



## Flaxseed: Functional Food Components & Therapeutic Role

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### ABSTRACT

*From the past few years, people are becoming more health conscious and demanding the food having high nutritional value. In this regard, the demand for flaxseed in food and beverages, functional foods and functional attributes of many traditional foods are being explored. Flax continues to surge forward in its recognition as a functional food and has recently gained attention in the area of disease prevention primarily because it is the richest known source of various functional food components such as alpha-linolenic acid, lignans, as well as being a good source of fiber. Traditionally, flaxseed was grown for its oil bearing seed and for its fiber. But with rapidly changing global health scenario and awareness regarding the ill effects overmedication, plant based products have gained the attention. The demand of consumers has increased for the new food products with taste, safety, convenience and nutrition. Nutrition has emerged an added dimension in the chain of food product development. Flaxseeds due to presence of various bioactive compounds have been considered as complete medicinal food and found to be preventive against various metabolic disorders. Flaxseed contains various functional components which have positive effects in disease prevention. Recent studies have shown that the flaxseed in its whole or in its flour form can be incorporated in various recipes and can be developed in form of bakery and other products. Although scientific evidence supports flaxseed consumption but many people are still unaware of the benefits provided by flaxseed and its therapeutic role in prevention of disorders. This review highlights the functional food components present in flaxseed and its therapeutic role in prevention of various disorders.*

**Keywords:** Flaxseed, functional food, lignans, fiber, metabolic disorders

## INTRODUCTION

In the modern era one of the important challenges today faced by the current living is good health as in this era the people are suffering from several degenerative lifestyle diseases. Growing awareness about the role of diet and quest for wellness has generated interest in foods that can work like medicine. With rapid changes in lifestyle scenario and fast realization of the ill effects of overmedication and wrong food practices; the scientists and health professionals are exploring the plant products. 'Functional foods' are foods or dietary components that may provide a health benefit beyond basic nutrition. Functional foods deliver a health boost beyond what is expected from their traditional nutrient content [1]. Flaxseed has to be considered as a functional food, due to its potential health beneficial compounds as it already is in Canada, in a way which is relevant to either the state of well-being and health or the reduced risk of diseases. [2, 3]

Flaxseed (*Linum usitatissimum* L.) is a plant that produces both fibre and a hard, brown-shelled, oil-bearing seed known for its nutritional benefits. The plant grows in every part of the world except the tropics and the arctic, and blooms a pleasing blue, five-petalled flower [4, 5]. The spherical fruit capsules contain two seeds in each of five compartments. The seed is flat and oval with a pointed tip. It have smooth glossy surface. The colour of flaxseed varies from color dark brown to yellow [6]. The texture of flaxseed is crisp and chewy possessing a pleasant nutty taste [7]. In

present era, consumer's trend towards functional food has increased significantly as health awareness rose. Flaxseed can be one stop for novel high quality source of nutrition.



**Fig.1-**The blue flowers of Flaxseed Plant



**Fig.2-**The Brown coloured Flaxseeds

## NUTRITIONAL COMPOSITION OF FLAXSEED

Flax plant (*Linum usitatissimum*) has long been used as industrial oil and fibre crop. Flaxseed is a treasure of various nutritious compounds which plays an important role in the prevention of various disorders. It has been grown in some

parts of the world, particularly Canada (35 %), Argentina (21.8 %), China (18.9 %), India (13.8 %) and the U.S. (11.3 %). The main constituents of flax seed include its mucilage (6%), insoluble fibers (18%), proteins (25%), and oils (30-40%) with  $\alpha$ -linolenic acid (50-60% of oils) being the primary fatty acid [8]. Its mucilage can be easily extracted from the seed and has been used as a stabilizer and thickener in the food industry [9].

### FUNCTIONAL FOOD COMPONENTS OF FLAXSEED

Flaxseed is a very good source of various functional food components. These are:

#### *Lignans*

Lignan is one of the important constituent of flaxseed. The lignans are a group of chemical compounds found in plants. Lignans are one of the major classes of phytoestrogens, which are estrogen -like chemicals and also act antioxidants. Secoisolariciresinol diglucoside (SDG) is a major lignin. Lignan consumption reduces cardiovascular risk and inhibits the development of some types of diabetes [10]. Lignan is also found to be protective against cancer.

#### *Alpha- Linoleic Acid*

Flaxseed is a very good source of  $\alpha$ -linolenic acid. ALA from flaxseed exerts positive effect on blood lipids. 12 g of ALA was taken three times a day by group of healthy young women in the flaxseed oil capsules and compared with group given in flaxseed flour supplemented products. Impressive reductions in blood lipids were observed in both cases [11].

#### *Fiber*

Fiber occurs as structural material in the cell walls of plants and has important health benefits for humans. Flaxseed is a rich source of dietary fiber. Diets rich in dietary fiber may help reduce the risk of heart disease, diabetes, colorectal cancer, obesity and inflammation [12]. High amount of dietary fiber adds bulk to waste products in the gut and increases bile movement in the gastrointestinal movement. The fiber content of flaxseed could potentially affect insulin secretion and its mechanism of action in maintaining plasma glucose homeostasis. Flaxseed was shown to reduce the post prandial blood glucose response in humans [13].

#### *Gum*

Flaxseed gum has nutritional value as dietary fiber as such it appears to play a role in reducing diabetes and coronary heart risk. It also appears to play an important role in prevention of cancer and obesity [14]. Flaxseed gum behaves like typical viscous fiber with the ability to reduce blood glucose response [15].

### TRADITIONAL USES

Flaxseed has been used in the diet of humans for thousands of years. While tracing the long and fascinating history of flaxseed's use, the scientific story of the plant and its modern potential is revealed [14]. In ancient times, flaxseed was grown for its oil bearing seed and for its fiber [16]. In ancient Egyptian tombs Linen cloth woven from flaxseed has been found, while Jewish high priests of the Old Testament wore garments made from flax. Before World War II

flaxseed had been commonly used as food and it was forgotten until its comeback in the 1990s. Studies reveal that it is not only a nutritious food, but it also has therapeutic benefits, both preventative and curative [17]. Early records show that it has been grown since the beginning of civilization, and people all over the world have celebrated its usefulness throughout the ages. In southern Mesopotamia (5200 – 4000 B.C.) irrigation was used to grow flax. History also reveals that Babylonians cultivated flaxseed as early as 3000 B.C. and their burial chambers depict flax cultivation and clothing from flax fibers. Hippocrates wrote, about using flaxseed for the relief of intestinal discomfort (650 B.C.) and Theophrastus recommended the use of flaxseed mucilage as a cough remedy (in the same era) [18].

### **FLAXSEED AS FUNCTIONAL FOOD**

From the past few years, people are becoming more health conscious demanding the food having high nutritional value and the same time conferring health benefits. In this regard, the demand for flax in food and beverages, functional foods and dietary supplements has risen dramatically [19]. The use of flaxseed as a functional food is gaining more popularity in the recent years. In ancient times it is grown for food and other uses. Flaxseed is an excellent source of various bioactive compounds such as alpha linoleic acid, proteins, soluble and insoluble dietary fiber as well as omega-3 fatty acids. The flaxseed can be used as a whole or in the form of flour can be incorporated in different other foods

including bakery products. A lot of work has been carried out on the composite flour technology with special reference to improve the wheat flour quality through blending it with other flours. Flaxseed is considered to be a complete functional food due to the presence of  $\alpha$ -linolenic acid [20] and other bioactive compounds. Flax is considered a functional food or source of functional ingredients, because it contains various functional components all of which have positive effects in disease prevention. Although scientific evidence supports flaxseed consumption, many people are still unaware of the benefits provided by this product and its possible applications in the production of foodstuffs [21]. There are numbers of studies indicating the role of raw flaxseed and its baked products in health promotion and disease prevention [22, 23]. The flaxseed contains both soluble and insoluble fibers. About one-third of the fiber in flaxseed is soluble and it may help to lower cholesterol and to regulate levels of blood sugar. The remaining two-thirds of the fiber in the flaxseed is insoluble which aids digestion by increasing bulk and preventing constipation [24]. Flaxseed has gained much importance in recent times as ethno medicine due to its wide pharmacological actions. Although its therapeutic potential, as antioxidant, primarily as anticancer, antidiabetic, prevention in insomnia, prevention in bone disorders and an anti atherosclerotic agent is known [25].

### **CLINICAL USES**

People have been consuming flaxseed due to its good flavor and nutritional properties. The various



health beneficial properties associated with the consumption of flaxseeds are given as below:

#### **Antiatherosclerotic Properties of Flaxseed:**

Flaxseed has recently gained attention in the area of cardiovascular disease primarily because it is the richest known source of both Alpha-linolenic acid (ALA) and the phytoestrogen, lignans, as well as being a good source of soluble fiber. Human studies have shown that flaxseed can modestly reduce serum total and low-density lipoprotein cholesterol concentrations, reduce postprandial glucose absorption, decrease some markers of inflammation and raise serum levels of the omega-3 fatty acids, ALA and eicosapentaenoic acid [26,27]. Flaxseed with very low ALA, flaxseed oil, and secoisolariciresinoldiglucoside (SDG) reduced the development of hypercholesteromic atherosclerosis by 46%, 69%, 0%, 73%, and 34% respectively, in the rabbit model [28].

#### **Antidiabetic Properties of Flaxseed:**

Flaxseed flour supplementation in the diet has been suggested as a preventive measure against diabetes and associated other complications [29]. Flaxseed gum reduced blood glucose and cholesterol in an interventional study, in which 60 type 2 diabetic patients were studied [30]. A controlled trial including 34 adults with well-controlled type 2 diabetes who consumed milled flaxseed (32 g/day) or flaxseed oil (13 g/day) daily for 12 weeks demonstrated, however, no glycemic control [31]. In general, it was verified that ingestion of flaxseed by diabetic patients or

animals presented limited results that need to be further investigated. Some compounds present in flaxseed, utilized in their isolated form, were efficient in improving glycemic control [32,33].

#### **Anticancerous Properties of Flaxseed:**

Flaxseeds have been shown to reduce the early risk markers for and incidence of mammary and colonic carcinogenesis in animal models [34, 36-38]. Lignans from flaxseed have been shown to reduce mammary tumor size by >50% and tumor number by 37% [39] in carcinogen-treated rats. Effect of flaxseed feeding on risk markers of cancer in humans [40] demonstrated that the ingestion of 10 g of flaxseed per day elicited several hormonal changes associated with reduced breast cancer risk. Rosa et al. (2010) demonstrated that the addition of flaxseed oil to the standard diet of Wistar rats diminished the adherence of lymphocytes in the intestinal mucus when compared to the addition of other oils [41]. Because it contains elevated levels of dietary fibers, flaxseed may also offer protection against cancer, principally colon cancer [42].

#### **Flaxseed in Insomnia:**

Insomnia is a common problem in most of the people and mainly its major causes are the conditions such as anxiety, stress and depression. People suffering from insomnia due to stress can sleep well by having flaxseeds. It's high level of  $\omega$ -3 fatty acids and tryptophan helps in boosting serotonin (sleep regulating compound) levels in blood. Magnesium also helps in overcoming anxiety, stress and depression, thus enhancing

sleep. Magnesium exerts its effect by relaxing the nervous system and muscles and overcoming the night terrors [43].

### **Flaxseed in Bone Health:**

Alpha linolenic acid, the omega-3 fat found in flaxseed promotes bone health by helping to prevent excessive bone turnover-when consumption of foods rich in these omega-3 fat results in a lower ratio of omega-6 to omega-3 fats in the diet [44]. When the women who had been having 14 hot flashes per week for at least a month and weren't taking estrogen to relieve their menopausal symptoms were fed 2 tablespoons of crushed flaxseed twice daily for six weeks, the women halved their number of daily hot flashes while taking flaxseed. In addition, the intensity of the women's hot flashes dropped by 57% [45].

### **CONCLUSION**

Health protection is given the highest priority in life in comparison with other factors and attention is now being shifted from treating the diseases from chemical based therapy to natural based therapy. The attention is drawn on extraction of the functional food components of plants and seeds present in nature of ancient times. Flaxseed has been part of both diet and treatment for centuries. A large number of nutritional attributes present in flaxseeds are attracting the health professionals and nutritionist to consider the flaxseed in the formulation of functional foods and in the choice of a healthy diet. Functional foods may prove as a means to reduce the diseases without any health consequences. Studies have

uncovered nutritional benefits of flaxseed related to its unique composition. The incorporation of flaxseed in health industry may act as a means of reducing the diseases. Flaxseed is a rich source of Alpha linolenic acid (ALA), fiber and lignans, gums which makes it a potentially attractive functional food for modulating several risk factors responsible for causing diseases. The innovations in food product development in more-recent years have enhanced flaxseeds use as an component in diet, occupying a place as an ingredient in many forms with specific nutritional benefits for today's health conscious individuals. Being the richest source of ALA, lignans, fiber, flaxseed has been found beneficial in the prevention of various disorders. More research is needed to define the role of this functional food in reducing lifestyle disorders.

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