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Anethum graveolens: Physicochemical Properties, Medicinal Uses, Antimicrobial Effects, Antioxidant Effect, Anti-Inflammatory and Analgesic Effects: A Review

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ABSTRACT

Anethum graveolens, belong to the family Umbelliferae, is indigenous to southern Europe. It is an annual herb growing in the Mediterranean region, central and southern Asia. Now it is cultivated widely throughout the world. It is used traditionally as a popular aromatic herb and spice that has a very long history of use going back to more than 5,000 years. It was used as a remedy for indigestion and flatulence and as milk secretion stimulant. The essential oil and different extracts of *Anethum graveolens* seeds exerted antimicrobial activity against wide range of microorganisms. The essential oils and acetone extracts shown antimicrobial activity against *Staphylococcus aureus*, *Bacillus cereus*, *Enterococcus faecalis*, *Listeria monocytogenes*, *Escherichia coli*, *Yersinia enterocolitica*, *Salmonella choleraesuis*, *S. typhimurium*, *Shigella flexneri*, *Salmonella typhi*, *Pseudomonas aeruginosa*, and *Mycobacterium*. *Anethum graveolens* seed extracts exerted moderate activity against *Helicobacter pylori*.

Keyword: *Anethum graveolens*, Physicochemical, Medicinal uses, Antimicrobial, Antioxidant, analgesic effects.

INTRODUCTION

Anethum graveolens used as an anti-convulsion, anti-emetic, anti-cramp (in children), as a wound healer and to increase the appetite and strengthen the stomach. *Anethum graveolens* contained essential oils, fatty oil, moisture (8.39%), proteins (15.68%), carbohydrates (36%), fiber (14.80%), ash (9.8%), furanocoumarin, polyphenols and mineral¹⁻⁴. Previous studies showed that *Anethum graveolens* induced antimicrobial, anti-inflammatory, analgesic, gastric mucosal protective and antisecretory effects, smooth muscle relaxant effect, hyperlipidaemic, increased progesterone concentration, and many other effects⁵⁻⁹. The aim of the present review is to highlight the chemical constituent and pharmacological effects of *Anethum graveolens*.

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%.

Chemical constituents

Anethum graveolens contained essential oils, fatty oil, moisture (8.39%), proteins (15.68%), carbohydrates (36%), fiber (14.80%), ash (9.8%) and mineral elements such as calcium, potassium, magnesium, phosphorus, sodium, vitamin A and niacin. Fruits of *Anethum graveolens* contain 1 - 4% essential oil comprising of major compounds: carvone (30 - 60%), limonene (33%),

α -phellandrene (20.61%), including pinene, diterpene, dihydrocarvone, cineole, myrcene, paramyrcene, dillapiole, isomyristicin, myristicin, myristin, apiol and dillapiol. *Anethum graveolens* essential oil also contained furanocoumarin, 5-(4''-hydroxy-3''methyl-2''-butenyloxy)-6, 7- furocoumarin, oxypeucedanin, oxypeucedanin hydrate and faltarindiol¹⁰⁻¹⁴. The total phenol and total flavonoid contents of *Anethum graveolens* L. extract were 105.2 mg of gallic acid equivalents/g of the dried extract and 58.2 mg of catechin equivalents/g of the dried extract, respectively.

Pharmacological effects

Antimicrobial effects

Anethum graveolens seed extracts have also been reported to possess anti-ulcer activity, and have shown moderate activity against *Helicobacter pylori*. Aqueous and organic extracts of seeds have exhibited potent antibacterial activity Table 1. The essential oils also active against three fungi (a yeast, *Candida albicans* and two molds, *Penicillium islandicum* and *Aspergillus flavus*). D-limonene and Dcarvone, have exhibited strong antifungal activity against *Aspergillus niger*, *Saccharomyces cerevisiae* and *Candida albicans*¹⁵⁻¹⁹. Many authors mentioned that the antimicrobial activities could be attributed to furanocoumarin in *Anethum graveolens*.

Anti-inflammatory and analgesic effects

Table 1: Major phytochemical compounds identified in *Anethum graveolens*.

Part of plant	System	Effects	Country	Preparation	Ref.
	Traditional used	remedy for indigestion and flatulence milk secretion stimulant anti-convulsion anti-emetic anti-cramp wound healer to increase the appetite strengthen the stomach essential oils	throughout the world		5,7
essential oil	Pharmacological	Antimicrobial anti-ulcer			11,14
seeds	Pharmacological	antibacterial activity antifungal Anti-inflammatory and analgesic mucosal protective and antisecretory effects inhibited acetylcholine relief digestive problems		Aqueous and organic extracts Alcoholic extract	11,14,22 24 27 30 7

The hydro alcoholic extract of the *Anethum graveolens* seed caused significant decrease in the inflammation and pain in rats. *Anethum graveolens* oil and diclofenac-gel showed a significant ($p < 0.001$) decrease in the paw volume in rats compared to the blank group. *Anethum graveolens* oil showed even more decrease in the paw volume compared to the diclofenac. A single topical application of an ethanol extract of the fruits to the inner and outer surface of the ear of mice inhibited ear inflammation induced by 12-*O*-tridecanoylphorbol-13 acetate by 60%. A 10% aqueous extract of the fruits and 5% aqueous solution of the essential oil had analgesic effects in mice pain induced by hot plate and acetic acid writhing models²⁰⁻²². The effect of the fruits (1.0 g/kg body weight) was comparable to 200 mg / Kg body weight of acetyl salicylic acid.

Effects on gastrointestinal system

A. graveolens seed extracts possessed significant mucosal protective and antisecretory effects in the gastric mucosa lesions induced in mice by oral administration of HCl (1 N) and absolute ethanol. The acidity and total acid content were reduced by the orally or intraperitoneally administration of the extracts. *Anethum graveolens* seed extracts exerted moderate activity against *Helicobacter pylori*. The essential oil of *Anethum graveolens* reduced contractions of rabbit intestine. Ethanol extract inhibited acetylcholine and histamine induced contractions of guinea-pig ileum. Dill seeds have been used as household remedy to relief digestive problems such as stomachache, indigestion and flatulence²³. Dill water is believed to have a soothing effect and is given to babies to treat gripe, relieve hiccups and colic. The essential oil was a mild carminative and reduced foaming *in vitro*.

Hyperlipidaemic effects

The crude extract of *Anethum graveolens* L showed anti-hypercholesterolaemic and anti-hyperlipidaemic activities. The crude extracts of *A. graveolens* L. besides having strong antihyperlipidaemic effects, it improved the

biological antioxidant status by reducing lipid peroxidation in liver and modulating the activities of antioxidant enzymes in rats fed with high fat²⁴. Treatment of hyperlipidaemic rats with defatted ethanolic *Anethum graveolens* L. extract (single daily dose of 1 ml, equivalent to 500 mg of the plant powder) and high-fat diet for up to 10 and/or 30 days reversed the serum lipid levels compared to rats which were fed only high-fat diet. In addition, it induced significant increase in HMGCoA/mevalonate ratio as compared to rats which were fed high-fat diet after treatment with defatted ethanolic *Anethum graveolens* L. extract for 30 days. Dill powder and its essential oils also exerted hypolipidaemic activity in rats. Intravenous administration of 12.5 mg/kg body weight of 70% dried ethanol extract of the fruits dissolved in normal saline or 4.0 µl/kg body weight of the essential oil induced diuresis and enhance sodium and calcium excretion in dogs. Intravenous administration of 5–10 mg/kg body weight of 5% seed oil in saline to cats caused hypotension and increased respiration volume^{21,22}.

Effects on reproductive system

The effects of *Anethum graveolens* L. (dill) extracts on female reproductive system were studied in female rats. The experimental groups were fed 0.045 g/kg and 0.45 g/kg of aqueous extract and 0.5 g/kg and 5 g/kg of ethanol extract for 10 days. Treatment with high dose of the extract resulted in a significant increase in duration of the estrous cycle and diestrus phase. Smooth endoplasmic reticulum (SER), rough endoplasmic reticulum (RER) and mitochondria were increased in granulosa lutein cells in high dose groups. There were no significant statistical differences in amount of serum estradiole between experimental, control and sham groups but the serum progesterone concentration increased significantly in high dose treatment group compared with control and sham groups^{23,24}.

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