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## Alsi (*Linum Usitatissimum* (Linn.): A potential multifaceted Unani drug

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### Abstract

Alsi or Katan popularly known as flax seed is one of the famous Unani drug used in a number of pathological conditions. It is also known as *Bazar-ul- Katan* or *Tukhm-e- Katan*. Although entire plant has medicinal value but its seed and oil are more important and have wide medicinal application. The botanical name of katan is *Linum usitatissimum* Linn. (Family: Linaceae). *Linum usitatissimum* (Linn.) belongs to the family Linaceae. The flax plant is not a new crop and is native to West Asia and the Mediterranean. As the source of linen fiber, flax has been cultivated since at least 5000 BC. Traditionally, flaxseed has been grown for its oil. Flaxseed has been playing a major role in the field of diet and disease research due to its potential health benefits associated with high content of  $\alpha$ -linolenic acid (ALA)(57%), which is an essential omega-3-fatty acid and also because of a major lignan, namely secoisolaric iresinoldiglucoside (SDG).

**Keywords:** Alsi, *Linum Usitatissimum* Linn., potential

### Introduction

Common name: Flax *Latin name: Linum usitatissimum*, Synonyms: Linseed, Common Flax, Flax Weed, Lint Bells, and Toad Flax *Family: Linaceae Habitat:* The plant is native to the temperate regions of Europe and Asia. *Description:* Katan/ Flax is an annual herb of about 0.7 m high with blue flowers and a globular capsule. Its leaves are linear, lanceolate or ovate, attenuated at both ends, acute at the apex and up to 3.8 cm long. Flowers are small about 2.5 cm long, blue, bluish violet or white in terminal panicles in corymbose. Sepals: the 2 outer elliptic, acuminate, with entire membranous margins the 3 inner broader, acuminate, with ciliate margins, all strongly 3 nerved, the middle along reaching the apex. Petals are blue and slightly crenate. Fruits are capsular with 5 cells containing compressed, ellipsoid, smooth, dark brown and shining seeds [1, 2, 3, 4]. The seed are ovate, flattened and obliquely pointed at one end, about 4-6 mm long and 2-2.5 mm broad. The testa is brown, glossy and finely pitted odorless, taste mucilaginous and oily. If cruciferous seed are present, a pungent odour and taste may develop on crushing and moistening (Evans, 2009). Seeds are mucilaginous, oily and slightly bitter in taste [1, 3, 5]. 10-20 seeds in the capsule, oval lenticular 4-6 mm in length. Surface is smooth, shiny and dark brown [6, 7]. A light depression in one edge enclosed in hilum and micropile, from hilum a yellow raphae runs to the chalaza [8].



Flaxseed is one of the oldest crops, having been cultivated since the beginning of civilization [9]. The Latin name of the flaxseed is *Linum usitatissimum*, which means "very useful". Flax was first introduced in United States by colonists, primarily to produce fiber for clothing [9]. Every part of the flaxseed plant is utilized commercially, either directly or after processing. The stem yields good quality fibers having high strength and durability [10]. Flax has been used until 1990s principally for the fabrication of cloths (linen) and papers,

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while flaxseed oil and its sub-products are used in animal feed formulation [10]. There is a small difference in using the terms flaxseed and linseed. Flaxseed is used to describe flax when consumed as food by humans while linseed is used to describe flax when it is used in the industry and feed purpose [11]. In the last two decades, flaxseed has been the focus of increased interest in the field of diet and disease research due to the potential health benefits associated with some of its biologically active components. Flaxseeds have nutritional characteristics and are rich source of  $\omega$ -3 fatty acid:  $\alpha$ -linolenic acid (ALA), short chain polyunsaturated fatty acids (PUFA), soluble and insoluble fibers, phytoestrogenic lignans (secoisolariciresinol diglycoside-SDG), proteins and an array of antioxidants [12, 13, 14]. Its growing popularity is due to health imparting benefits in reducing cardiovascular diseases, decreased risk of cancer, particularly of the mammary and prostate gland, anti-inflammatory activity, laxative effect, and alleviation of menopausal symptoms and osteoporosis. This review is an attempt to cover the history of flax and flaxseed oil, its journey from being a traditional medicine to a potent source of multifaceted therapeutic drug.

### Vernacular Names

The Various Vernacular Names of Alsi are: Alsi, Tisi (Hindi); Bazarug, Kuman, Tukhm-e-Katan, Zahir, Zaghū (Persian); Atasi, Atima, Chanaka, Devi, Haimwati, Kshauma, Kshaumi, Kshuma, Madagandha, Madotkata, Malina, Masina, Masrina, Masruna, Nilapushpi, (Sanskrit); Bazrul Katan, Buzruk, Bazen, Katan (Arabic); Agasebeeja, Semeegara, Agasi, Kain Atish, Agashi (Kannada); Alish, Kenu (Kashmir); Agastha, Cheruchana-Vittintevilta (Malayalam); Alashi, Javas (Marathi); Atushi, Peso (Oriya); Alish, Alsi, Tisi (Punjabi); Tisi, Tusi, (Assamese); Chikna, Tisi (Behar); Masina, Tisi, Alasi (Bengali); Alasi, Javasa, Javas (Bombay); Linho (Brazil); Alashi, Alsi (Canarese); Hou la Tse (Chinese); Alshi, javas (Deccan); Blaebows, Common Flax, Flax, Flix, Linseed, Lint Bells (English); Lin chaud, Lin commun, Lin cultivate, Grins de Lin (French); Flachs, Haarlinsen, Lein, Saatlein (German); Lino (Italian); Linon (Greek); Alshi, Arasi (Gujarati); Len, Lyon (Russian); Lino (Spanish); Bari Aala (Suryani); Bazrag (Sherazi); Alshi, (Tamil); Atasi, Madanginjalu, Ullusulu (Telugu); Ziggār (Turki); Keten (Turkish); Alsi, Katan (Urdu); Lisfermoon, Lifertus (Unani) [15, 16, 17, 18, 19, 20, 21, 22].

### Mizaj (Temperament)

Temperament of Alsi/ Katan according to different Unani physicians has been mentioned as Hot and Dry in first degree (Seed) [4, 15, 17], Hot and Wet (Oil) [15], Hot<sup>1</sup> and Equable between Wet & Moist (Mo'atadil) [16, 23].

### Actions and Clinical indications of Alsi/Tukhm-e-Katan (seeds)

After reviewing the classical Unani literature for various clinical uses of the plant *Linum usitatissimum*, its use has been described in detail, such as Mulattif (Demulcent) [15], Mufattit-e-Hisat (Lithotriptic) [15], Mukhrij-e-Hisat-e-Gurda-wa-Masana (expellant of kidney and urinary bladder stones) (Khan, 1313H; Kareem, 1879; Ghani, 2010), Mudammil-e- Qurooh-e-Gurda-wa-Masana [15, 16], Mudir-e-Labn (Galactagogue) [15, 24], Mudir-e-Haiz (Emmenagogue) [16, 24], Maghliz-e-Mani (Semen Inspissant) [15, 16, 17], Muhallil-e-Waram (Anti-inflammatory) [16, 17, 23], Muqawwi-e-Bah (Aphrodisiac) [17, 23], Muqawwi-e-Basar (Eye Tonic) [24], Muqawwi-e-Aaza (General Body Tonic) [24],

Dafe-e- Tashannuj [16], Habis-ud-Dam (Styptic/Haemostatic) [17], Jali (Detergent) [15, 24], Mudir-e-Baul (Diuretic) [17, 24, 25], Moarriq (Diaphoretic) [17, 24, 25], Musakkin-e-Alam (Analgesic) [15, 16, 23, 24], Muwallid-e-Mani (Spermatogenesis) [17], Muqee [17], Mulayyan (Laxative) [16, 24], Mufatteh Sudade Ama'a (Deobstruent of intestine) [17], Qabiz (biryān) (Astringent) [15, 23], Nafakh (Flatulent) [15, 17, 23], Mufajjir Auraam (Resolvent) [17], Munaffis-e-Balgham (Phlegm Expectorant [17, 22], Munaffit (Vesicant) [17, 23], Flower of the plant is Mufarreh-wa-Muqawwi-e- Qalb (Exhilarant and Cardio Tonic) [17, 24, 25], Musakkin-e-Laza (Anti-pruritic) [16, 17], Mustahi (Appetizer) [16, 17, 21], Musakkin-e-Sual (Antitussive) [17, 24, 25].

### Therapeutic Uses of Tukhm-e-Katan (seeds)

The tukhm-e-katan is exploited throughout the world for treatment of various diseases, and it is the oldest and the safest medicine to manage or cure various ailments. Its applications are mentioned in the works of Hippocrates, and Dioscorides as well as in medieval books on medicinal herbs like that of Galen, Ibn Sina etc. A number of medicinal and therapeutic uses of flax had been mentioned variedly by Hippocrates, Galen, Ibn Sina, Dioscoridous, Rhazi, Ibn Ul Baitar, etc [26]. They include:

Balghami khansi (Bronchial Asthma) [15, 17, 26, 27, 29] Zeeq-un-Nafas (Dyspnea) [27, 29] Warm-e-Urooq-e- Khashna (Bronchiolitis) [27, 29, 30] Nafs-ud-dam (Hemoptysis) [17] Sang-e-Gurda (Renal calculus) [17, 27, 30] Sang-e-Masana (Vesicle Calculus) [17, 30] Dard (Pain) [17, 28, 30] Warm-e-Jigar (Hepatitis) [17] Warm-e-Tihal (Inflammation of the Spleen) [31] Zat-Ur-Riya (Pneumonia); Warm-e-Shaob-e-Muzmin (Bronchitis); Warm-e-gilaf-e-Qalb (Pericarditis); Wajaul mufassil (Arthritis) [17, 27, 30] Zat-ul-Janab (Pleurisy) [17, 30, 31] Sozish-e-Halq (Throat irritation) [17, 31] Wajaul Mufassil (Arthritis) [17, 27, 30] Irqunnasa (Sciatica) [17, 30] Niqrās (Gout) [17, 30] Qurooh Ama (Intestinal ulcers) [17, 18, 30, 31] Qurooh-e-Gurda-wa-Masana (Ulcers of kidney and urinary bladder) [15, 17, 18, 31] Qarha-e-Reham (Uterine ulcer) [15, 17, 31] Ikhtenaq-ur-reham (Hysteria) [21] Awram-e-Zahira-wa-Batina (Inflammation of external and internal organs) [15, 17, 18, 31] Basoor-e-labniya (Acne vulgaris) [17, 31] Qooba (Ringworm) [15, 17, 18, 31] Kalaf (Melasma) [15, 17, 18, 31] Sa'afa (Alopecia) [17] Surkhi Ain (Redness of eyes) [17, 30, 31] Dard-e-Ain (Pain in eyes) [31] Zoaf-e-Aam (General weakness) [17] Amraz-e-kulliya (Kidney disease) [31, 32] Ulcer; Local inflammation [32] Flaxseeds as mentioned in the Indian pharmacopeia as a demulcent, emollient, expectorant, and thermogenic and diuretic. It is astringent after roasting [4]. Flax Seed has been used as a remedy for colds, coughs and irritations of the urinary tract. The whole seed is prescribed as a laxative in the same manner as ispaghula (*Plantago ovata*). The mucilaginous infusion, Linseed Tea as it is called, is used internally as a demulcent in cold, coughs and bronchial affections, inflammation of the urinary tract, gonorrhoea and diarrhoea. Crushed linseed is applied in the form of a poultice for the relief of local inflammations and ulcers, boils and carbuncle; linseed poultice retain heat better than most other substitutes and they dilate the local blood vessels, relax the tissue, and thereby relieve the tension and pain hence they act as a good supportive. Linseed poultice is also useful in bronchitis and other deep-seated inflammations and has been recommended for gouty and rheumatic swellings [1, 4, 18, 32, 34, 35, 36, 37, 38].

### Dosage (Miqdar khuraq) mentioned in Unani classical literature

10-15gms [32]

### Adverse effects

It may lead to improper digestion visual disturbances, decrease blood formation [15, 17, 21, 25].

### Corrective

- *Punica granatum* (Anar) and Honey for improper digestion; visual disturbances decrease blood formation.
- *Coriandrum sativum* Linnz, (Kishnee) for refractory error
- Sikanjibeen For improper digestion is used [16, 17, 23]

### Phytochemistry

Flaxseeds have a hard shell that is smooth and shiny and the color ranges from deep amber to reddish brown depending upon whether the flax is of the golden or brown variety. The envelope or testa of the seed contains about 15% of mucilage. Flaxseed is rich in fat, protein and dietary fibre. The composition of flaxseed can vary with genetics, growing environment and method of seed processing [39]. An analysis of flaxseed averaged 41% fat, 20% protein, 28% total dietary fibre, 7.7% moisture and 3.4% ash [40, 41]. The protein content of the seed decreases as the oil content increases [42]. It is well known that flax seeds are a source of high content of polyunsaturated fatty acids [43]. Flaxseed has become known as a functional food due to its nutritional composition, which has positive effects on disease prevention providing health-beneficial components [44].

### Fatty acids

Flaxseed has been valued historically for its abundance of fat, which provides a unique mix of fatty acids. Flaxseed is rich in the essential omega-3 fatty acid, alpha linolenic acid. The omega-3 fatty acids have biologic effects that make them useful in preventing and managing chronic conditions such as type 2 diabetes, kidney disease, rheumatoid arthritis, high blood pressure, coronary heart disease, stroke, Alzheimer disease, alcoholism and certain types of cancers [45]. The high alpha linolenic acid (C18:3, n-3) content of flaxseed oil and the observed protective effects of omega-3 fatty acids on cancer have led to the hypothesis that the fatty acid composition of flaxseed may render it protective against cancer [46].

### Protein

The amino acid pattern of flax protein is similar to that of soybean protein, which is viewed as one of the most nutritious of the plant proteins. Flax is gluten free. The specific agent in gluten that causes a condition known as 'celiac disease' is gliadin, which is rich in the amino acids proline and glutamine [47].

### Carbohydrates

Flaxseed is low in carbohydrate [40]. For this reason, flax contributes little to total carbohydrate intake. Fibre Total fibre is the sum of dietary fibre and functional fibre. Functional fibre consists of nondigestible carbohydrates that have been extracted from plants, purified and added to foods and other products.

Dietary fibre acts as a bulking agent in the gut. It increases stool weight and the viscosity of digested material, while also decreasing the transit time of material through the gut. In this manner, dietary fibre helps control appetite and blood glucose, promotes laxation and reduces blood lipids, reduce the risk of heart disease, diabetes, colorectal cancer, obesity and inflammation [48, 49, 50, 51].

### Mucilage gums

Mucilage gums extracted from flax seeds are added to laxatives and cough syrups [53]. Flax mucilage consists of three distinct types of arabinoxylans which form large aggregates in solution and contribute to its gel qualities [52].

### Phenolics

Flax contains at least three types of phenolics [54, 55] viz., phenolic acids (about 1%), flavonoids (35-70 mg/ 100 g) and lignans. Flax contains 75 to 100 times more lignans than any other plant source. They are also considered phytoestrogens, they help balance hormone levels, such as estrogen, in the body. They've also been found to help reduce menopause symptoms, similar to soy phytoestrogens [56]. The principal lignan present in the flaxseed is secoisolariciresinol diglucoside (SDG).

### Vitamins and minerals

Flaxseed contains several water and fat-soluble vitamins [57]. Vitamin E is present abundantly in flax primarily as gammatocopherol [58]. Gamma-tocopherol is an antioxidant that protects cell proteins and fats from oxidation; promotes sodium excretion in the urine, which may help lower blood pressure; and helps lower the risk of heart disease, some types of cancer and Alzheimer disease [59, 53]. Flax contains a small amount of vitamin K in the form of phylloquinone, which is the plant form of the vitamin K. Vitamin K plays an essential role in the formation of certain proteins involved in blood clotting and in building bone [61, 62]. The mineral content of flaxseed includes magnesium, potassium and low quantity of sodium.

### Latest scientific Studies

#### Antiarrhythmic effects

Scientific reviews suggest a possible antiarrhythmic effect of ALA and omega-3 fatty acids present in flax seeds [63, 64, 65]. However, another study found that antiarrhythmic effects were concentration-dependently enhanced by DHA and EPA, but not by ALA [66]. Higher intake of dietary linolenic acid might be associated with a reduced risk of abnormally prolonged repolarization in men and women [67].

#### Anticoagulant and antiplatelet effects

Available data specific to flaxseed (which is unique from fish oil in that it contains up to 20% omega-6 fatty acids and its omega-3 fatty acids must be converted into eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are conflicting regarding its effects on platelet function. Two studies comparing flaxseed oil to a linoleic acid control (one study in healthy volunteers (N=11) and one study in patients with rheumatoid arthritis (N=22)) reported that flaxseed oil decreased collagen-stimulated platelet aggregation and bleeding time [68, 69].

#### Anti-diabetic functions

Daily lignan supplementation resulted in modest, yet statistically significant improvements in glycemic control in type 2 diabetic patients without apparently affecting fasting glucose, lipid profiles and insulin sensitivity [70]. Peak blood glucose values were improved by ingestion of flaxseed fibre in healthy subjects [71]. After removing oil, the flax cake mixed with antioxidants (chilli) could serve as a supplement to the poorest of poor suffering from diabetes in rural populations [72]. Flaxseed lignin, SDG reduced high-fat diet-induced visceral and liver fat accumulation and improved

hyperlipidaemia, hypercholesterolemia, hyperinsulinaemia and hyperleptinaemia. Flaxseeds, which also contain PUFA and dietary fiber, are therefore a promising food to help decrease the risk of lifestyle related diseases [73].

#### Anti-cancerous action

Flaxseed has been shown to reduce the early risk markers for and incidence of mammary and colonic carcinogenesis in animal models [74, 75, 76, 77]. Lignans from flaxseed have been shown to reduce mammary tumor size by >50% and tumor number by 37% [78] in carcinogen-treated rats. Effect of flaxseed feeding on risk markers of cancer in humans [79] demonstrated that the ingestion of 10 g of flaxseed per day elicited several hormonal changes associated with reduced breast cancer risk. Flavanoids, herbacetin 3, 7- Odimethyl ether [80] and herbacetin [81], the aglycone of 1, were shown to mediate antioxidant activity which may contribute to the chemopreventive activity of flaxseed [82]. Flaxseeds significantly increased urinary excretion of lignans without changing the serum hormone concentration of premenopausal women suggesting that the chemoprotective effects reported for flaxseed may have resulted from mechanism other than a hormonal effect [83].

#### Cardio protective effect

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. Alpha-linolenic acid is the natural precursor of the cardioprotective long-chain n-3 fatty acids. Dietary flaxseed has been shown to have potent antiatherogenic effects in rabbits. Dietary flaxseed significantly improves lipid profile in hyperlipidemic patients and may favorably modify cardiovascular risk factors. Studies on experimental animals indicated that flax and pumpkin seed mixture had antiatherogenic and hepatoprotective effect probably mediated by unsaturated fatty acids in the mixture [84]. Flaxseeds are richest source of lignans that are converted to enterolactone by intestinal microflora. Enterolactone has been suggested to be the prime active compound mediating atherosclerosis protective effects [85].

#### Anti-Diabetic effect

Dietary fibers, lignans, and  $\omega$ -3 fatty acids, present in flaxseed have a protective effect against diabetes risk [86, 87, 88]. Flaxseed lignan SDG has been shown to inhibit expression of the phosphoenolpyruvate carboxykinase gene, which codes for a key enzyme responsible for glucose synthesis in the liver [88]. Supplementation of diet of type 2 diabetics with 10 g of flaxseed powder for a period of 1 month reduced fasting blood glucose by 19.7 % and glycated hemoglobin by 15.6 % [89]. It could be due to lower content of glycemic carbohydrates and higher content of dietary fibers of flaxseed. Several small studies using a fasting glucose tolerance approach have found a reduction in postprandial blood glucose levels of women consuming flaxseed [90].

#### Nephro-protective effect

Studies has shown that the anti-inflammatory properties of  $\omega$ -3 fatty acids, has shown protective effects on kidneys from damage in adults. PUFA supplementation was observed as reducing renal inflammation and fibrosis in animal models. Baggio *et al.* 2005 &Gopinath *et al.* (2011) showed that increased dietary intake of long-chain  $\omega$ -3 PUFA was inversely associated with the prevalence of CKD [91, 92]. Cicero *et al.* (2010) showed that long-term supplementation of omega-3 fatty acids was associated with a significant reduction in systolic and diastolic blood pressure. Hypertension is a risk factor for CKD; hence, the influence of long-chain n-3 PUFA on blood pressure may be a potential mechanism by which it protects the kidneys [93].

#### Hormonal effects

Flaxseed (not flaxseed oil) is a rich source of plant lignans [94, 95]. It has been proposed that flaxseed and its lignans have potent antiestrogenic effects on estrogen receptor-positive breast cancer [96]. Flaxseed is a concentrated food source of the lignan secoisolaricresinol diglycoside (SDG) [97]. Enterolactone and enterodiol (metabolized from flaxseed in the bowel) may decrease cell proliferation and inhibit aromatase, 5-alpha-reductase, and 17-beta-hydroxysteroid dehydrogenase activity, which may offer a reduction in the risk of breast, prostate and other hormone sensitive cancers [98].

#### Anti-ulcer effect

Water extract of whole seed of flax in guinea pig and mouse stomach has shown significant spasmolytic effect and protective effect against experimental ulcero genesis ( $p < 0.01$ ), both effect was observed to increase with increase in the soaking period [99].

#### Anti-allergic effects

Role of dietary long-chain polyunsaturated fatty acid (PUFAs) consumption during pregnancy and early childhood and its influence on allergy and respiratory diseases as the long-chain polyunsaturated fatty acids have been reported to have immunomodulatory effects (Shek *et al.* (2012). PUFAs act via several mechanisms to modulate immune function. Omega-3-fatty acids may alter the T helper 2 cell differentiations. PUFAs may further modify cellular membrane, induce eicosanoids metabolism, and alter gene expression.

#### Natural treatment of bowel syndrome

Cunnane *et al.* (1995) studied the influence of consuming 50 g flaxseed per day for 4 weeks on several indices of nutrition in 10 young healthy adults. Various reviews and articles have described comprehensively the effects of flax fiber, including gastrointestinal (GI)- motility, constipation, glucose tolerance, hypocholesterolemic effect and fermentation [100, 101].

#### Conclusions

Various wild and cultivated plants play an important role in the culture, customs, traditional health care practices, rituals etc. and their vital interrelationship has evolved over generations of experience and practices. The scientific analysis validated the various aspects of indigenous traditional knowledge and research is going on. Flaxseed (Linseed) encompasses the potential health suiting nutritional profile in it. Based on the information, it is evident that flaxseeds are the richest source of  $\alpha$ -linolenic acid and lignans. It is also a considerable potential source of soluble

fibre, antioxidants and high quality protein. Its long journey from being a medicine in ancient times to the health food source in 21st century has opened the doors for a large population. The role of flaxseed lignans and  $\omega$ -3 fatty acid in reducing the risks associated with cardiac and coronary disease, cancer (breast, colon, ovary and prostate) and other human health risk factors has been well known. When healthy heart is one of the most desired and highly demanded health benefits from functional foods; and where food industry's goal is to develop innovative solutions to address nutritional challenges, flaxseed is going to play a vital role for the same. Flaxseed can contribute in improving the availability of healthy food choices, specifically by improving the nutrient profile of foods through reductions in the salt, sugar and saturated fat content; and by increasing the content of  $\omega$ -3 fatty acids and other bioactive compounds. As a result, flax and flaxseed oil may be preferred ingredients of functional foods and nutraceuticals in future. Further, enrichment of diets of the animals with flax/flaxseed oil for production of  $\omega$ -3 enriched eggs, milk, meat and other animal origin products could be another approach in utilizing flaxseeds. This review provides extensive information on the medicinal or therapeutic uses of Alsi / Flaxseed and supports the potential of Alsi as a multifaceted Unani drug that needs further research.

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