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REVIEW ARTICLE

Pharmacognostical, Pharmacological, Investigation on Anethum Graveolens Linn: A Review

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ABSTRACT

Many herbal remedies have been employed in various medical systems for the treatment and management of different diseases. The Anethum Graveolens commonly known as "Dill" has been recognized in different system of traditional medicines for the treatment of different diseases and ailments of human beings. This review supports all updated information on its pharmacognosy, pharmacological activity and traditional uses. Preliminary phytochemical screening of this plant revealed the presence of flavonoids, essential oil, phenolic compounds. It has been reported as antibacterial, antispasmodic, hyperlipidimic, antiulcer activity, antioxidant, hypolipidemic, genotoxicity, diuretic effect. There is no report available on isolated constituents of bioactive compound from whole fruits of Anethum Graveolens which support its further to isolating a useful pharmacologically active compound as a drug.

Key words: Anethum Graveolens, Dill, Pharmacological, Pharmacognostical, Traditional uses.

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INTRODUCTION

Herbal medicines have been the main source of primary health care in many nations. About 80% of the world's populations are still dependent on traditional medicines. Folk medicines today play a key role in the developing countries due to a lack of or limited modern health service. From ancient times, plants have been a rich source of effective and safe medicines. Due to their safe, effective and inexpensive nature, indigenous remedies are popular among the people of both urban and rural areas in china and India [1]. Aromatic and medicinal plants are widespread throughout the Mediterranean region, being dominant elements of the natural flora. Since the ancient time they have been utilized by local inhabitants for production of domestic preparations, beverages, confectionary and foods. Now a days, their cultivation is increasing continuously due to the high demand for raw materials, especially products made with the help of biological technique [2].

Medicinal plants which form the backbone of traditional medicine, have in the last few decades been the subject for very intense pharmacological studies this has been brought about by the acknowledgement of the value of medicinal plants as potential sources of lead compounds in the drug development. Their arises a need and therefore to screen medicinal plants for bioactive compound as basis for further pharmacological studies [3]. A field experiment was conducted during two successive seasons 2007/2008 and 2008/2009, to determine the influence of filter mud cake; 4,8 and 12m/fed and potassin 3,6 and 9ml/L and their combinations on vegetative growth, yield, volatile oil(percentage and yield), nitrogen, phosphorus and potassium(percentage and content) of *Anethum graveolens* plants. Plant height, branch number, herb dry weight, umbels number, seed yield /plant and per fed, volatile oil(percentage and yield,N,P,K(percentage and content) were generally increased as a result of applying filter mud cake. The heights values of the previous characteristics were obtained with potassin at high concentration generally the combined effect among filter mud cake and potassin treatments on *Anethum graveolens* [4]. Essential oils extracted from *Anethum graveolens* were investigated for their ability to inhibit the growth and coordinated expression of virulence factors in Candida sp.strains recently isolated from clinical specimens, identified by using vitek11 automatic system and tested for susceptibility to antifungal drugs by E.test method [5].

The vegetable (dill) packaged in polyethylene pouches. Vegetable is evaluated in three condition included perforated, active modified atmosphere, passive modified atmosphere at different temperature [5 , 6, 10 , 20 , 25]. Traditional medicine has served as a source of alternative medicine, new pharmaceutical and health care product [7]. Dill has been one of the most important spice vegetables grown in Poland. As reported by Dyduch (2000) [8]. The essential oil of freeze-dried dill herb was isolated by hydro distillation, solvent extraction and carbon di oxide extraction and analyzed by combination of GLC-MS. Head space gas chromatography(HSGC) was also used for analyzing dill volatiles [9]. *Anethum graveolens* found in many places such as India, Europe, United States, Turkey and China. It has been used for cooking and in uygur medicine since ancient times in china aromatic herbal oils used for

cooking and flavoring cover a board spectrum of anti-microbial activities [10]. The major components of *Anethum graveolens* are flavonoids, phenolic compounds and essential oil [11-12].

TRADITIONAL USES

Over the last few years, many studies have focused on plants with therapeutic properties [13]. *Anethum graveolens* is used for some gastrointestinal ailments such as flatulence, indigestion, stomachache and colic [14]. The fruit has an antispasmodic effect on the smooth muscle of the gastrointestinal tract [15] with regard to central nervous system (CNS), Anethum graveolens has been used to alleviate tiredness from disturbed nights and strengthen brain. The aerial parts of the plant are often cooked with fish to add flavor to it and stimulate the brain [16]. The hexane extract of *Anethum graveolens* highly effective in controlling tobacco cut worm. These extracts were effective at inhibiting the growth of the cut worm larvae stage but could not inhibit the growth of pupae developing into adult [17]. Some triterpenes are known as antiulcer drugs and their action has been suggested to be duo to the activation of cellular protection, reduction of mucosal prostaglandins metabolism-cytoprotective action and reduction of gastric vascular permeability [18].

Flavonoids have antiulcer and gastro protective activities [19-20]. The well known properties of dill from the traditional medicine, such as carminative, stomachic, diuretic have been reported [21]. The study supports the traditional use of green leaves as vegetable and food flavoring agent [22]. Dill has been used as a popular aromatic herb and spice that has a very long history of use going back to more than 2,000years. Dill water is believed to have a soothing effect and is given to babies to treat gripe, relieve hiccups and colic. Chewing the seeds reduces the bad breath. Dill is also a galactagogue that is known to increase the flow of milk in nursing mothers and will be taken by the baby in the milk to help prevent colic. Dill can be used as a regulatory agent of the menstrual cycle. Dill has been reported to possess antihyperlipidaemic and antihypercholesterolaemic activity (Yazdanparast and Alavi, 2001; Yazdanparast and Bahramikia, 2008). Dill has also been reported as Anticancer (Zheng et al., 1992); anti-diabetic (Panda, 2008); antioxidant (Al-Ismail and Aburjai, 2004; Satyanarayana et al., 2004; Bahramikia and Yazdanparast, 2009); antisecretory (Hosseinzadeh et al., 2002).

CLASSIFICATION

The generic name “Anethum” is derived from the Greek word “anethon” and the common name dill comes from the Old Norse word, dylla or dilla which probably means “to soothe” (Singh and panda, 2005).

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Kingdom	:	Plantae
Subkingdom	:	Tracheobionta
Super division	:	Spermatophyta
Division	:	Magnoliophyta
Class	:	Magnoliopsida
Subclass	:	Rosidae
Order	:	Apiales
Family	:	Apiaceae
Genus	:	Anethum
Species	:	Specie

Pharmacognostical Studies

Anethum graveolens (dill) is an annual, erect, 50-150cm tall and glabrous herb with hallow, furrowed and branched stems; alternate, multipinnate and feathery leaves. The yellowish flowers are arranged in compound terminal umbels. The brown coloured fruits are tinny, oval and flat. Dill includes essential oils, fatty oil, moisture (8.39%), proteins (15.68%), carbohydrates (36%), fibre (14.80%), ash (9.8%) and mineral elements such as calcium, potassium, magnesium, phosphorous, sodium, vitamin A, and niacin. Fruits of dill contain 1-4% essential oil comprising of major compounds: carvone (30-60%), limonene (33%), alpha-phellandrene (20.61%), including pinene, diterpene, dihydrocarvone, cineole, myrcene, Para myrcene, dillapiole, isomyristicin, myristicin, myristin, apiol and dillapiol. (Ishikawa et al., 2002; Raghavan, 2006). Other constituents of dill essential oil are furanocoumarin, 5-(4”-hydroxy-3”methyl-2”butenyloxy)-6,7-furocoumarin, oxypeucedanin, oxypeucedanin hydrate and falcarindiol(Stavri and gibbons, 2005).

Dill (*Anethum graveolens*) has been cultivated in Mediterranean region, Europe and central southern Asia. Since antiquity. It grows throughout India, chiefly in Punjab, uttarpradesh, Gujarat, Maharashtra, Assam and west Bengal [23]. Macroscopic characteristic of Anethum graveolens are fruits, dark brown, often stalk attached, broadly oval and compressed dorsally; mericarp usually separate and free, 4mm long, 2-3mm broad and 1mm thick, glabrous, traversed from the base to apex by 5 lighter coloured primary ridges of which 3 dorsal, slightly raised, brown, filiform and inconspicuous, 2lateral prolonged into thin, yellowish membranous wings; odour, faintly aromatic resembling that of caraway, and a warm, slightly sharp taste, akin to caraway. Microscopic characteristics of dill fruits are pericarp shows epidermis of polygonal tabular cells having thick outer wall and striated cuticle; mesocarp, parenchymatous, some cells lignified and show reticulate thickening; endocarp consists of tabular cells sometimes with sinuous anticlinal walls; vittae, 4 on the dorsal valleculae and 2 on the commissural surface, extending the length of each mericarp with an endothelium of brown cells and containing volatile oil; dorsal costae three, one larger and the two lateral broadly winged, each costae

with vascular strands; endosperm much flattened and consists of thick-walled, cellulosic, parenchyma containing fixed oil and numerous aleurone grains upto 5micrones in diameter containing micro-rosette crystals of calcium oxalate; carpophores split, passing at the apex into the raphe of each mericarp containing a vascular strand of sclerenchymatous fibres and spiral vessels. The powder characteristics of Anethum graveolens are brown; shows spiral vessels, micro-rosette crystals of calcium oxalate and oil globules, aleurone grains upto 5 microns in diameter. T.L.C. of alcoholic extract of the drug on silica gel "G" plate using Toluene shows on exposure to Iodine vapour two spots at Rf. 0.59 and 0.68 (all yellow). On spraying with Anisaldehyde-Sulphuric acid reagent and heating the plate for about ten minutes at 110 c three spots appear at Rf.0.37 (pink) 0.59 (blue) and 0.68 (violet) [24].

Pharmacological Studies

The main purpose of this review is to understand the significance of Anethum graveolens in ayurvedic medicines and non-medicinal purposes and emphasis can also be given to the enhancement of secondary metabolites of this medicinal plant.

Adaptogenic activity

Anethum graveolens Linn. (Umbelliferae, A. graveolens) is a widely used spice with a long history of traditional medicinal use for the treatment of various ailments. The present study examines the anti-stress and cognition-improving effects of A. graveolens extract in a rat model. Urinary vanillylmandelic acid (VMA) and ascorbic acid were estimated as biomarkers for evaluating antistress activity in rats. Conditioned avoidance response using Cook's pole climbing apparatus in normal and scopolamine-induced amnestic rats was used to assess cognitive-improving activities. Thiobarbituric acid reactive substances (TBARS) assay was used to evaluate antioxidant activity. Daily administration of A. graveolens at doses of 100, 200 and 300 mg/kg body weight 1 h prior to induction of stress inhibited stress-induced urinary biochemical changes in a dose-dependent manner without altering the levels in normal control groups. Changes in cognition (as determined by the acquisition), retention and recovery in rats were dose-dependent. The extract also produced significant lipid peroxidation inhibition in both rat liver and brain, compared to a reference standard antioxidant, ascorbic acid. The aqueous extract of A. graveolens exhibited significant anti-stress, antioxidant and memory enhancing activities. The study provides a scientific basis for the traditional use of the plant as a culinary spice in foods [25].

Anti Hypercholesterolaemic Effect

Serum triacylglycerides and total cholesterol levels in rats, with hyperlipidaemia induced by diet, were determined after oral administration of a water extract of Anethum graveolens leaves before and after the extraction of the furocoumarin content of the leaves. Administration of the extracts consecutively for 14 days reduced the triacylglycerides and total cholesterol levels by almost 50 and 20%, respectively. Chloroform extraction of furocoumarins

from the aqueous extracts did not reduce the antihyperlipidaemic potential of the extracts to a significant degree. Oral administration of the essential oil of A. graveolens seeds, at two different doses, also reduced the triacylglyceride levels by almost 42%. The total cholesterol level was not reduced by the same doses of the essential oil [26].

Anti Oxidant Effect

Antioxidant activities of ethanolic extract from dill flower and its various fractions were evaluated with 2,2-diphenyl-1-picrylhydrazyl radical scavenging, Trolox equivalent antioxidant capacity, reducing power, chelating power, and β-carotene bleaching assays. The flower extract was successively separated into *n*-hexane, ethyl acetate and ethanol soluble fractions by liquid–liquid partition. Dill leaf and seed extracts were used for comparison. In all assays, the flower extract showed higher antioxidant activity than the leaf and seed extracts. With regard to various fractions of the flower extract, the sequence for antioxidant activity was ethyl acetate fraction > ethanol fraction > original flower extract > *n*-hexane fraction. Phenols including flavonoids and proanthocyanidins should be responsible for antioxidant abilities of the flower extract. Chlorogenic acid, myricetin, and 3,3',4',5,7-pentahydoxyflavan (4 → 8)-3,3',4',5,7-pentahydoxyflavan were the major phenolic acid, flavonoid, and proanthocyanidin, respectively, in the dill flower extract [27].

Hypolipidemic Effect

The aerial parts of *Anethum graveolens* (dill weed) are used in Iran as a hypolipidemic agent. The scientific basis for its use has yet to be established. In this study the hypolipidemic activity of dill powder and its essential oil (its most important fraction) were evaluated in male Wistar rats (180 +/- 20 g) fed a high cholesterol diet. Anethum graveolens essential oil (AGEO) was prepared by hydrodistillation and analyzed using GC/MS. AGEO had a yield of 2% and GC/MS analysis showed that alpha-phellandrene (32%), limonene (28%) and carvone (28%) were its major components. Daily oral administration of AGEO to rats at doses of 45, 90 and 180 mg/kg for 2 weeks significantly and in a dose-dependent manner reduced total cholesterol, triglyceride and low density lipoprotein cholesterol (LDL-C). AGEO also increased significantly high density lipoprotein cholesterol (HDL-C). Anethum graveolens powder when added to the diet of animals showed similar effects on serum lipids. It is concluded that Anethum graveolens has significant lipid lowering effects and is a promising cardio protective agent [28].

Genotoxicity Effect

Genotoxic properties of the essential oils extracted from dill (*Anethum graveolens* L.) herb were studied using chromosome aberration (CA) and sister chromatid exchange (SCE) tests in human lymphocytes in vitro, and *Drosophila melanogaster* somatic mutation and recombination test (SMART) in vivo. In the CA test, the most active essential oil was from dill seeds, then followed essential oils from dill herb. In the SCE test, the most active essential oils were from dill herb and seeds followed by essential oils from pine needles and peppermint

herb. Essential oils from dill herb and seeds induced CA and SCE in a clear dose-dependent manner. All essential oils were cytotoxic for human lymphocytes. In the SMART test, a dose-dependent increase in mutation frequency was observed for essential oils from dill herb. Essential oil from dill seeds was almost inactive in the SMART test [29].

Toxicological Effect

As a folk remedy, *Anethum graveolens* seed (dill) is used for some gastrointestinal ailments. We aimed to evaluate aqueous and ethanolic extracts of anti-ulcer and acute toxicity effects of the Anethum graveolens in mice. Gastric mucosal lesions were induced by oral administration of HCl (1 N) and absolute ethanol in mice. The acidity and total acid content of gastric juice were measured in pylorus-ligated mice. LD50 values of the aqueous and ethanolic extracts were 3.04 g/kg, i.p., (1.5, 6.16) and 6.98 g/kg, i.p., (5.69, 8.56), respectively. The efficacy of high dose of extracts (p.o.) was similar to sucralfate. The acidity and total acid content were reduced by the orally or intraperitoneally administration of the extracts. The results suggest that A. graveolens seed extracts have significant mucosal protective and antisecretory effects of the gastric mucosa in mice [30].

Ulcer Activity

As a folk remedy, *Anethum graveolens* seed (dill) is used for some gastrointestinal ailments. We aimed to evaluate aqueous and ethanolic extracts of anti-ulcer and acute toxicity effects of the Anethum graveolens in mice. Gastric mucosal lesions were induced by oral administration of HCl (1 N) and absolute ethanol in mice. The acidity and total acid content of gastric juice were measured in pylorus-ligated mice. LD50 values of the aqueous and ethanolic extracts were 3.04 g/kg, i.p., (1.5, 6.16) and 6.98 g/kg, i.p., (5.69, 8.56), respectively. The efficacy of high dose of extracts (p.o.) was similar to sucralfate. The acidity and total acid content were reduced by the orally or intraperitoneally administration of the extracts. The results suggest that Anethum graveolens seed extracts have significant mucosal protective and antisecretory effects of the gastric mucosa in mice [31].

Hyperlipidemic Effect

Hyperlipidemia as a major risk factor of atherosclerosis is treated with different drugs. Concerning length of therapy and vast majority of side effects, herbal medication may be suitable substitute for these drugs. In this single-blind, placebo controlled study, lipid profiles of 150 hyperlipidemic patients in cardiology outpatient department of Shiraz University of Medical Sciences were checked at same conditions. They were divided into three equal groups randomly (each composing of 50 patients). They were given enteric-coated garlic powder tablet (equal to 400 mg garlic, 1 mg allicin) twice daily, anethum tablet (650 mg) twice daily, and placebo tablet. All patients were put on NCEP typeП diet and Six weeks later, lipid profiles were checked. In garlic group: total cholesterol (decreased by 26.82 mg/dl, 12.1% reduction, and P-value: .000), and LDL-cholesterol (decreased by 22.18 mg/dl, 17.3% reduction, and P-value:

.000) dropped. HDL-cholesterol (increased by 10.02 mg/dl, 15.7% increase, and P-value: .000) increased. Although triglyceride dropped by 13.72 mg/dl (6.3%) but this was not significant statistically (P-value: .222). In anethum group: surprisingly, triglyceride increased by 14.74 mg/dl (6.0%). Anethum could reduce total cholesterol by 0.4 % and LDL-cholesterol by 6.3% but these were not significant statistically (P-value: .828, and .210, respectively). Anethum has no significant effect on lipid profile, but garlic tablet has significant favorable effect on cholesterol, LDL-cholesterol, and HDL-cholesterol. Garlic may play an important role in therapy of hypercholesterolemia [32].

Antispasmodic Effect

The aim of the present study was to investigate the effect of Dill Fruit Hydroalcoholic Extract (DFHE) on the rat ileum contractions induced by some known spasmogens and also to study the possible mechanism(s) involved. Dill fruit extract was prepared by macerated with alcohol (70%). A piece of ileum (2 cm) was removed from male Wistar rats and mounted in an organ bath containing air bubbled Tyrode solution with 0.5 g initial tension and contractions were recorded by an isotonic transducer. The precontracted ileum by KCl (60 mM), ACh (1 µM) and $BaCl_2$ (4 mM) were relaxed by the cumulative concentrations (0.5-4 mg mL^{-1}) of DFHE ($p<0.0001$). The relaxatory effect of the extract on the $BaCl_2$-induced ileum contractions was greater than the other spasmogens. The spasmolytic effect of the extract (1 mg mL^{-1}) was not reduced after tissue incubation (20-30 min) with phentolamine (1 µM), propranolol (1 µM), naloxone (1 µM) and L-NAME (100 µM). In high-potassium (120 mM) Ca^{2+}-free Tyrode solution, cumulative concentrations of $CaCl_2$ (0.225-3.6 mM) induced ileal contractions, however, the extract (0.5-2 mg mL^{-1}) reduced these contractions dose-dependently ($p<0.001$). Present results suggest that the α- and β-adrenoceptors, opioid receptors and NO generation are not involved in the DFHE inhibitory effect. Furthermore, the results suggest that the relaxatory effect of DFHE on the ileum may be due to blockade of voltage dependent calcium channels [33].

Female Reproductive System Effect

The effects of *Anethum graveolens* L. (dill) extracts on the female reproductive system were studied in 54 Wistar female rats with regular estrous cycle in six groups. The experimental groups were fed with 0.045 g/kg and 0.45 g/kg of aqueous extract, 0.5 g/kg and 5 g/kg of ethanol extract for 10 days. The sham group was fed with solvent and the controls received no treatment. The estrous cycle changes were determined by daily vaginal smear changes. At the beginning and at the end of the experiment blood samples were provided to determine the blood estradiol and progesterone concentration. The ovaries were prepared histologically and the volume of different follicles was estimated. A significant increase was observed in the duration of the estrous cycle and in the diestrus phase and the progesterone concentration in high dose extract treatment. The stereological study did not reveal any significant changes in the volumes of ovaries, primary, secondary and graafian follicles. Dill can be used either as a regulatory agent of the menstrual cycle for women with irregular cycles or as an antifertility agent. More studies are needed to clarify the properties of this herb [34].

Antimycobacterial Effect

As part of a project to characterize selected members of the Kuwaiti flora for their phytochemistry and antimycobacterial activity, a new furanocoumarin, 5-[4''-hydroxy-3''-methyl-2''-butenyloxy]-6,7-furocoumarin (3), was isolated from the whole herb of Anethum graveolens. The known compounds oxypeucedanin (1), oxypeucedanin hydrate (2) and falcarindiol (4) were also isolated from this plant. The structure of each compound was determined by interpretation of NMR and mass spectrometric data. The three known compounds exhibited antibacterial activity against a panel of rapidly growing mycobacteria with minimum inhibitory concentration (MIC) values in the range 2-128 microg/mL [35].

Antibacterial Effect

Anethum graveolens Linn, *Foeniculum vulgare* Mill. And *Trachyspermum ammi* L. are widely used traditional medicinal plants to treat various ailments. To provide a scientific basis to traditional uses of these plants, their aqueous and organic seed extracts, as well as isolated phytoconstituents were evaluated for their antibacterial potential. Antibacterial activity of aqueous and organic seed extracts was assessed using agar diffusion assay, minimum inhibitory concentration and viable cell count studies; and their antibacterial effect was compared with some standard antibiotics. The presence of major phytoconstituents was detected qualitatively and quantitatively. The isolated phytoconstituents were subjected to disc diffusion assay to ascertain their antibacterial effect. Hot water and acetone seed extracts showed considerably good antibacterial activity against all the bacteria except *Klebsiella pneumoniae* and one strain of *Pseudomonas aeruginosa*. Minimum inhibitory concentration for aqueous and acetone seed extracts ranged from 20–80 mg/ml and 5–15 mg/ml respectively. Viable cell count studies revealed the bactericidal nature of the seed extracts. Statistical analysis proved the better/equal efficacy of some of these seed extracts as compared to standard antibiotics. Phytochemical analysis showed the presence of 2.80 – 4.23% alkaloids, 8.58 – 15.06% flavonoids, 19.71 – 27.77% tannins, 0.55–0.70% saponins and cardiac glycosides. Antibacterial efficacy shown by these plants provides a scientific basis and thus, validates their traditional uses as homemade remedies. Isolation and purification of different phytochemicals may further yield significant antibacterial agents [36].

Diuretic Effect

A preliminary phytochemical screening of fruits of *Anethum graveolens* L., *Apium graveolens* L., *Daucus carota* L., and seeds of *Eruca sativa* Mill., revealed the presence of volatile oil, sterols and/or triterpenes, carbohydrates and/or glycosides, tannins and flavonoids in the four entitled plants; Glucosinolates were detected only in *Eruca* seeds. Pharmacological evaluation of the aforementioned plants for diuretic activity has shown the ethanolic extracts of *Eruca sativa* seeds and fruits of *Anethum graveolens, Daucus carota* as well as the volatile oils in the former two plants to produce an increase in urine flow in dogs. Volatile oil

of *Eruca* seeds, significantly, increased Na^+, K^+ and Cl^- excretion in urine, whereas *Anethum graveolens* volatile oil significantly increased Na^+ and Cl^- excretion only [37].

CONCLUSION

Throughout screening of literature available on Anethum graveolens its very useful plants in creating many diseases. Ethanomedical studies received much attention as this bring to light the numerous little known and unknown medicinal virtues especially plant origin which need evaluation on modern scientific line such as preliminary phytochemical analysis and pharmacological screening.

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