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THE ROLE OF ANETHUM GRAVEOLENS SEED IN HEALTH BENEFIT

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ABSTRACT

Anethum graveolens L., commonly known as dill, is an aromatic annual herb belonging to the family Apiaceae. Traditionally valued as both a culinary spice and medicinal plant, dill has been extensively used across diverse cultures for its therapeutic and nutritional benefits. The plant is a rich source of essential oils, flavonoids, terpenoids, phenolic compounds, and other bioactive metabolites, with carvone, limonene, dill ether, and α-phellandrene as its major constituents. These compounds are responsible for a wide range of pharmacological properties, including antimicrobial, antifungal, antioxidant, anti- inflammatory, antispasmodic, antidiabetic, and anticancer effects. Dill has been traditionally employed in the treatment of gastrointestinal disorders, flatulence, colic in infants, and to stimulate lactation in nursing mothers. Contemporary studies highlight its potential in regulating lipid metabolism, improving insulin sensitivity, alleviating pain, and providing gastroprotective effects. Additionally, dill plays a significant role in food preservation, perfumery, and the pharmaceutical industry due to its aromatic oils and antimicrobial activity. Despite its broad spectrum of applications, safety concerns arise from compounds such as apiole, which may exert neurotoxic or abortifacient effects if

consumed in excess. Current review under scores the importance of anethum graveolance and explore its potential as a nutraceutical and functional food ingredient. Overall, Anethum graveolens represents a promising medicinal herb with multifaceted uses, nutritional value, meriting deeper pharmacological and clinical investigations.

KEYWORDS: Anethum graveolens, Anti bacterial, Nutritional values, Health benefits, Flavonoids, Dill oil.

INTRODUCTION

1. ANETHUM GRAVEOLENS

Figure 1: Plant Parts of Anethum graveolens.

1.1 TAXONOMICAL CLASSIFICATION[1-4]

Kingdom-Plantae

Division-Magnoli ophyta

Class-Magnoliopsida

Order-Apiales

Family-Apiaceae

Genus-Anethum

Species-Anethum graveolens

Synonyms

The plant Anethum graveolens, has several synonyms, including Anethum arvense,Anethum sowa, and Peucedanum graveolens. Pastinaca anethum Spreng, Peucedanum graveolens Benth. and Selinum anethum Roth. Dill fruit, Anethum, European dill, Fructus anethi.

Common name

The common name for Anethum graveolens is dill. other names include garden dill and, in some regions, it may be referred to as **Gujarti:** suva **Hindi:** Sowa, **Malayalam:** Sathakuppa,

Unani: Soyaa, **Siddha:** Sadakuppai, **Sanskrit:** Sthatpushpi, **Punjabi:** Soya, **English:** Dill and Anet, **Arabic:** Shibth and Haba helwa.

1.2 BOTANICAL DESCRIPTION[5]

Anethum graveolens (dill) is an annual or biennial herb that grows up to about 90 cm tall and bears small yellow flowers in compound umbels. It is the only species in the genus *Anethum*, though some botanists classify it under *Peucedanum*. A variant known as East Indian dill or Sowa is widely cultivated in South and Southeast Asia for its foliage during the cool season.

1.3 PHYTOCHEMICAL PROFILE[9-16]

Anethum graveolens possesses a rich phytochemical profile including essential oils, phenolic compounds, terpenoids, flavonoids, and other secondary metabolites.

Phytochemical analysis of dill plant revealed the presence of alkaloid, carbohydrate, resin, terpenoids, flavonosides, saponin, steroid, tannin, flavanoid and absence of reducing sugar, glycosides, anthraquinone, phlobatanins.

Major chemical constituents

Anethum graveolens contains essential oils, fatty oils, and several bioactive compounds such as carvone, limonene, α-phellandrene, and furanocoumarins. Its primary metabolites include carbohydrates (36%), proteins (15.68%), and fiber (14.80%). The plant also provides minerals like calcium, potassium, magnesium, phosphorus, sodium, along with vitamin A and niacin. Dill fruits yield about 1–4% essential oil rich in carvone and other terpenoids. The essential oil also contains compounds like dillapiole, myristicin, apiol, and cineole. Phenolic and flavonoid contents are notably high, contributing to antioxidant properties. Overall, essential oils are the most significant chemical constituents of *Anethum graveolens*.

Plant parts contain major chemical constituents

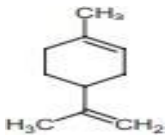
Carvone: A major component in dill, particularly in the seeds, with varying concentrations depending on the plant part and growing conditions.

Limonene: Another significant constituent, also found in varying amounts across different plant parts.

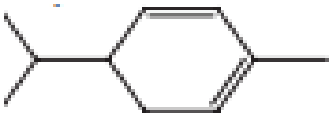
Dill ether: A characteristic compound of dill essential oil.

α-Phellandrene: A terpene that is a major component in dill, especially in the leaves and flowers.

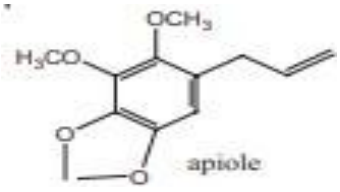
Dill apiol: Dill essential oil contains compounds such as dill apiol, with composition varying by plant part. Studies on Romanian dill showed that α-phellandrene and limonene dominate in leaves and flowers, while dill ether is present in leaves and flowers but absent in fruits. Vegetative herbs are rich in α-phellandrene, limonene, and p-cymene. Flowering herbs mainly contain carvone, p-cymene, and dill ether. Seeds are characterized by high levels of carvone, dillapiole, and limonene.

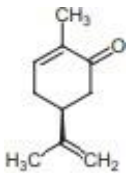


d-limonene



α-Phellandrene





d-carvone

Phenolic Compounds

Dill contains several phenolic acids such as vanillic, caffeic, ferulic, chlorogenic, and rosmarinic acids. It also includes flavonoids like gallic acid, quercetin, and kaempferol that contribute to its bioactive properties.

1.4 PHYSICOCHEMICAL PROPERTIES[17-18]

Anethum graveolens, is known for its diverse physicochemical properties. Foreign organic matter: not more than 2.0%, total ash: not more than 11.0%, acid-insoluble ash: not more than 1.5%, water-soluble extractive: not less than 15.0%, and alcohol-soluble extractive: not less than 4.0%.

1.5 BIOLOGICAL PROPERTIES

Essential oil of dill exhibited various biological activities such as antimicrobial, antifungal, antioxidant, insecticidal, anti-inflammatory, antispasmodic, antidiabetic, anticancer and anti-hypercholesterolemia, due to the presence of biologically active compounds.

Medicinal uses

Anethum is used in gripe water to relieve colic, flatulence, and intestinal spasms, especially in infants and young children. Its aromatic, carminative essential oil improves appetite, aids digestion, relieves gas, and freshens breath. It also acts as a galactogogue, stimulating milk flow in lactating mothers and cattle. It also cures urinary complaints, piles and mental disorders.

Parts used medicinally

Anethum graveolens, has various medicinal uses, primarily involving the leaves and seeds. **Seeds:** Dill seeds are traditionally used for their carminative, stomachic, and diuretic properties. **Leaves:** Dill leaves, also known as dill weed, are used in salads and for flavoring foods, and they also possess medicinal properties. The leaves and seeds.

1.6 REPORTED HEALTH EFFECT[23-29]

Antimicrobial effects

Aromatic and medicinal plants produce bioactive compounds that inhibit the growth of bacteria and fungi. These compounds, mainly derived from secondary metabolism, are closely associated with plant defense and environmental interactions. Essential oils play an important role in protecting plants against phytopathogenic microorganisms.

Anti-inflammatory and analgesic effects

AGS contains physiologically active constituents such as tannins, limonene, carvone, and fatty acids that exhibit anti-inflammatory and gastroprotective effects. Dill seeds also possess analgesic and spasmolytic properties, aiding pain relief and relaxation of uterine muscles during labor. These effects are mainly attributed to bioactive compounds including flavonoids, terpenes, and phenolic acids.

Effect on gastrointestinal system

Reference its fruits have been used for medicinal purposes in their life of digestive problems and to stimulate milk for nursing mothers. It is believed that dill water has a soothing effect on the digestive system.

Hyperlipidemic effects

AGS contains physiologically active constituents such as tannins, limonene, carvone, and fatty acids that exhibit anti-inflammatory and gastroprotective effects. Dill seeds also possess analgesic and spasmolytic properties, aiding pain relief and relaxation of uterine muscles during labor. These effects are mainly attributed to bioactive compounds including flavonoids, terpenes, and phenolic acids.

Effects on reproductive system

High doses of *Anethum graveolens* (dill) reduce male sexual potency and spermatogenesis and significantly alter female reproductive cycles by prolonging the diestrus phase and increasing progesterone levels. Elevated free radicals and cytokines adversely affect male fertility by damaging DNA, lipids, and testicular cells. Therefore, reducing oxidative stress and inflammation is essential for protecting fertility and managing diabetes-related metabolic complications.

1.7 REPORTED CASE STUDY ON BIOLOGICAL ACTIVITIES OF DILL PLANT[30]

1. Anti-inflammatory and analgesic activity

The hydroalcoholic extract of *Anethum graveolens* seeds significantly reduced inflammation and pain in animal models. Dill oil markedly decreased paw edema in rats, showing greater efficacy than diclofenac gel. Topical ethanol fruit extract inhibited ear inflammation by 60%, while aqueous fruit extract and essential oil exhibited analgesic effects comparable to acetylsalicylic acid.

2. Anti-bacterial activity

Anethum graveolens, *Foeniculum vulgare*, and *Trachyspermum ammi* are widely used medicinal plants whose seed extracts show significant antibacterial activity. Aqueous and acetone extracts exhibited strong bactericidal effects against most tested bacteria, with acetone extracts showing lower minimum inhibitory concentrations. Several extracts demonstrated efficacy comparable to standard antibiotics. Phytochemical analysis revealed substantial levels of flavonoids, tannins, alkaloids, and other bioactive compounds. These findings scientifically validate the traditional use of these plants as antimicrobial remedies.

1.8 CASE STUDY REPORTED IN OTHER MISCELLANEOUS EFFECTS[31]

Three human studies assessed the anti-infective effects of dill. Infants under one year with *Giardia lamblia*–induced diarrhea received oral dill leaf water extract for five days. Dill treatment significantly reduced stool parasite prevalence and bowel movement frequency. Its effectiveness was comparable to the antibiotic metronidazole.

Clinical trials showed that dill extracts used as vaginal suppositories or creams significantly reduced symptoms of vulvovaginal candidiasis, with efficacy comparable to clotrimazole. Dill intake showed variable effects on skin firmness and elasticity. Oral consumption of 1.5 g/day dill powder for two weeks improved symptoms of irritable bowel syndrome. Additionally, a mouth rinse containing dill seed oil reduced gingivitis similarly to

chlorhexidine.

1.9 APPLICATIONS AND IMPORTANCE AS HEALTH FOOD[32-35]

Anethum (dill) seeds are used as a spice, while its fresh and dried leaves (dill weed) are used as a condiment and tea. The aromatic herb is widely used to flavor pickles, salads, sauces, soups, meats, and fish. Dill oil, extracted from seeds, leaves, and stems, is used as a flavoring in the food industry. It is also used in perfumery and as a substitute for caraway oil.

Anethum acts as a natural preservative by inhibiting bacteria such as *Staphylococcus*, *Streptococcus*, *E. coli*, and *Pseudomonas*. Dill compounds enhance insecticide effectiveness, and its essential oil is toxic and repellent to *Tribolium castaneum*. Anethole from *A. graveolens* is also an effective vermicide against hookworm.

Application in different forms as health food

Anethum graveolens, or dill, is commonly available in several dosage forms, both for medicinal and culinary applications

1) **Dried Seeds:** Dill seeds are frequently used in cooking and can be ingested whole or ground. These have been used in traditional medicine practices.
2) **Essential Oil:** Extracted from seeds, leaves, and stems, dill essential oil is used in the food industry as a flavoring agent and also in perfumery and pharmaceuticals. Research has examined the use of specific amounts of dill oil in studies.
3) **Extracts:** Dill can be prepared as aqueous, ethanolic, or hydroalcoholic extracts from various parts of the plant. Studies suggest different types of extracts might possess varying properties or activities.
4) **Dill Water:** This is a traditional preparation, particularly used for infants to help with issues like colic and flatulence. Traditional uses outline specific amounts for different age ranges.

Nutritional profile

Fresh dill is very low in calories, yet a surprisingly good source of several essential vitamins and minerals, including vitamin C, manganese, and vitamin A, Vitamin A is an essential nutrient that is important for maintaining vision and supporting a healthy immune system. It also plays a role in male and female reproduction. Similarly, vitamin C is vital for your immune system and helps with bone formation, wound healing, and metabolism.

Dill is also a good source of manganese. While needed in very small amounts, it is an

essential mineral that supports normal functioning of your brain, nervous system, and metabolism of sugar and fat. Furthermore, fresh dill provides 1–2% of the DV for calcium, copper, magnesium, potassium, riboflavin, and zinc.

As for dill seeds, they have many similar nutritional benefits. One tablespoon (6.6 grams) of seeds provides 8% of the DV for calcium, 6% of the DV for iron, and 1–5% of the DV for magnesium, manganese, phosphorus, and potassium.

Dosage

The average daily dose of the seeds is 3 g; essential oil is 0.1-0.3g.

Adults: Dill oil: 0.05-2 ml (3 times daily) (3,6) or 0.1-0.3 g daily in divided doses.

Children: Pure essential oil should not be given to infants and young children but it may be used in a pharmaceutical dosage form, under medical supervision and should not exceed the appropriate dose.

1.10 SAFETY AND ADVERSE EFFECTS[36-38]

Dill herb and fruit and their preparations including their oils are added to a wide range of food categories as spice or for flavouring purposes. Although individual consumption figures for the EU are not available, the Fenaroli's handbook of flavour ingredients cites values of 0.17 mg/kg bw per day for dill and 0.18 mg/kg bw per day for dill oil.

When considering the ADME of the individual components, the phenolic compounds, including flavonoids, present in the additive at concentrations below the thresholds for Cramer Class I compounds or Cramer Class III compounds, respectively, will be readily metabolised and excreted and are not expected to accumulate in animal tissues and products. Similarly, for carvone, the available data indicate that it is absorbed, metabolised and rapidly excreted and is not expected to accumulate in animal tissues and products.

Safety for the user

The additive contains carvone, a compound for which hazards for skin and eye contact and respiratory exposure were recognised. The additive under assessment should be considered as irritant to skin and eyes, and as a dermal and respiratory sensitiser. When handling the additive, exposure of unprotected users to estragole cannot be excluded. Therefore, to reduce the risk, the exposure of the users should be minimised.

Safety for the environment

Graveolens is a native species to Europe where it is widely grown both for commercial and decorative purposes. Therefore, the use of the tincture under the proposed conditions of use in animal feed is not expected to pose a risk for the environment.

Adverse effects

If adverse reactions occur, a doctor or a pharmacist should be consulted. May alter sodium balance and cause allergic reaction.

1.11 STORAGE[39]

To store fresh dill, you first want to lightly spritz the leaves with fresh water, wrap the sprigs loosely in a paper towel, and then place them in a zip-top plastic bag.

Store the dill in the vegetable drawer of your fridge for up to 1 week. For longer storage, you can also freeze fresh dill by rinsing and then placing the sprigs in a single layer on a cookie sheet in the freezer.

Once frozen, transfer the sprigs to a freezer-safe bag and return to the freezer for up to 6 months for best flavor. Frozen dill can be used in cooking without thawing first. Dried dill and dill seeds should be stored in an airtight container in a cool, dark place for 6 months to 1 year.

When stored properly, fresh dill will keep for up to 1 week in the fridge and up to 6 months in the freezer. Dried dill and dill seeds should keep for 6 months to 1 year.

1.12 LIMITATIONS[40-41]

Water deficit or drought is known as an important limiting factor of growth and yield of aromatic and medicinal plants.

The A. graveolens seed extracts tested in our study only have clinically relevant potency against P. mirabilis if used alone.

1.13 RECOMMENDATIONS

Potential benefits: Mild lipid-lowering (especially LDL, Triglycerides), improved insulin sensitivity, digestive relief, labor support, lactation aid.

Evidence strongest for LDL and Triglycerides reduction, digestive effects, and labor duration

shortening. Caution advised in pregnancy and specific health conditions; consult healthcare provider.

CONCLUSION

Anethum graveolens (dill) is a highly valued medicinal and culinary herb, rich in essential oils, phenolic compounds, flavonoids, and other bioactive constituents. Its seeds, leaves, and oil exhibit diverse pharmacological properties including antimicrobial, antifungal, antioxidant, anti-inflammatory, analgesic, antispasmodic, anti-ulcer, antihyperlipidemic, antidiabetic, and anticancer effects. Dill also supports digestive health, lactation, and labor management, while contributing nutritional benefits through vitamins and minerals. Although generally recognized as safe, caution is advised regarding apiole-rich preparations, pregnancy use, and potential allergic effects.

Overall, dill holds significant therapeutic potential and practical applications in medicine, food, and industry. However, further clinical research is needed to confirm its efficacy, establish standardized dosages, and ensure safety across different populations.

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