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Phytopharmacological Profiling of *Linum Usitatissimum.L* (Flax Seeds)-A Comprehensive Review

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ABSTRACT
Linum usitatissimum L., commonly known as flaxseed or linseed, is a widely utilized medicinal and nutritional plant belonging to the family Linaceace. It has been traditionally consumed for its laxative, anti-inflammatory, and cardioprotective properties and has gained significant scientific attention due to its rich phytochemical composition. Flaxseeds are a valuable source of omega-3 fatty acids (alpha-linolenic acid,) lignans (secoisolariciresinol diglucoside), dietary fibers, proteins, phenolic acids, flavonoids, carotenoids, vitamins, and essential minerals. This review comprehensively summarizes the plant profile, phytochemistry and pharmacological activities of flaxseeds based on *in vitro*, *in vivo*, and *in silico* studies. Experimental and clinical evidence highlights their beneficial effects in the management of cardiovascular diseases, hyperlipidemia, diabetes mellitus, hypertension, obesity, inflammatory disorders, cancer, renal disorders and postmenopausal complications. The multifaceted pharmacological actions of flaxseeds are primarily attributed to their antioxidant, anti-inflammatory, hypoglycemic, hypolipidemic, and hormone-modulating properties. Overall, flaxseeds represent a promising nutraceutical with significant therapeutic potential for the prevention and management of chronic metabolic and degenerative diseases

INTRODUCTION

Falx seeds (*linum usitatissimmum*), commonly called as linseed belonging to the family Linaceae. Traditionally it is known to have different names depends on various languages such as Jaswa in Marathi, Alse in Hindi, Akse bija in kannada, Avisa ginjalu in Telugu. In Latin, the name of flax seed is *Linum usitatissimmum*, which means "very useful" [1]. Almost all parts of linseed plant are utilized by humans for various purposes. Humans have been consuming linseed since ancient times. Seeds of flax contains oil which is used for edible purpose after refining. The stem yields fiber of good quality possessing high strength and durability. Flax seeds are having 55% of ALA, 28-30% of protein and 35% of fiber. Flax seeds also containing biologically active components like ALA (alpha-linolic acid), SDG (secoisolariciresinol Diglycoside) and dietary fibers which increasing interest of reserachers about the potential health benefits of flax seeds [2]. Lignans are the rich source of flax seeds upto 13mg flaxseed. It contains 38-45% of oil which are having many beneficial properties [3]. Flax seeds are majorly used for its laxative property before its widespread consumption as a food ingredient. Flaxseeds are having two parts seed and the shell. Seed contains lignans, digestible proteins, oils are rich in omega-3-fatty acids and phenolics. The shell comprises of high quality of fiber and mucilage. The shell or outer part of flaxseed is smooth and glossy with a specific colour from brown to dark gold [4]. flaxseeds possess various health benefits like lowering cholesterol, controlling hyperglycemia, alleviating diabetes and preventing the onset of obesity. Apart from those it also shows laxative, anti-inflammatory, anti-arrhythmatic, thrombotic properties [5].

PLANT PROFILE

L. usitatissimmum is an annual plant [6]. Its origin is uncertain, but regarded as indigenous to India.

Table 1: Scientific Classification

Kingdom	Plantae
Order	Malphighiales
Family	Linaceae
Genus	Linum
Species	*L.usitatissimmum*
Binomial name	*Linum usitatissimmum*
Synonym	L.crepitans(Boem) dumort
Varities	*L.usitatissimmum* var. stenophyllum(Boiss) Rech. F, *L.usitatissimmum* var. usitatissimmum
Uses	Anti-oxidant, anti-inflammatory, and cardioprotective effects.
Life cycle	Annual

Fig.1: flax seed plant different parts

Flowers: The flax flowers are delicate and symmetrical, commonly pale blue with five rounded petals. There is other two more varieties white and pale pink. The flowers bloom mainly in June and July.

Fig.2: flaxseed flower

Fig. 3: flaxseeds showing two different colours

Fruit: Flax fruits are small, rounded capsule about 6 to 9 mm in diameter. The fruit dries and splits open to release 6 to 10 glossy brown seeds called as linseeds. These seeds are oval, flat and slightly mucilaginous when wet.

Roots: Roots are vital organs in terrestrial higher plants for acquisition of essential nutrients and water. Flax is one of the major crop has been grown as both fibre and oilseed crops for entire span of its cultivation. There are wide range of benefits are from its stem fibres and its oil-rich seeds. Flax is a tap rooted plant and has a shallower root system. It grow to depth of 90 to 120 cm with lateral spread of 30 cm in light soil [7].

PHYTOCHEMISTRY:

Phenolic acids: phenolics are the largest source of lignans which are very beneficial to human health [8]. The flax seeds containing phenolic compounds are mainly classified into two classes, which are phenolic acids and lignans. In these two the phenolics are comprised of major portion and lignans holds the smaller portion of total phenolic compounds. The phenolic acids are containing mainly ferulic acid, coumaric acid, chlorogenic acid, vanillic acid and p-hydroxy benzoic acid, while the lignans consists of matareSinol, pinoresinol, and secoisolarisericinol [9]. The coumaric acid, vanillic acid, ferulic acid, lignans, SDGS are having antioxidant properties [10]. Which protects body from free radicals production and it acts as anticarcinogenic agent [11].

Flavonoids: Numerous flavonoids are present with different quantities and varieties of flaxseeds. Bioactive substances, especially flavonoids, and natural pigments are all abundant in flaxseeds [12].

Carotenoids:

Carotenoids are having significant effects on both human health and food business [13]. Carotenoids are organic compounds which gives characteristic colour to flax seeds. Among carotenoids, beta carotene have higher activity of provitamin A [14].

Minerals:

Flaxseeds are rich source of macro and micro nutrients. Among major nutrients carbohydrates, proteins, and fats are abundant in flaxseeds, while minor nutrients include vitamins and minerals, also present in flaxseeds are magnesium, potassium, sodium, zinc, manganese, copper and iron [15]. Minerals are very essential for humans that regulate various metabolic processes in body and also provide support to skeleton.

Lipids: lipids are abundant in total unsaturated fatty acids in comparison with small amount of saturated fatty acids [16]. An investigation of FO extracted with pet. ether elucidated alpha linolic, linoleic, palmitic and stearic acids as major constitutes [17]. Flaxseeds are having a little higher amount of alpha linoleic acid and oleic acids and lower linolenic acid [18,19]. Alpha linolenic acid (ALA) is an essential polyunsaturated fatty acid with omega carbon at 3rd position, which cannot be synthesized by human body itself. ALA is used in synthesis of Docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) by using different pathways. Which are essential for maintaining normal growth and development of the human body, especially for brain and skin [20].

Proteins and peptides:

Flaxseed is an abundant source of proteins, which are up to 23% of total seed weigh. The combination of flax seed with balanced amino acid gives high protein quality score (82%) which is better than that of soyabean. The ratio of lysine to arginine of flax seed of 0.37 is far lesser than that of soyabean (0.88) which is lower lipidemic and atherogenic potential and thus heart friendliness. flaxseeds are considered as preferable source of protein because of appreciable amounts of sulfur based aminoacids, such as cysteine and methionine, branched chain aminoacids, such as leucine, isoleucine, aline and other essential aminoacids such as tyrosine, threonine, and lysine. Flaxseeds are also rich in proteins like aspartic acid, glutamine, asparagine and arginine [21]. Flaxseeds mainly contains two types of proteins based on solubility namely albumins and globulins. Which are also known as linins and colinins [22,23]. These compounds have been found to possess multiple beneficial traits, such as immunosuppressive, anti-malarial, anti-tumor and a protectant against bone degeneration.

Fig.5: figure showing the benefits of flax seeds

Cardiovascular diseases: Due to presence of omega-3 fatty acids, lignans, protein, and soluble fiber in flaxseeds which reduces the risk of cardiovascular diseases such as ischemic heart disease or atherosclerosis [24].

Ulcerative colitis:

Flaxseed supplementation is also used for management of metabolic-syndrome-related parameters, which includes serum concentration of triglycerides, total cholesterol, and HDL/LDL in patients with mild tp moderate ulcerative colitis (UC) [25].

Dyslipidemia:

Flaxseed supplementation may help to treat dyslipidemia, especially in overweight or obese patients. Whole flaxseed is more beneficial in lipid metabolism regulation [26,27].

Hypertension:

Presence of ALA, lignans and dietary fiber, flaxseed may be helpful in treatment of hypertension [28]. The flaxseed shows hypotensive effect in prediabetic patients [29].

Hypoglycemic property:

Flaxseed consumption improves glycemic control and insulin sensitivity in type-2 diabetes. Flaxseeds are also improve cytokines and adipokines in overweight and obese with pre-diabetes [30,31].

Anticancer property: flaxseeds are the richest plant sources of lignans which reverse early cancerous lesions and inhibit the growth of tumor, progression of disease and angiogenesis. Flaxseed lignans having the ability to interfere with malignant tumor, which affects its characteristics. Flaxseed lignans are also affects the connections in molecular signalling networks, modulate signaling cascades in various stages of cancer [32,33].

Anti-inflammatory property: flaxseed lignans are having antioxidants due to presence of phenolic acids, and tocopherols [34,35]. Flaxseed lignans can lower the concentration of inflammatory markers [36].

Digestive health:

Regular consumption of flaxseed contributes to increasing fecal fat excretion. It plays an important role in prevention of being overweight and obesity [37].

Renal health:

Flaxseeds are good source of omega-3 fatty acids, which are having anti-inflammatory qualities and also protect kidney from damage. Polyunsaturated fattyacids supplementations shown to reduce kidney fibrosis and inflammation [38].

Postmenopausal and female hormonal status:

Flaxseed consumption having significant impact on postmenopausal women's quality of life due to presence of significant bioactive components in flaxseed [39]. There was a substantial reduction in menopausal symptoms reported on high dosage of flaxseed [40].

Table 2: Pharmacological Profiling By *In Vitro, In Vivo,* And *In Silico*

S.NO	Activity	Flaxseed	Study type/cell line	Result	References
01.	Anticancer	Flaxseed derivatives	*In vitro* and *in vivo*	Anticancer effect	Eriksen et al. (2017), Mali et al. (2019) [41]
		Flaxseed derivatives	Two AML cell lines in vitro namely KG-1 and Monomac-1	Anticancer effect	Tannous et al. (2020) [42]
		Flaxseed lignans	Healthy human beings B lymphoblasts	Selective cancerous cell targeting and leaving the normal cell	Mali et al. (2017) [43]
02.	Hyperlipidemia	Roasted flaxseed supplementation included in chapattis	Lipid profile of hypercholesterolemic patients	Decreased total cholesterol (TC), LDL-cholestrol levels, triglycerides (TG) and increased HDL cholesterol levels.	Prasad et al. (2020) [44]
		Flaxseed supplementation	Hyperlipidemic patients	Total cholesterol improvement, triglyceride, and (LDL-C) levels along with prevention as well as delayed progression of heart diseases	Hadi et al. (2020) [45]
		Flaxseed	For severe hyperlipidemic patients	Flaxseed supplementation was tolerated well by the patients and led to exceptional and consistent decreased levels of LDL and total cholesterol	Kanikowska et al. (2020) [46]
				Reduction in weight as	

		Flaxseed powder (30 g for 40 days)	Lipid profile of 70 hyperlipidemic patients	well as BMI of subjects. Significant decrease in total cholesterol and low-density lipoprotein levels was obsereved	Torkan et al. (2015) [47]
03.	Anti-diabetic	Ground flaxseed (0,13, or 26 g consumed for 12 weeks)	25 overweight or obese women and men in postmenopausal stage and pre-diabetic	The group that was given flaxseed dosage of 13 g/day experienced decreased glucose level as compared to the other two groups	Hashemzadeh et al. (2017) [48]
		Grounded flaxseed and flaxseed oil (10% grounded flaxseed and 4% flaxseed oil)	Streptozotocin (STZ)-induced diabetic rats	The diabetic rats who received 10% grounded flaxseed were more prone to improve within 8 weeks from diabetes that was induced	Prasad and Dhar (2016) [49]
04.	Hepatoprotective	Flaxseed and its oil	NALFD in 54 adult male albino rats	The result proved that significant decrease in body weight gain, organ weight, peritoneal fat pad PFP/body weight PFP, leptin, glucose, lipid profile including (cholesterol, triglycerides, LDL-c, and VLDL-c), liver enzymes including AST, ALT, AND ALP, while these treatments induced significant increase in feed intake, HDL-c, and antioxidant enzymes (GSH-GPx, SOD, and CAT)	El-Aziz et al. (2020) [50]
05.	Anti-metabolic syndrome	Flaxseed oil and sunflower oil	60 volunteers aged 30-60 years were diagnosed with MetSyn	Significant reductions in total cholesterol, low-density lipoprotein cholesterol, and triglyceride levels were seen. Effective in amelioration of some symptoms of MetSyn and reduce BP levels and lipid peroxidation	Akrami et al. (2018) [51]
		Flaxseed oil	D-galatosamine-sensitized albino rats	The results obtained were that LPS/DGaIN vitally enhanced serum liver functions, MDA,TNF-ALFA,IL-1 ALFA, urinary 8-OhdG concomitant with a decrease in liver GSH and SOD than the control group while, these parameters were reduced by intake of flaxseed oil	Hussein et al. (2016) [52]
		Flaxseed oil and sunflower oil	68 NAFLD patients	Reduced fatty liver grade decreased AST and ALT serum levels. Reduced levels of glucose in the blood and fat mass of the group given flaxseed oil and the mass of the muscles of the batch given oil made from sunflowers were observed.	Rezaei et al. (2020) [53]

06.	Cardiovascular Diabetes Osteoporosis Atherosclerosis Cancer Arthiritis Neurological and auto immune disorders	Rich in omega-3 fatty acid	In silico proteolysis	As promising stimulating, anticancer, antithrombotic, ACE inhibitor, anti-inflammatory	Akila M, The inhibitor of Leptin Signalling Pathway. [54]
07.	PCOS	Lignans from flaxseeds	*In silico* and *in vitro*	Antioxidant effect on body provides a convenient approach for management of PCOS and better ovulation	Akila M, The inhibitor of Leptin Signalling Pathway. [54]
08	Antihyperlipidemic activity	Flaxseeds by molecular docking	*In silico*	The 5 phytochemicals sominone, guggulsterone, phytosterol, withanolide, and basilol can serve as potential inhibitor in regulating HMGCR'S function may assist the development of effective hyperlipidemic drugs	Akila M, The inhibitor of Leptin Signalling Pathway. [54]
09	Antiobesity	Flaxseed components ALA and SDG	*In silico*	SDG and ALA exhibited favourable and stable interactions with target protein $SOCS_3$. Hence exhibiting promising potential as neutraceuticals for obesity prevention	Akila M, The inhibitor of Leptin Signalling Pathway. [54]s

CONCLUSION

Flaxseeds (*linum usitatissimum* L.) are considered to be an important functional food and medicinal resource with remarkable phytopharmacological potential. The present review highlights that flaxseeds are rich in bioactive compounds such as alpha-linolenic acid, lignans, phenolic acids, flavonoids, dietary fiber, and high-quality proteins, which collectively contribute to their diverse health-promoting effects. Evidence from *in vitro*, and *in vivo*, and *in silico* studies demonstrates their efficacy in reducing cardiovascular risk factors, improving lipid and glucose metabolism, modulating inflammatory pathways, exhibiting anticancer activity, and supporting hormonal balance and renal health. Despite strong preclinical and clinical findings, further large-scale human studies are required to establish standardized dosages, long-term safety, and precise molecular mechanisms. Nevertheless, regular incorporation of flaxseeds into the diet or their development as nutraceutical formulations may serve as an effective, natural, and economical strategy for preventing and managing various chronic diseases. Thus, flaxseeds hold significant promise as a multifunctional therapeutic and preventive agent in modern healthcare.

REFERENCES

[1] Anurag AP, Prakruthi M, Mahesh MS. Flax Seeds (Linum usitatissimmum): Nutritional composition and health benefits. IP Journal of Nutrition, Metabolism and Health Science. 2020 Aug 15;3(2):35-40.

[2] Kajla P, Sharma A, Sood DR. Flaxseed—a potential functional food source. Journal of food science and technology. 2015 Apr;52(4):1857-71.

[3] Hall III C, Tulbek MC, Xu Y. Flaxseed. Advances in food and nutrition research. 2006 Jan 1;51:1-97.

[4] Duarte S, Shah MA, Sanches Silva A. Flaxseed in Diet: A Comprehensive Look at Pros and Cons. Molecules. 2025; 30(6): 1335.

[5] Pramanik J, Kumar A, Prajapati B. A review on flaxseeds: Nutritional profile, health benefits, value added products, and toxicity. EFood. 2023; 4(5):e114.

[6] Saleem MH, Ali S, Hussain S, Kamran M, Chattha MS, Ahmad S, Aqeel M, Rizwan M, Aljarba NH, Alkahtani S, Abdel-Daim MM. Flax (Linum usitatissimum L.): A potential candidate for phytoremediation? Biological and economical points of view. Plants. 2020 Apr 13;9(4):496.

[7] Sertse D, You FM, Ravichandran S, Cloutier S. The complex genetic architecture of early root and shoot traits in flax revealed by genome-wide association analyses. Frontiers in Plant Science.2019;19(10):1483.

[8] Ramsay A, Fliniaux O, Quéro A, Molinié R, Demailly H, Hano C, Paetz C, Roscher A, Grand E, Kovensky J, Schneider B. Kinetics of the incorporation of the main phenolic compounds into the lignan macromolecule during flaxseed development. Food Chemistry. 2017; 217:1-8.

[9] Bekhit AE, Shavandi A, Jodjaja T, Birch J, Teh S, Ahmed IA, Al-Juhaimi FY, Saeedi P, Bekhit AA. Flaxseed: Composition, detoxification, utilization, and opportunities. Biocatalysis and agricultural biotechnology. 2018; 13:129-52.

[10] Frankel EN. Lipid Oxidation, the Oily Press. University of California, Davis, California, USA. 2005: 103-6.

[11] Park JB, Velasquez MT. Potential effects of lignan-enriched flaxseed powder on bodyweight, visceral fat, lipid profile, and blood pressure in rats. Fitoterapia. 2012; 83(5): 941-6.

[12] Suri K, Singh B, Kaur A, Yadav MP. Physicochemical characteristics, oxidative stability, pigments, fatty acid profile and antioxidant properties of co-pressed oil from blends of peanuts, flaxseed and black cumin seeds. Food Chemistry Advances. 2023, 1(2):100231.

[13] Viñas-Ospino A, López-Malo D, Esteve MJ, Frígola A, Blesa J. Green solvents: Emerging alternatives for carotenoid extraction from fruit and vegetable by-products. Foods. 2023 Feb 17;12(4):863.

[14] Yonekura L, Nagao A. Intestinal absorption of dietary carotenoids. Molecular nutrition & food research. 2007 Jan;51(1):107-15.

[15] Kaur M, Kaur R, Gill BS. Mineral and amino acid contents of different flaxseed cultivars in relation to its selected functional properties. Journal of Food Measurement and Characterization. 2017 Jun;11(2):500-11.

[16] Yaqoob N, Bhatti IA, Anwar F, Mushtaq M, Artz WE. Variation in physico-chemical/analytical characteristics of oil among different flaxseed (Linum usittatissimum L.) cultivars. Italian Journal of Food Science. 2016 Jan 1;28(1):83-9.

[17] Ishag OA, Khalid AA, Abdi A, Erwa IY, Omer AB, Nour AH. Proximate composition, physicochemical properties and antioxidant activity of flaxseed. Ann Res Review Biol. 2019:1-0.

[18] Rubilar M, Gutiérrez C, Verdugo M, Shene C, Sineiro J. Flaxseed as a source of functional ingredients. Journal of soil science and plant nutrition. 2010 Jul;10(3):373-7.

[19] Zhang ZS, Wang LJ, Li D, Li SJ, Özkan N. Characteristics of flaxseed oil from two different flax plants. International Journal of Food Properties. 2011 Nov 1; 14(6): 1286-96.

[20] Mueed A, Shibli S, Korma SA, Madjirebaye P, Esatbeyoglu T, Deng Z. Flaxseed bioactive compounds: Chemical composition, functional properties, food applications and health benefits-related gut microbes. Foods. 2022;11(20): 3307.

[21] Wu S, Wang X, Qi W, Guo Q. Bioactive protein/peptides of flaxseed: A review. Trends in Food Science & Technology. 2019 Oct 1;92:184-93.

[22] Madhusudhan KT, Singh N. Isolation and characterization of the major fraction (12 S) of linseed proteins. Journal of Agricultural and Food Chemistry. 1985; 33(4):673-7.

[23] Youle RJ, Huang AH. Occurrence of low molecular weight and high cysteine containing albumin storage proteins in oilseeds of diverse species. American Journal of Botany. 1981 Jan;68(1):44-8.

[24] Hadi A, Askarpour M, Salamat S, Ghaedi E, Symonds ME, Miraghajani M. Effect of flaxseed supplementation on lipid profile: An updated systematic review and dose-response meta-analysis of sixty-two randomized controlled trials. Pharmacological research. 2020 Feb 1;152:104622.

[25] Morshedzadeh N, Rahimlou M, Shahrokh S, Karimi S, Mirmiran P, Zali MR. The effects of flaxseed supplementation on metabolic syndrome parameters, insulin resistance and inflammation in ulcerative colitis patients: An open-labeled randomized controlled trial. Phytotherapy Research. 2021 Jul;35(7):3781-91.

[26] Masjedi MS, Pour PM, Shokoohinia Y, Asgary S. Effects of flaxseed on blood lipids in healthy and dyslipidemic subjects: a systematic review and meta-analysis of randomized controlled trials. Current Problems in Cardiology. 2022 2Jul 1;47(7):100931.

[27] Yang C, Xia H, Wan M, Lu Y, Xu D, Yang X, Yang L, Sun G. Comparisons of the effects of different flaxseed products consumption on lipid profiles, inflammatory cytokines and anthropometric indices in patients with dyslipidemia related diseases: systematic review and a dose–response meta-analysis of randomized controlled trials. Nutrition & Metabolism. 2021 Oct 11;18(1):91.

[28] Khalesi S, Irwin C, Schubert M. Flaxseed consumption may reduce blood pressure: a systematic review and meta-analysis of controlled trials. The Journal of nutrition. 2015 Apr 1;145(4):758-65.

[29] Javidi A, Mozaffari-Khosravi H, Nadjarzadeh A, Dehghani A, Eftekhari MH. The effect of flaxseed powder on insulin resistance indices and blood pressure in prediabetic individuals: A randomized controlled clinical trial. Journal of Research in Medical Sciences. 2016; 21(1):70.

[30] Hajiahmadi S, Nadjarzadeh A, Gharipour M, Hosseinzadeh M, Fallahzadeh H, Mohsenpour MA. Effect of flaxseed oil on glycemic control and inflammatory markers in overweight adults with pre-diabetes: A double-blind randomized controlled clinical trial. Journal of Herbal Medicine. 2020; 24: 100387.

[31] Almehmadi A, Lightowler H, Chohan M, Clegg ME. The effect of a split portion of flaxseed on 24-h blood glucose response. European journal of nutrition. 2021 Apr;60(3):1363-73.

[32] Regulska-ilow B. The legitimacy of using dietary supplement diglycoside secoisolariciresinol (SDG) from flaxseed in cancer. Roczniki Państwowego Zakładu Higieny. 2021 Jan 1.

[33] Di Y, De Silva F, Krol ES, Alcorn J. Flaxseed lignans enhance the cytotoxicity of chemotherapeutic agents against breast cancer cell lines MDA-MB-231 and SKBR3. Nutrition and cancer. 2018;70(2):306-15.

[34] Barthet VJ, Klensporf-Pawlik D, Przybylski R. Antioxidant activity of flaxseed meal components. Canadian Journal of PlantScience.2014; 94(3):593-602.

[35] Musazadeh V, Jafarzadeh J, Keramati M, Zarezadeh M, Ahmadi M, Farrokhian Z, Ostadrahimi A. Flaxseed

oil supplementation augments antioxidant capacity and alleviates oxidative stress: A systematic review and meta-analysis of randomized controlled trials. Evidence-Based Complementary and Alternative Medicine. 2021;2021(1):4438613.

[36] Mirfatahi M, Tabibi H, Nasrollahi A, Hedayati M, Taghizadeh M. Effect of flaxseed oil on serum systemic and vascular inflammation markers and oxidative stress in hemodialysis patients: a randomized controlled trial. International urology and nephrology. 2016 Aug; 48(8):1335-41.

[37] Kristensen M, Jensen MG, Aarestrup J, Petersen KE, Søndergaard L, Mikkelsen MS, Astrup A. Flaxseed dietary fibers lower cholesterol and increase fecal fat excretion, but magnitude of effect depend on food type. Nutrition & metabolism. 2012; 9(1): 8.

[38] Baggio B, Musacchio E, Priante G. Polyunsaturated fatty acids and renal fibrosis: pathophysiologic link and potential clinical implications. Journal of nephrology. 2005;18(4): 362.

[39] Cetisli NE, Saruhan A, Kivcak B. The effects of flaxseed on menopausal symptoms and quality of life. Holistic nursing practice. 2015 May 1;29(3):151-7.

[40] Dodin S, Lemay A, Jacques H, Légaré F, Forest JC, Mâsse B. The effects of flaxseed dietary supplement on lipid profile, bone mineral density, and symptoms in menopausal women: a randomized, double-blind, wheat germ placebo-controlled clinical trial. The Journal of Clinical Endocrinology & Metabolism. 2005; 90(3):1390-7.

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