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Nutritional And Health Benefits Of Flax Seeds: A Review

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Abstract- Flaxseed is cultivated in many parts of the world including India for fiber, oil as well as for medicinal purposes and also as nutritional product. Consumption of flax seed has been increased due to its possible functional properties in health. Flaxseed has the properties of super food as well as functional foods being good source of alpha lenolenic acid, lignans, high quality of protein, phenolic compounds and soluble fiber.

Key Words- Alpha Lenolenic Acid, Lignans, Phenolic Compounds, Functional Food

Introduction- In 1994, the National Academy of Sciences' Food and Nutrition Board defined functional foods as “any modified food or food ingredient that may provide a health benefit beyond the traditional nutrients it contains”. The International Life Sciences Institute defines them as “foods that, by virtue of the presence of physiologically-active components, provide a health benefit beyond basic nutrition”. During the first 50 years of the 20th century, scientific focus was on the identification of essential elements, particularly vitamins, and their role in the prevention of various dietary deficiency diseases. This emphasis on nutrient deficiencies or “under nutrition” shifted dramatically, however, during the 1970s when diseases linked to excess and “over nutrition” became a major public health concern. Flax belongs to the family of Lineaceae. It gives blue flowering and produces all over the year. It is flat small seeds and contains

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golden yellow to reddish brown colour depending upon its cultivation period when it plucked from its pods. Flaxseed had nutty strong taste and by the texture it is very crispy. Flaxseed known by its two names depending upon its uses. When flaxseed used for human consumption it called flaxseed but when it is used for industrial application it called linseed. Whole plant of flaxseed is useful for so much of purposes. Flaxseed contains very nutritious oil which is edible after its refining. It stems yields good quality of fiber that gives high strength and durability. In India, people have been consuming flaxseed since ancient times. It has been cultivated for consumption as well as medicinal purposes and as nutritional product. The top flaxseed growing countries include India, United States, China and Ethopia. In India flaxseed is mainly farmed in Madhya Pradesh, Maharashtra, Chattisgarh and Bihar. Flaxseed was native of India and was a staple food crop.

Nutritional Composition- Flaxseed has the properties of super food as well as functional foods, being good source of alpha-lenolenic acid, lignans, good quality of protein, phenolic compounds and soluble fiber. The chemical composition of flaxseed depends upon growing environment, processing conditions and genetics. The lipid content of flaxseed varies from 37 to 45 g/100g of the seed as reported by various scientists. Cotyledons [the embryonic leaf in seed-bearing plants, one or more of which are the first to appear from a germinating seed] are the major oil storage tissues, contains 75% of the seed oil. Flaxseed oil constitutes 98 % triglycerides, phospholipids and oil % free fatty acids. On average basis it contains 21% protein. Major proteins are globulin [26-58%] and albumin [20-42%]. Amino acid profile and nutritional value of the flaxseeds are comparable to that of soya proteins that is rich is arginine, aspartic acid and glutamic acid. Its high cysteine and methionine contents improve the antioxidant levels, by this it helps in reducing the risk of cancer.

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The processing conditions dehusking and defatting affects its content of protein. Flaxseed is the richest source of phytoestrogens [lignans]. It contains very low level of carbohydrates [1 gm/100 gm]. Flaxseed have three types of phenolic compounds-phenolic acids, flavonoids and lignans. Major phenolic acids present in defatted flaxseed are ferulic acid [10.9 mg/g], chlorogenic acid [7.5mg/g], galic acid [2.8mg/g]. Other phenolic acids include P-coumoric acid glucosides, hydroxy cinnamic acid glucosides and 4-hydroxy-benzoic acid that are present in low quantities. Flavone C and Flavone O-glycosides are the major flavonoids found in flaxseeds. (Kajla. Priyanka., et. al., 2015).

Flaxseed is a good source of minerals especially, phosphorous [650 mg/100g], magnesium [350-431 mg/100g], calcium [236-250mg/100 gm] and has very low amount of sodium [27 mg/100 gm]. It contains highest amount of potassium 5600-9200 mg/kg among various foods and high potassium intake is inversely related to blood platelet aggregation, free radicals in blood and stroke incidence. It also contains small amounts of water soluble and fat soluble vitamins. Vitamin E is present as alpha tocopherol. Alpha tocopherol is an antioxidant providing protection to cell proteins sodium excretion in urine, which may help in lowering of blood pressure and heart disease risks and Alzheimer disease (Kajla. Priyanka., et. al., 2015).

Flaxseed as Functional Food

Flaxseed come in the category of functional food due to its presence of three main bioactive components alpha lenolenic acid, lignans and dietary fiber.

Alpha lenolenic acid is a rich source of omega 3 fatty acid in the vegetarian diets.

The oil of flaxseed is rich in PUFA [Polyunsaturated fatty acid, moderation] MUFA [Monounsaturated fatty acid] and have low amount of saturated fat. It is

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rich in the essential fatty acids alpha lenolenic acid [ALA] and lenolenic acid [LA]. These essential fatty acids are required for the human body because body can not synthesize them, thus need to be supplied in the diet (Kajla. Priyanka., et. al., 2015).

Objectives- The objective of this paper is to study the nutritional composition of flaxseed as well as its therapeutic properties in various diseases.

Methodology-Firstly fifty papers were reviewed (review paper, research paper, article, concept paper, book chapter) based on various aspects of flaxseed then the papers were short listed, Papers published in last seventeen years and which are based on nutritional composition, functional property, therapeutic properties etc. of flaxseed were included and then content analysis was done.

Review of Literatures and Findings-

Role of Flaxseed in Prevention of Diseases

It was reported that flaxseed has various disease prevention purposes such as Cardio Vascular diseases, Cancer, Blood Glucose control, Weight Management etc.

Cardiovascular Disease

Flax seed has been researched as a potential treatment for preventive measure against cardiovascular disease. The anti inflammatory action of the lignans and Omega 3 polyunsaturated fats found in flaxseed are thought to be the main contributors. Rodriguez-Leyva D., et.al., (2013) found in his study that the exhibiting symptoms of cardiovascular disease, dietary flaxseed has displayed powerfully protective e▪ ects. The most impressive involves the decrease in both systolic and diastolic blood pressure in patients with peripheral arterial disease.

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Rodriguez-Leyva D., et.al., (2013) and Caligiuri, S.P.B.; et.al., (2016) concluded in their studies that the consumption of flaxseed significantly reduced both bronchial and central blood pressures in their trials. The ability of whole flaxseed to reduce cholesterol in humans has been supported in several studies. Studies suggested that 15- 50 grams of flaxseed a day [either whole or powder] can reduce total and LDL cholesterol by 1.6 to 18 % in both normal and hypertensive patients without any significant effects on HDL or triglycerides increases its levels in serum if consumed with regular diet (Carraro. Julia., et. al., 2012, Mishra. Sunita. & Verma Pooja., 2013, Arya. Shalini., et. al., 2012).

Diabetes

Diabetes is a disease caused by deficiency in insulin production or by ineffectiveness of the insulin produced , resulting in increased blood glucose levels which cause damage to body systems, in particular the blood vessels and nerves. Hypercholesterolaemic post menopausal women showed reduced glucose and insulin levels after eating flaxseed (Carraro. Julia., et. al., 2012, Mishra. Sunita. & Verma Pooja., 2013, Arya. Shalini., et. al., 2012). Soltanian, N.; et. al., (2018) and Mani, U.V.; et.al., (2011) showed in their studies that the flaxseed supplementation helped in reducing blood glucose level in the patients of type 2 Diabetes. Hutchins, A.M.; et.al., (2013) concluded in his study that flaxseed also help in lowering the blood glucose level of Pre diabetic patients. Studies quoted that the gum and lignans derived by flaxseed also decreased blood glucose level of type 2 diabetic patients (Thakur, G., et.al., (2009) and Pan. A, et.al., (2007).

Cancer

Mason, J.K.; et. al., (2014) and Flower, G.; et. al., (2014) concluded in their reviews of human trials that dietary flaxseed has significant protective effects

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against breast cancer. Flower, G.; et. al., (2014) also supported in his study that flax associated protection against primary breast cancer as well as a reduced risk of mortality in women living with breast cancer. Beneficial effects were observed with 25 gm doses of milled flaxseed said in his study. Flaxseed cures not only breast cancer but it also showed the sensitivity for Cancer of prostate gland, lung, colon, ovary, endometrium, hepatocellular and cervix have been inhibited concluded by many studies [Mali, A.V., et. al., (2019), Lin, X, et al., (2002), Chikara, S., et. al., (2018), Christofidou -Solomidoum, et. al., (2014), Shah, N.R., et. al.,(2016)]. Various mechanisms are proposed for the action of flaxseed on reducing the risk of cancer. In general, the strongest evidences are related to the action of its bioactive compounds, diminishing proliferation and progression of tumors. From the current information available, there are strong suggestions that are bioactivity of flaxseed for protection against Cancer, especially breast cancer, is attributed to the lignans (Mishra. Sunita. & Verma Pooja., 2013, Arya. Shalini., et. al., 2012).

Female Hormonal Health- Landete, J. M., et. al., (2016) said in his study that flaxseed also exhibit a protective effect against menopausal symptoms. Several studies have examined the effects of flaxseed or its bioactive ingredients on the quality of life and the frequency and severity of hot flashes in post-menopausal women. The estrogenic action of certain metabolites of flaxseed suggested a potentially positive effect on these post menopausal symptoms. Cetisli, N. E., et. al., (2015) found in his study that 140 post menopausal women, who ingested a flaxseed supplementation diet decreased the symptoms of menopause and increased the quality of life.

Skin Health- Neukam, K., et al., (2011) found in his study that a significant decrease was noted in skin sensitivity, trans epidermal water loss, skin roughness and scaling with an increase in skin hydration and smoothness after

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the 12 week ingestion of flaxseed oil. ALA was identified as the main bioactive responsible for these effects on skin and aging.

Gastro-Intestinal Health- It was known that the lignans that are unusually high in content within flaxseed need to be metabolized by intestinal bacteria in order to gain access to the systemic circulation in humans. The production of enterolignans like enterodiol and enterolactone from SDG (Secoisolariciresinol Diglucoside) is best generated from milled flaxseed and defatted flaxseed meal, in comparison to a variety of other foods that contain SDG concluded in the study (Thompson, L. U, et. al, 1991). This intestinal metabolism is accomplished via the biotransformative action of specific intestinal bacteria (Wang, C. Z, et. al., 2010) including *Ruminococcus bromii* and *Ruminococcus lactaris* (Lagkouvardos, I., 2015). Others have found *Lactobacillus casei* and *Lactobacillus acidophilus* were important for the digestion of whole flaxseed in order to increase enterodiol bioaccessibility (Munoz, O., 2018). Soltanian, N., et. al., (2018) shown in his study trial, flaxseed baked into cookies was ingested by constipated patients with type 2 diabetes. They found the flaxseed reduced constipation symptoms, weight, fasting plasma glucose, triglycerides and LDL and HDL cholesterol levels. In a subsequent trial using the same type of patient population, flaxseed affected all of these parameters once again and importantly, was superior in its capacity to reduce constipation symptoms to Psyllium (Soltanian, N., 2019).

The recommended amount of daily dietary fiber of ›25g is, according to many studies, useful in the treatment of constipation. Ground flaxseed consists of 40% of dietary fiber, 2/3 of which is insoluble [Cellulose, hemicelluloses and lignin] and 1/3 is soluble fiber. Insoluble fiber binds water and thus increases the bulk in colon. Soluble fiber from flaxseed mucilage has similar effects than guar gum e.g. delay in gastric emptying, improvement in glycemic control and alleviation

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of constipation. Roughly ground flaxseed seems to have better water binding capacity than the finely ground flaxseed meal (Mishra. Sunita., & Verma. Pooja., 2013).

Conclusion-Flaxseeds (Linseed) due to its health beneficial compounds have generated interest. Various studies have been done on the nutritional aspects and medical applications but more studies are needed to understand the curative properties of flaxseed. The components present in flaxseed attract the food technologists and nutritionists to explore its activities in health sector. This encourages development of new branded healthy and functional foods using flaxseeds, oil and cakes.

Today a major portion of world is suffering from disorders like cardiovascular diseases, diabetes, hypertension, neurological disorders hence there is a need to cure the people by adopting natural strategy. Flaxseed is one of the emerging foods which have the potential of curing these disorders. The incorporation of medicinal plants towards the development of nutritional food products fights the disorders which are associated with unhealthy life style and secondly, they are safer as they are natural foods, they don't cause any side effect.

Various clinical trials revealed that the flaxseed constituents provide disease preventive and therapeutic benefits.

Incorporating Flaxseed In Diet

Flax has a place in a balanced diet to help meet individuals Omega 3 fatty acid needs and may be a low risk intervention for various health conditions.

The quantity of flaxseed that should be suggested depends on the amount of Omega 3 fatty acids recommended for a particular age group or medical population.

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For achieving flax seeds health benefits anybody can incorporate flax into their diets

It should be noted that consuming the ground form allows the body to absorb the nutrients more seeds, which are hardly to chew digest and may pass through the gastro intestinal system whole.

1. It can be sprinkled on top of salads. The nutty toasty flavor of this ground seed actually enhances the salad flavor.
2. In ground form it can be used in breakfast smoothie.
3. Can also be added to paratha stuffings. Parathas come out softer.
4. It can be great addition in baking recipes. Flaxseeds can be included in bran muffins or baked crackers for healthier treats.
5. Flaxseed is a vegetarian's boon as it is a great substitute for egg.
6. Flaxseed is very similar in taste to walnut. So it works as a great substitute in brownies and brownies will turn out moist and dense in texture and flavor.
7. Flaxseed can be incorporated in cereal for all round nourishment. It particularly tastes good with oatmeal and banana.
8. Flaxseeds can be added to raita, served with masala bhaat, pulao, biryani and parathas.
9. Flaxseed can be combined with nuts and other ground seeds along with pureed dates and cocoa powder for some delicious chocolate laddoos that are way more healthier than chocolate, but just as yummy.
10. Flaxseed can be added into granola bars, moongfali chikkis, punjiri, kheer.

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