

Medicinal and therapeutic uses of Dill (*Anethum graveolens* L.) - A review

S.S. Meena*, G. Lal, P.N. Dubey, M.D. Meena and Ravi Y.

ICAR-National Research Institute on Seed Spices, Ajmer-305206, Rajasthan, India.

Abstract

Dill, an annual, erect, profusely branched herb is grown for its leaves and seeds. It has a long history of use as a spice in our food, where its seeds and leaves are used as flavoring agents. Dill seeds inherently contain variable quantity of essential oil ranging between 2.5 to 3.5 per cent which is useful as medicine in many ailments for human health viz. antispasmodic, loss of appetite, cough and colds, menstrual cramps, liver problems, anticarcinogenic, oral care, boosting immune system, protection against bone degradation, anti-inflammatory, carminative and urinary tract disorders etc.

Key words : *Anethum* spp., Pharmacological effects, Phyto chemicals, Therapeutical properties.

Introduction

Dill is an erect hardy annual plant grown for its leaves and seeds. European (*Anethum graveolens* L) and Indian (*Anethum sowa* Roxb.) dill are two species of dill under cultivation. European dill is native to Europe and is mostly grown in England, Germany, Romania, Turkey, USA and the erstwhile USSR (Bailer, 2001). Sowa is cultivated on commercial scale in India on around 21900 hectare area having production of 23632 tones (2013-14 DASD). Indian dill is grown in the states of Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Uttar Pradesh, Bihar, Punjab and Andhra Pradesh for its seeds, which are used for the extraction of oil and are exported as such to earn foreign exchange. Rajasthan shares 48% of total dill production. Chittorgarh, Nimbahera, Jhalawar, Udaipur, Kota and Bundi are the main dill producing districts of Rajasthan.

Dill is regarded as one of the oldest cultivated seed spices since ancient era. Initially it was used as one of the herbs for flavouring in dynastic Egypt and for flavouring and

medicine by the Greeks and Romans. Gripe water is an important formulation from Dill water which has soothed babies' colic for ages in Europe, England, and Turkey. Adults consume dill wine as people today take bicarbonate preparations. Charlemagne insisted that crystal vials of "Dill Oil" be placed at banquets to stop the disquieting hiccups of guests who ate or drank too much (Maureen, 2006). In the 17th century, Nicolas Culpeper listed dill as a "tonic that strengthens the brain". The Greek physician Hippocrates, known for the Hippocratic Oath, recorded a recipe for a dill mouthwash. It is mentioned in Charlemagne's list of herbs, and he served dill tea. Dill seeds contain 2.5 to 3.5 per cent oil, which is very useful for human health and used as medicine in many ailments.

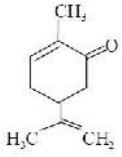
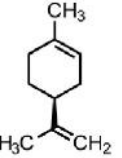
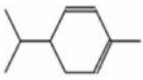
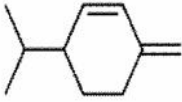
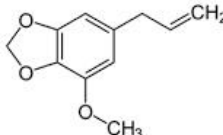
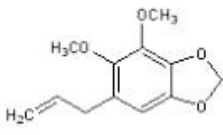
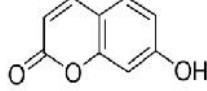

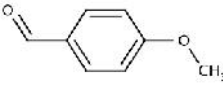
Dill phytochemicals and their uses

The qualitative and quantitative phytochemical screening of plant showed that leaves, stems and roots were rich in tannins, terpenoids, cardiac glycosides and flavonoids depicted in table 1.

Table 1. Phytochemical analysis of *Anethum graveolens* L. seeds, leaves and roots.

Metabolites	Seeds	Leaves	Roots
Tannins	+	+	+
Terpenoid	+	+	+
Saponins	+	-	+
Steroid	-	+	+
Flavonoid	+	+	+
Cardiac-Glycoside	+	+	+
Antraquinone	+	-	-

Table 2. Formulae of important compounds in Dill.

Compounds	Molecular formula	References
<p>d-carvone</p> 	C ₁₀ H ₁₄	[Singh <i>et al.</i> ,2005; Dhalwal <i>et al.</i> ,2008]
<p>d-limonene</p> 	C ₁₀ H ₁₆	[Blank & Grosch, 1991; Blank <i>et al.</i> ,1992]
<p>- phellandrene</p> 	C ₁₀ H ₁₆	[Blank & Grosch, 1991; Blank <i>et al.</i> ,1992; Raghvan <i>et al.</i> ,1994]
<p>-phellandrene</p> 	C ₁₀ H ₁₆	[Blank & Grosch, 1991; Blank <i>et al.</i> ,1992; Raghvan <i>et al.</i> ,1994]
<p>Myristicin</p> 	C ₁₁ H ₁₂ O ₃	[Raghvan <i>et al.</i> ,1994; Dhalwal <i>et al.</i> ,2008; Lee <i>et al.</i> ,2005]
<p>Apiole</p> 	C ₁₂ H ₁₄ O ₄	[Bailer <i>et al.</i> ,2001; Santos <i>et al.</i> ,2002; Shulgin & Sargent 1967]
<p>Umbelliferone</p> 	C ₉ H ₆ O ₃	[Dhalwal <i>et al.</i> ,2008]
<p>Anethole</p> 	C ₁₀ H ₁₂ O	[Newberne <i>et al.</i> ,1999]
<p>P- anisaldehyde</p> 	C ₈ H ₈ O ₂	[Singh <i>et al.</i> ,2005]

From Dill plant parts numerous compounds have been extracted and isolated from the seeds, leaves and inflorescence and 17 essential volatile compounds have been identified. The main constituents of dill oil which is pale yellow in color, darkens on keeping, with the odor of the fruit and a hot, acrid taste are a mixture of a paraffin hydrocarbon and 40 to 60% of d-carvone (23.1%) with d-limonene (45%). It also consists of α -phellandrene, eugenol, anethole, flavonoids, coumarins, triterpenes, phenolic acids and umbelliferones. The fruit yields about 3.5% of the oil its specific gravity varies between 0.895 and 0.915.

Carvone and limonene are monoterpenes, which are present as main constituent of dill oil from fruits. α - phellandrene, dill ether and myristicin are the compounds, which form the important odor of dill herb. Monoterpenes are often responsible for the characteristic odors of plants. These substances are believed to function principally in ecological roles, serving as herbivore-feeding deterrents, antifungal defenses and attractants for pollinators. Seventeen compounds have been identified in Indian dill leaf. Industrial applications of carvone are as fragrance and flavor, potato sprouting inhibitor and antimicrobial agent. D-limonene is one of the most common terpenes in nature. It is an excellent solvent of cholesterol; d-limonene has been used clinically to dissolve cholesterol-containing gallstones. It has chemo preventive and chemo therapeutic activities and also reported to have low toxicity in pre-clinical studies. Myristicin is a naturally occurring insecticide and an important compound of essential oil. Anethole is a terpenoid that is present in minor quantity in *Anethum* spp., but is also found in essential oil of anise and fennel. It is used as a flavoring substance. p-anisaldehyde has a strong aroma and is an important component in pharmaceuticals and perfumery. Important compounds found in *Anethum* spp. are presented in Table 2.

Proximate properties

The proximate composition of dill seed varies with variety of crop and region where it is grown and stage of harvest. The seed contains moisture (6.6%), volatile oil (2.7%) and minerals (9.09%) (Pruthi 1979 & 2001). The detailed chemical composition is given in the table 3.

Traditional and folk values

As revealed from the history pertaining to the folk lore medicinal uses of dill and the present importance of herbs as playing important healthcare for common man by Ayush, India this herb possess important health care properties easily affordable by common mass. The herb and seeds contains various chemical compounds which

can be used as composite or individual for improving health and curing common and specific ailments. The use of dill by various types of existing therapies has been listed below in Table 4.

Table 3. Proximate analysis of dill seeds.

Composition/ Constituents	Content (100g ⁻¹)
Moisture	06.6g
Protein	13.1g
Fat	17.9g
Crude fibre	20.7g
Carbohydrate	35.7g
Minerals	06.0g
Mineral matter	09.09g
Calcium	01.6g
Phosphorus	00.21g
Iron	00.012g
Sodium	00.01g
Potassium	01.1g
Vitamin A	175IU
Vit B1	00.42mg
Vit B2	00.28mg
Niacin	02.8 mg
Vitamin C	12mg
Volatile oil	02.7 g
Food energy	435 calories/100g

Around 5000 years ago it was used by Egyptian doctors and traces have been found in Roman ruins in Great Britain (Quer *et al.*, 1981). In the middle ages it was believed that it protects against witchcraft. Greeks covered their heads with dill leaves to induce sleep (Meena *et al.*, 2007). Traditionally, the seeds and herb of dill are in common use as medicine by preparing various extracts, oil and other forms. Oil distilled from seed is used in preparation of dill water or gripe water, which is administered to children suffering from bloat, stomach ache and hiccups. Decoction of dill is used in indigestion, vomiting and promoting milk in lactation mothers. Roasted dill and fenugreek seed mixed together with water is given in diarrhea. Leaf and root paste is applied on swelling of joints for relief. Fresh dill seed powder with ghee is useful in curing sterility in woman, when used with milk cures jaundice; dill seed paste with sandal wood provides relief from headache. Dill is useful in stimulating and regulating menstrual flow. It is effective in spasmodic menstrual pain and absence of menstruation due to anemia, exposure to cold and pregnancy. Seed powdered mixture of dill and fennel seeds in equal proportions when consumed (two spoonful) in morning and evening controls blood pressure (Singh *et al.*, 2007; Meena *et al.*, 2010).

Table 4. Traditional and folk values.

S. No.	Type of therapy	Medicinal uses
1.	Ayurvedic	Abdominal discomfort, colic and promoting digestion. Preparations like katu tikta rasa, usna virya, katu vipaka, laghu, tiksna and snigdha gunas which cures 'vata', 'kapha', ulcers, abdominal pains, eye diseases and uterine pains. Preparations like Dasmoolarishtam, Dhanwantharishtam, Mrithasanjeevani, Saraswatharishtam, Gugguluthiktaquatham, Maharasnadi kashayam, Dhanwantharam quatham etc (Ravindran & Balachandran, 2005).
2.	Charaka samhita	Paste of linseed, castor seeds and shatapushpa (<i>A.spp.</i>) pounded with milk for external applications in rheumatic and other swellings of joints (Ravindran & Balachandran, 2005).
3.	Kashyapa samhita	As a tonic, rejuvenator and intellect promoter (Khare, 2004).
4.	Unani medicine	In curing colic, digestive problem and also in gripe water (Khare, 2004).

Medicinal and Pharmacological Properties

Traditionally, *Anethum graveolens* possess a wide range of anti-inflammatory activities. Pharmacological studies show antimicrobial, antihyperlipidemic and antihypercholesterolemic activities of dill seeds (Nair & Chanda, 2007; Chaurasia & Jain 1978; Delaquis *et al.*, 2002 and Yazdanparast & Alavi 2001). Seed extracts of *Anethum graveolens* L. have significant mucosal protective, antisecretory and anti-ulcer activities against HC₁- and ethanol-induced stomach lesions in mice (Hosseinzadeh, 2002). The seeds of *Anethum graveolens* L., gives two important flavonoids viz., quercetin and isoharmentin, which have antioxidant activity and could counteract with free radicals. This effect may help to control peptic ulcer (Mahran *et al.*, 1992, Mohele & Wellmann, 1985). Hydrochloric extract obtain from Dill fruit is a potent relaxant of contractions induced by a variety of spasmogens in rat ileum, so it supports the use of dill fruit in traditional medicine for gastrointestinal disorders (Naseri & Heidari, 2007). Crude extracts of *Anethum graveolens* L. besides having strong antihyperlipidemic effects can also improve the biological antioxidant status by reducing lipid peroxidation in liver and modulating the activities of antioxidant enzymes in rats fed with high fat diet (Yazdanparast & Bahramikia, 2007). It has been reported that aqueous extracts of *Anethum graveolens* showed a broad-spectrum antibacterial activity against *S. aureus*, *E. coli*, *P. aeruginosa*, *S. typhimurium*, *Shigella flexneri* and *Salmonella typhi* (Arora & Kour, 2007). The higher activity of extract can be explained on the basis of the chemical structure of their major constituents such as dillapiole and anethole, which have aromatic nucleus containing polar functional group that is known to form hydrogen

bonds with active sites of the target enzyme (Frag *et al.*, 1989). *Anethum* is used as an ingredient in gripe water, given to relieve colic pain in babies and flatulence in young children (Pulliah, 2002). The seed is aromatic, carminative, mildly diuretic, galactagogue, stimulant and stomachic (Meena *et al.*, 2013). The essential oil in the seed relieves intestinal spasms and griping, helping to settle colic (Duke, 2000; Fleming, 2000). The carminative volatile oil improves appetite, relieves gas and aids digestion. *Anethum* stimulates milk flow in lactating mothers and is often given to cattles for this reason. It also cures urinary complaints, piles and mental disorders (Nair & Chanda, 2007).

Specific medicinal and pharmacological properties Preventive cure for insomnia

The essential oils found in herbs have peculiar and powerful properties. They act as a stimulative, sedative and hypnotic. They stimulate as well as pacify (Yilliet *al.*, 2006). Similarly the essential oils from dill seeds are no exception. The flavonoids and vitamin-B complex present in its essential oils, activate the secretion of certain enzymes and hormones which have calming and hypnotic effects, thereby helping people get a good night's sleep.

Osteoporosis and bone health

The calcium content of dill means that it is an important element in protecting you from bone loss and the loss of bone mineral density (Jacek *et al.*, 2005). Osteoporosis affects millions of people each year, and calcium, along with other essential minerals, is a key component in the proper growth and development of bones and the repair of injured bones as well.

Managing diabetes

Dill has long been associated with diabetes and the management of insulin levels. Despite the fact that research is somewhat limited in this area, particularly on

human subjects, studies have indicated that they can help reduce the fluctuations of serum lipids and insulin levels in corticosteroid-induced diabetes.

Carminative benefits

As a well-known carminative, dill can help prevent the embarrassing condition of excessive gas. It is not only an uncomfortable condition to experience in public, but if gas continues to build up, it can actually be a dangerous situation where it presses on the delicate organs of the chest cavity (Kour & Arora, 2009). A carminative force gas downward through the digestive tract and allows it to leave the body in a safe way.

Immunity hike

Dill has long been associated with antimicrobial activity. It has been shown to prevent a number of microbial infections throughout the body as well as the infections that may result in open wounds or small cuts on the skin (Katya & Janice, 1999).

Hiccup issues

Hiccups occur for various reasons but primarily they occur due to trapped gas and its repeated upward movement through the food pipe. The second cause is due to certain allergies, hypersensitivity, hyperactivity, and nervous malfunctioning. Dill can help in these situations. As a carminative, it helps the expulsion of gases and also reduces gas formation; while as a sedative, dill helps to calm down hiccups due to allergies, hyperactivity, or nervous disorders (Meena *et al.*, 2013).

Anti-diarrhea

Diarrhea is mainly caused by two things; indigestion and microbial action. In terms of indigestion, dill can be quite helpful, as it has very good digestive properties. Secondly, dill can help due to the monoterpenes and flavonoids present in its essential oils, which are germicidal or bactericidal in nature. They can help cure diarrhea by inhibiting (Syedet *et al.*, 2009) microbial infections that try to attack the body.

Anticancerous

Let's turn our attention to the monoterpenes we have been talking about. Monoterpenes are chemo-preventive, and since they are stimulating in nature, they activate the secretion of an enzyme called glutathione-S-transferase (the radical glutathione is an effective antioxidant) which is very effective in neutralizing carcinogens. It is particularly effective at neutralizing cyano and benzo derivatives and free radicals, thereby protecting the body from cancer. The other antioxidants in the essential oils of dill also contribute to cancer prevention (Fleming 2000).

Conclusion

Dill is widely cultivated under large areas in India. Both the cultivable species as illustrated above bear immense inherent medicinal and therapeutical values. The most important attribute to its medicinal utility is proven from its folk lore medicinal popularity since ages. This has been used for the treatment of various common ailments successfully without any side effects. Various plant parts and their extracts have been found to cure or provide relief in today health issues. The common cures explored are antimicrobial activity, indigestion, vomiting, antidiarrheal, galactagogue, antisterility, spasmodic menstrual pain, blood pressure etc. The specific cures of dill seed extract include insomnia, cancer, diabetes, hypertension, bone density and immunity maintenance etc. The data can be validated from the presence of various bioactive compound present in significant quantity having the proven potentiality to cure and heal the various ailments. The medicinal study presented through various investigations proves the therapeutical value of *Anethum* spp.

References

- Arora, D. S. and Kaur, J. G. 2007. Antibacterial activity of some Indian medicinal plants. *J. Nat. Med.* 61: 313–317.
- Bailer, J., Aichinger, T., Hackl, G., Hueber, K. D. and Dachler, M. 2001. Essential oil content and composition in commercially available dill cultivars in comparison to caraway. *Indus Crops Prods.* 14:229–239.
- Blank, I. and Grosch, W. 1991. Evaluation of potent odorants in dill seed and dill herb (*Anethum graveolens* L.) by aroma extract dilution analysis, *J. Food Sci.*56:63–67.
- Blank, I., Sen, A. and Grosch, W. 1992. Sensory study on the character-impact flavor compounds of dill herb (*Anethum graveolens* L.). *Food Chem.* 43:337–43.
- Chaurasia, S. C. and Jain, P. C. 1978. Antibacterial activity of essential oils of four medicinal plants. *Indian J. Hosp. Pharm.* 15:166–168.
- Delaquis, P. J., Stanich, K., Girard, B. and Mazza, G. 2002. Antimicrobial activity of individual and mixed fractions of dill, cilantro, coriander and eucalyptus essential oils, *Int. J. Food Microbiol.* 74:101–109.
- Dhalwal, K., Shinde, V. M. and Mahadik, K. R. 2008. Efficient and sensitive method for quantitative determination and validation of Umbelliferone, carvone and Myristicin in *Anethum graveolens* and *Carum carvi* seeds. *Chromatograph.* 67: 163–167.

- Duke, J. A. 2001. Handbook of Medicinal Herbs. London: CRC Press. p. 42.
- Farag, R. S., Daw, Z. Y. and Aboraya, S. H. 1989. Influence of some spice essential oils on *Aspergillus parasiticus* growth and production of aflatoxin in a synthetic medium. *J. Food Sci.* 54:74–77.
- Fleming, T. 2000. PDR for Herbal Medicines. New Jersey: Medical Economics Company. p. 252.
- Hosseinzadeh, H., Karimi, G. R. and Ameri, M. 2002. Effects of *Anethum graveolens* L. seed extracts on experimental gastric irritation models in mice, *BMC Pharmacol.* 2:21–25.
- Jacek, S., Zofia, L. and Waldemar, K. 2005. Contents of macro and microelements in fresh and frozen dill (*Anethum graveolens*L.) 91(4):737-743.
- Katya, P. S. and Janice, B. H. 1999. Bioactivity of essential oils of selected temperate aromatic plants: antibacterial, antioxidant, anti-inflammatory and other related pharmacological activities. Plant Biology Department, SAC Auchincruive, Ayr, Scotland, UK., KA65HW.
- Kaur, G. J. and Arora, D. S. 2009. Antibacterial and phytochemical screening of *Anethum graveolens*, *Foeniculum vulgare* and *Trachyspermum ammi*. *BMC Complementary and Alternative Medicine. International Society for Complementary Medicine Research (ISCMR)*.
- Khare, C. P. 2004. Indian herbal remedies, Berlin, Rational western therapy, ayurvedic and other traditional usages, botany, New York, Springer: 60–61.
- Lee, B. K., Kim, J. H., Jung, J. W., Choi, J. W., Han, E. S. and Lee, S. H. 2005. Myristicin-induced neurotoxicity in human neuroblastoma SK-N-SH cells, *Toxicol Lett*, 157:49–56.
- Mahran, G. H., Kadry, H. A., Thabet, C. K., Al-Azizi, M. and Liv, N. 1992. GC/MS analysis of volatile oil of fruits of *Anethum graveolens*, *Int. J. Pharmacog.* 30:139–44.
- Maureen, R. 2006. Herbalpedia. Available at www.herbalpedia.com/DILL.pdf.
- Meena, S. S., Lal, G., Mehta, R. S., Kant, K. and Anwer, M. M. 2010. Seed spices for home remedies. *Indian Horticulture*, Jul-Aug.: 6-8.
- Meena, S. S., Mehta, R. S., Malhotra, S. K., Singh, R. K. and Vashishtha, B. B. 2007. Effect of sheep manure, vermi-compost and bio-fertilizers on productivity of dill, *Indian J Arid Horticulture.* 2(2):29-30.
- Meena, S. S., Singh, B., Singh, D., Ranjan, J. K. and Meena, R. D. 2013. Pre and post-harvest factors affecting yield and quality of seed spices. *Int J of Seed Spice.* 3(1):1-11.
- Mohele, B., Heller, W. and Wellmann, E. 1985. UV-induced biosynthesis of quercetin 3-o-beta-d-glucuronide in dill *Anethum graveolens* cell cultures, *Phytochem.* 24:183–185.
- Nair, R. and Chanda, S. 2007. Antibacterial activities of some medicinal plants of the western region of India, *Turk. J. Biol.* 31: 231–236.
- Naseri, M. K. and Heidari, A. 2007. Antispasmodic effect of *A. graveolens* fruit extract on rat ileum, *Int. J. Pharm.* 3:260–4.
- Newberne, P., Smith, R. L., Doull, J., Goodman, J. I., Munro, I. C., Portoghese, P. S. 1979. The FEMA GRAS assessment of trans-anethole used as a flavoring substance. *Food Chem Toxicol.* 37:789–811.
- Pruthi, J. S. 1979. Spices and Condiments (2nd Ed.), National Book Trust of India, New Delhi : 112-114.
- Pruthi, J. S. 2001. Minor Spices and Condiments, ICAR, New Delhi. 124-33, 659-660.
- Pulliah, T. 2002. Medicinal Plants in India. Regency Publications, New Delhi:55–56.
- Quer, F. 1981. Plantas Medicinales, El Dioscorides Renovado. Barcelona: Editorial labor, S. A.: 500.
- Raghvan, B., Abraham, K. O., Koller, W. D. and Shankarnarayanan, M. L. 1994. Studies on flavor changes during drying of Dill (*Anethum sowa* Roxb) leaves, *J Food Qual.* 17:457–466.
- Ravindran, P. and Balachandran, I. 2005. Underutilized medicinal spices II, Spice India.: 32–36.
- Santos, A. G., Figueiredo, A. C., Lourenco, P. M., Barrosa, J. G. and Pedro, L. G. 2002. Hairy root cultures of *Anethum graveolens* (dill): Establishment, growth, time-course study of their essential oil and its comparison with parent plant oils, *Biotech Lett*, 24: 1031–1036.
- Shulgin, A. T. and Sargent, T. 1967. Psychotropic phenylisopropylamines derived from apiole and dillapiole, *Nature.* 215:1494–1495.
- Singh, G., Maurya, S., Lampasona, M. P. and Catalan, C. 2005. Chemical constituents, antimicrobial investigations and antioxidative potentials of *Anethum graveolens* L. essential oil and acetone extract Part 52, *J. Food Sci.* 70: 208–215.
- Singh, R. K., Meena, S. S. and Vashishtha, B. B. 2007. Medicinal Properties of Seed Spices. Published by Director, NRCSS, Ajmer. 1-48.
- Syed, F. H., Zaidi, K.Y., Makoto, K., Khan, U. and Toshiro, S. 2009. Bactericidal activity of medicinal plants,

- employed for the treatment of gastrointestinal ailments, against *Helicobacter pylori*. *Journal of Ethnopharmacology*, 121 (2): 286-291.
- Yazdanparast, R. and Alavi, M. 2001. Antihyperlipidaemic and antihypercholesterolaemic effects of *Anethum graveolens* leaves after the removal of furocoumarins, *Cytobios*. 105:185–191.
- Yazdanparast, R. and Bahramikia, S. 2007. Improvement of liver antioxidant status in hypercholesterolaemic rats treated with *A. graveolens* extracts. *Pharmacologyonline*. 3: 88–94.
- Yili, A., Yimamu, H., Maksimov, V. V., Aisa, H. A., Veshkurova, O. N. and Salikhov, S. I. 2006. Chemical composition of essential oil from seeds of *Anethum graveolens* cultivated in China. *Chemistry of Natural Compounds*. 42 (4): 491-499.

Received : October 2018; Revised : November 2018;
Accepted : December 2018.