



Bādiyān (*Foeniculum vulgare* Mill.): A great *Kāsir-e-Riyāḥ* (Anti-flatulence) & *Muqawwi basar* (Eye tonic) drug of Unani system of medicine: A review

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Abstract

Bādiyān (*Foeniculum vulgare* Mill.) is one of the most important medicinal herbs due to its commercial relevance and pharmaceutical industry applications. It is commonly known as fennel and for a long period has been used in traditional medicine for a variety of diseases such as digestive, endocrine, reproductive, respiratory problems and many more. It has established itself as a valuable source of traditional medicine, as well as a remarkable foundation in pharmaceutical biology for the development/formulation of new medications and future clinical applications. In Unani System of Medicine Fennel seeds are used to increase vision and also in high blood pressure, reduce symptoms of asthma and help to purify the blood. Phenolic compounds separated from *Foeniculum vulgare* are responsible for antioxidant activity, while unstable aroma compounds make it an excellent flavouring agent. Anethole and fenchone are two renowned chemical ingredients isolated from *bādiyān* having secretolytic effects on the respiratory tract.

Keywords: Badiyan, *Foeniculum vulgare*, Kasir-i-Riyah, Muqawwi Basar

Introduction:

Bādiyān (fennel) is thought to be one of the oldest medicinal plants, as it has been quoted from Adam, the first prophet, that if eaten with sugar daily in spring, it will protect against all diseases [1]. Fennel is a fragrant and flavorful herb with cooking and therapeutic use. The bulb, leaf and seeds of the fennel plant are utilised in a variety of cuisines around the world. It is divided into two subspecies, *piperitum* and *vulgare*: *piperitum* has bitter seeds, while *vulgare* has sweet seeds used as flavouring agents in baked goods, meat and fish dishes, ice creams, alcoholic beverages, and other applications due to their characteristic anise odour. Morphological distinctions between these two subspecies are not usually evident [2]. All parts of the fennel plant are utilized, including the roots, leaves, fruit and most importantly, the seeds. Its seeds contain 6.3 percent water, 9.5 percent protein, 10 percent fat, 13.4 minerals, 17.5 percent fibers, and 42.3 percent carbohydrates. Vitamins and minerals like as calcium, potassium, sodium, iron, phosphorus, thiamine, riboflavin, niacin, and vitamin C are found in its leaves. Fruits contain 10 to 12 percent oil, which is stored in the seed cotyledons [3]. It is cultivated throughout much of the world as a spice, medicinal or essential oil plant, or as a vegetable and has become naturalized in many places [4].

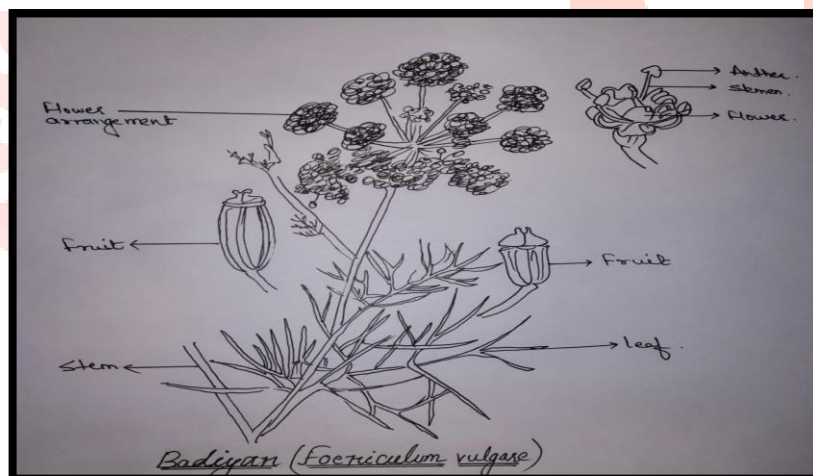
Botanical description:

A medicinal plant belonging to the Apiaceae family, it is 2.5 m tall and has a hollow stem. [2]. The leaves of the plant are similar to the leaves of fresh coriander, long, granulated and feathery [5]. Leaves are 40 cm long and are finely dissected, with the apical segment filiform (thread-like) and measuring around 0.5 mm broad. [2]. Flowers are usually bisexual, regular or irregular with yellow umbrella in the form of oval beads [3]. Fruits are 4-10 mm long, half wide or less and surrounded with dry seeds. The fruits are aromatic, stimulant and carminative [6]. Fennel has small seed with a length of about 8 mm and width of 3 mm with an aromatic odor & sweet in taste [3].



Fig: *Bādiyān* (*Foeniculumvulgare* Mill.)

Macroscopic: Entirely fruits are attached with pedicle, mericarps, up to around up to around 100mm long and 4mm wide, five sided with a broader commissural surface, tapering slightly towards base and apex, capped with a conical stylopod, glabrous, greenish or yellowish-brown with five paler prominent main ridges; endosperm; orthospermous [7].



Microscopic study of fruits: Pericarp with quadrangular to polygonal cells, smooth cuticle, and a few stomata in a transverse section of the fruit; trichomes absent; vittae, four dorsal and two commissural, extending the length of each mericarp, intercostal, with brown cell apithelium and volatile oil in cavity. Costae, 5 in each mericarp, each with one vascular strand with one inner xylem strand and two lateral phloem strands separated by a bundle of fibres; mesocarp, with considerable reticulate lignified parenchyma; inner epidermis with very narrow, thin walled cells organized in groups of 5-7 cells, many of these groups with longer axes of their cells at

an angle to those of adjacent groups (Parquetry arrangement); Carpophore with thick-walled, cellulosic parenchyma in two strands, often unsplit with two strands very close to each other; endosperm with thick-walled, cellulosic parenchyma containing much fixed oil, micro rosette crystals of calcium oxalate, and numerous aleurone grains upto 5 m in diameter [7].

Period of occurrence: Fruits ripen in September [7].

Procedure & time of collection: Stems cut with sickles and put up in loose bunches to dry in sun; when dry, fruits are beaten out in a cloth in sun, cleaned by winnowing and collected [7].

Habitat:

Plant is native of southern Europe and Asia. It is cultivated Chiefly in Russia, Rumania, Hungary, Germany, France, Italy, India, Japan, Argentina and USA [6]. In India it is highly cultivated in Gujarat and Rajasthan. On small scale it is grown in Maharashtra, U.P, Punjab, Bihar and Jammu & Kashmir [6, 8].

Vernacular names:

- Persian: Badiyan [5, 9,10,11], Raziyan [10,11,12].
- Arabic: Raziyanaj [5, 9, 10,12,13], Bisbas [3,14].
- Hindi: Saunf [5,6,10,11,12,15]
- English: Fennel [3,5,8,13,15], Finkel [10]
- Urdu: Saunf [7,10,16]
- Tamil: Shombu, Sokirie [7]
- Gujarati: Variyali, Variari, Warialli [7]
- Bengali: Mauri [6,7], Meethazeera [5]
- Sanskrit: Madhurika [6, 14], Pushppaspa [5, 14]
- Kashmir: Saunf [14]

Taxonomical Classification [4]

Kingdom:	Plantae
Order:	Apiales
Family:	Apiaceae
Genus:	Foeniculum
Species:	Vulgare

Mizāj (temperament): Hot in 2nd degree and dry in 1st degree [5, 11, 12, 17, 18], Hot in 3rd degree and dry in 1st degree [10, 12]

Ajza-i-Musta'mla (part used): Medicinally seeds, leaves and roots are used [5, 11, 12]

Nafa'Khās(main actions): *Kāsir-i-Riyāh* (anti-flatulence), *Mujalli Basara*[5], *Muqawwi-i-mi'da* (strengthening the digestive system), *Muqawwi-i-basar* (eye tonic) [13]

Af'al (actions):

Muhallil -i-Awarām (anti-inflammatory) [5, 8, 18], *Mulattif* (demulcent) [12,17, 18], *Mukhrij-i-Balgham* (Expectorant) [12], *Munaqqi-i-Akhlāt-i-ghalīzā*, [12, 9], *Munḍij-i-Balgham* (concoctive of phlegm), *Munḍij-i-Sawdā'* (concoctive black bile), [5,13,17], *Kāsir-i-Riyāh* (carminative), [5,8,9,12,13,15,17], *Muwallid-i-Laban* (galactogenic) [9, 10, 11, 12, 13, 17, 18], *Mudirr-i-Bawl* (diuretic) [8, 9, 10, 11, 12, 13, 17, 18], *Muḥarrik* (stimulants) [9], *Muqawwī-i-Başar* (eye tonic) [9, 11, 13, 15], *MufattiḥSudad*(deobstruent)[9, 10, 11, 12, 13,18], *Mujaffif* (desiccant) [5, 12], *Mudirr-i-Ḥayḍ* (emmenagogue) [10,11,12,13,17], *Muwallid-i-Manī* (Spermatogenic) [12, 18], *Muqawwī-i-Mi'da* (Stomachic) [5, 9,12,13], *Mufattit-i-Ḥaşāh* (Lithotriptic) [11,12], *Munaqqi-i-Raḥim* [12], *Qātil-i-Dīdān* (Antihelminthic) [5] *Musakkin* (analgesic) [18].

Iste'malat (uses):

According to *Ibne Sina*, fennel increases eyesight [12]. It is used in the treatment of *Balghami* (phlegm) and *Sawdāwi* (black bile) diseases. It is also used as a deobstruent for *Suddaof* Liver, Spleen and kidney. It is also beneficial in stomach pain due to flatulence. It is used in the form of *Safūf* (powder) with cow milk to treat retention of urine, amenorrhea and for increase production of milk. Apply fennel as an antimony (surma) to the eye after mortaring (kharal) in a decoction of fennel or fresh fennel water [12, 13]. Extract (Usarah) of fennel is used in the treatment of kidney and urinary bladder pain with *Mā' al-Sha'ir* (barley water). It is useful to stop chronic diarrhea. Powder of fennel with cold water is beneficial to cure vomiting and gastritis which occur due to fever [12]. It is also used in *Waja-us-Sadr* (Chest pain), *Humma-i-Kuhna* (Chronic Fever), *Suda* (Headache), *Shaqqeqa*, (Migrain), *Amraad-i-Balghamiwa Saudawi*, (Diseases of Phlegm and black Bile), *Rabw* (Bronchial Asthama), *Diq-al-Nafas* (Asthma), *Suzesh and Khushunat Ri'awa Qasabaar-Ri'a* (Irritation of Lungs and

Trachea), *Sual* (Cough), *Waram-i-Halaq* (Pharyngitis), *Buhha al-Sawt* (Hoarsness of Voice), *Dardasab* (Neuralgia), *Nafas al-Dam* (Haemoptysis)

Table No. 1: Showing Uses of *Badiyān* (fennel) in Traditional System of Medicine [2, 6].

S. No	Part Used	Uses
1.	Flower	<i>F. vulgare</i> flower paste relieves spasmodic gastric-intestinal symptoms, bloating, and flatulence. It is also used to treat upper respiratory tract catarrh and is also used in perfumes.
2.	Leaves	The leaves paste can be used to treat mouth ulcers, liver pain, and kidney problems and also used to treat diabetes.
3.	Aerial part	Aerial components are also utilised to improve milk flow in mother is being breastfed.
4.	Root	Urinary tract infection, renal calculi, glycosuria, fever, colic and muscular pain are all treated with root.
5.	Bark	For blood-related disorders and as tonic the bark is used.
6.	Seed	According to <i>IbneSina</i> , taking fennel orally increases eyesight [12]. To improve eyesight, fennel seeds are consumed fresh/raw, usually with a sweetener.

Ethanomedicinal Uses:

In the respiratory tract, its anethole and fenchone have been shown to have a secretolytic effect [8]. It helps with skin, chest, spleen, and kidney problems. It is used as a diuretic in the treatment of heart, liver and kidney diseases. The decoction is given to treat obstinate constipation in infants and children, one to two teaspoonfuls are provided with each feed. It aids milk digestion, inhibits gas formation and relieves colic in infants. To treat indigestion, biliousness, flatulence, constipation, atonic dyspepsia, impotency, scanty urination, thirst during summer and fever, painful menstruation, and other anomalies of menstruation, an infusion of fennel seeds prepared by boiling a desert spoonful in 6 ounces of water for half an hour is taken three ounces with honey thrice daily after food. Fennel water with anise water is used as the base of all Gripe waters because of this therapeutic effect. Haemoptysis, cough, bronchitis and lung abscess can all be treated with fennel seeds and figs. It is applied to the face as an acne treatment, and normal use lightens the skin colour. The leaves juice is used to treat asthma, bronchitis, infantile diarrhoea, urinary catarrh, dysentery and other ailments. Chewing a few seeds after each meal helps to avoid bad breath, indigestion, constipation, nausea and vomiting, hookworm infection and protects your eyesight [15, 19]. It is also used as Galactogenic and Diaphoretic [8, 15].

Miqdār-i-Khurak (dosage): Its oral dose 5-7 g [5, 13, 20].

Badal (substitute): *Tukhm-i-Karafs (Apiumgraveolens)* is used as substitute [5, 9, 13].

Muzir (adverse effects): It helps in digestion but itself it takes time to digest [9]. It is harmful for the person having hot temperament, as it causes Suda (headache), if taken in excess quantity [12].

Musleh (corrective): *Sandal (Santalum album)*, *Kafoor (Cinnamomum camphora)*, *Sikanjabin* [9, 12, 18].

Chemical constituents: Anethole is a major constituent of fennel seed/oil, Petroselenic acid, Fenchone, Pentosan, Pectin, Trigonellin, Choline, Vitamin A, Thiamine, Riboflavin, Niacin are also found in it [15].

Important Formulations: *Habb-i-Ghariqoon*, *Qurs-i-Mulayyin*, *Jawarish-i-Narmuskh*, *Jawarish-i-ZarooniSada*, *Jawarish-i-Razyanj*, *Jawarish-i-kamooni*, *Majoon-i-Muqil*, *Majoon-i-Musaffi-i-Khoon*, *Majoon-i-Nankhwah*, *Raughan-i-Baladur*, *Araq-i-Badiyan*, *Araq-i-Juzam*, *Sikanjabeen-i-BuzooriMotadil*, *Sharbat-i-Sadar*, *Sufoof-i-HazimKalan*, *Sufoof-i-Tabkheer* [15, 21].

Pharmacological Studies:

Expectorant activity:

The ciliary motility of the respiratory apparatus is stimulated by *Foeniculumvulgare* seeds, which increases the external transport of extraneous corpuscles. This action shows that fennel may be useful in the treatment of bronchial and broncho-pulmonary diseases, as well as in highly contaminated environments. The volatile oil of *F. vulgare* causes the smooth muscles of the trachea to contract, which may aid with breathing [22].

Anti-allergic activity:

After oral administration of 200 mg/kg once a day for 7 days, methanolic extract of *F. vulgare* fruit showed a significant inhibitory effect on DNFB-(2,4- dinitrofluoro benzene) induced delayed form hypersensitivity [23].

Anti-inflammatory activity:

Foeniculumvulgare methanol extract was given orally. Acute and sub-acute inflammatory diseases were inhibited by feeding the *vulgare* fruit to rats and mice. Carrageenan-induced paw edema, arachidonic acid-induced ear edema, and formaldehyde-induced arthritis were used to test the anti-inflammatory activity of

methanol extract. Non-steroidal anti-inflammatory drugs (NSAIDs) are commonly tested with these. In the case of acute inflammation, methanol extract (200 mg/kg) inhibits paw edema caused by carrageenan injection by 69% as compared to the control group of animals. In mice, a methanol extract of *F. vulgare* prevents ear edema (70%) caused by arachidonic acid [23].

Antimicrobial activity:

Agrobacterium radiobacterpv.tumefaciens, *Erwiniacarotovora*, *Pseudomonas fluorescens*, and *Pseudomonas glycinea* were all inhibited by an aqueous extract of the aerial portion of *Foeniculumvulgare*. *Enterococcus faecalis*, *Staphylococcus aureus*, *Escherichia coli*, *Klebsiellapneumoniae*, *Pseudomonas aeruginosa*, *Salmonella typhi*, and *Salmonella typhimurium* were all inhibited by an aqueous extract of seed sample [24].

Gastro-protective activity:

The fennel plant has been demonstrated to have a substantial preventive effect against gastrointestinal problems. Fennel oil emulsions were demonstrated to reduce colic in 65 percent of treated infants, which was much better than the control group. Al-Mofleh et al. looked at the effects of fennel on stomach ulcers in a study. According to the research, the herb has a preventive effect on gastric ulcers. In addition, the herb diminished stomach mucosal lining. Its antioxidant capacity was credited with this property [25, 26, 27].

Anti-diabetic activity:

A study looked into the effects of aqueous extracts from Apiaceae family plants like fennel on blood sugar levels and anti-diabetic properties. The findings showed that the extract could help diabetic patients control their blood glucose levels, and that using it on a daily basis could help them avoid chronic diabetes issues [28]. Fennel fruit methanol extract also lowered blood glucose and lipids while increasing liver and muscle glycogen stores. A study on streptozotocin-diabetic rats was done to assess the effect of fennel on blood sugar reduction. The findings revealed that fennel extract reduces hyperglycemia in diabetic rats, with part of this attributed to the herb's oxidation/restored system impact. As a result, this plant can be used to make anti-diabetic medications in the pharmaceutical business [29, 30].

Memory-protective activity:

Some plants, especially fennel herbs, are thought to help with memory and intelligence. The effect of fennel extract on memory in amnesiac rats was evaluated. As a result, the findings revealed that this extract had memory-boosting properties. Fennel extract was studied as a neurotropic factor and anti-acetylcholinesterase in mice by Joshi et al. Fennel extract effectively suppressed acetylcholinesterase, as per the results of this study. Fennel could be used to treat cognitive illnesses including dementia and Alzheimer's, according to this study [14, 31].

Hepato-protective:

The fennel plant has been shown to have a liver-protective effect in research. Fennel extract was examined in carbon tetrachloride-induced liver damage mice by Qiang et al. The extract was found to lower the levels of AST (aspartate aminotransferase), ALT (alanine amino transferase), ALP (alkaline phosphatase), and serum bilirubin in this investigation [32].

Conclusion

This review provides detailed information on the phytochemicals and biological properties of fennel. Historically, fennel has been used for ethno-botanical purposes, but it has become an important source of medicine for curing various diseases as above mentioned. Extensive research is needed to understand the mechanisms of action and bioactivity of the various phytochemicals and efficacy of the medicinal values of fennel. In the near future, fennel extracts could be further exploited as a source of useful phytochemical compounds and may play an important role in modern medicine.

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