risk of storage of fats, high blood pressure and arteriosclerosis. Fibres in food, especially soluble fibres increase the viscosity of fluid slow down the absorption of nutrients after a meal and lower the glucose and insulin responses.
In a clinical study (Hagander et al, 1988 Figure 7), 8 elderly diabetic subjects were served a breakfast containing 15 g of Fibrex, and, on other mornings, the same breakfast without Fibrex. Their blood glucose levels were significantly lower after the Fibrex breakfast than after the control breakfast. The effect was similar to that achieved by treatment with antidiabetic drugs. This study also revealed a previously unknown effect of fibre supplementation – an increase in somatostatin. This may be one contributing explanation to the lower blood glucose level.

Blood glucose levels after meal (mean value ±SA).

8 NIDD (Non-insulin-dependent diabetics) had lower blood glucose levels after a Fibrex meal than after a control meal.

EFSA (European Food Safety Authority) concludes in their Scientific Opinion released in April 2011 that it is the pectin in sugar beet fibre which is the active part in lowering an elevated blood LDL-cholesterol concentration. Pectin has been approved earlier and as 6g/day is needed to obtain the claimed effect, EFSA concludes that 30g/day intake of sugar beet fibre is needed to have the same effect due to the ratio of pectin in sugar beet fibre. This is a rather high intake, however, in line with the clinical studies made on sugar beet fibre. When using this health claim for sugar beet fibre one should refer to the active substance pectin.

The 13.1 claim was finally approved by the EU. Technical wording is “Pectins contribute to the maintenance of normal blood-cholesterol levels”.

Figure 7
Nordic Sugars Fibrex plant is located in the sugar beet district in south Sweden. It has ISO approvals and works with HACCP. An internal laboratory is continuously testing produced product to guarantee high quality.
Reference studies

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