

PHARMACOLOGICAL PROPERTIES OF PIMPINELLA ANISUM: A REVIEW

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ABSTRACT

Pimpinella anisum (anise), belonging to Umbelliferae family, is an aromatic plant which has been used in Iranian traditional medicine (especially its fruits) as carminative, aromatic, disinfectant, and galactagogue. So far, different studies were performed on aniseeds and various properties such as antimicrobial, antifungal, antiviral, antioxidant, muscle relaxant, analgesic and anticonvulsant activity as well as different effects on gastrointestinal system have been reported of aniseeds. It can also reduce morphine dependence and has beneficial effects on dysmenorrhea and menopausal hot flashes in women. In diabetic patients, aniseeds showed hypoglycemic and hypolipidemic effect and reduce lipid peroxidation. The most important compounds of

aniseeds essential oil were trans-anetole, estragole, γ -hymachalen, para anis aldehyde and methyl cavicol. Anise oil showed excellent antioxidant activity, in comparison with the reference compounds. Anise oil has the potential to be used as a therapeutic, antimicrobial, and antioxidant agent. Increasing microbial resistance to chemical antibiotics and their probabilistic side effects cause popularity of medicinal plants, so there is an instantaneous and steady need for novel antimicrobial compounds from plants.

KEYWORDS: *Pimpinella anisum*, chemical composition, pharmacological properties, antimicrobial effect, anise, essential oil, wound healing.

INTRODUCTION

Pimpinella anisum L, is a plant belonging to the Umbelliferae family, hails from the same family as carrots, celery and parsley; which is one of the oldest medicinal plants. It is an annual grassy herb with 30–50cm high, white flowers, small white fruits and small green to

yellow seeds, which grows in the Eastern Mediterranean Region, West Asia, the Middle East, Mexico, Egypt, and Spain.^[1] *Pimpinella anisum* is primarily grown for its fruits (aniseeds) that harvested in August and September. Aniseeds contain 1.5–5% essential oil and used as favoring, digestive, carminative, and relief of gastrointestinal spasms. Consumption of aniseed in lactating women increases milk and also reliefs their infants from gastrointestinal problems.^[2] Anise has a distinct, licorice-like taste. Hence, in the food industry, anise is used as flavoring and aromatic agent for fish products, ice-cream, sweets, and gums.^[1,3] So, the objective of this study was collecting all published articles about the chemical constituents, antimicrobial properties and wound healing process of aniseeds with literature search of Google scholar, PubMed, Science direct, Scopus, and SID database from 1970 up to 2011. Anise seeds are used as analgesic in migraine and also as carminative, aromatic, disinfectant, and diuretic in traditional medicine.^[4] Aniseed has warm and dry nature and can increase milk production, menstruation, urine, and sweat secretion and also making good complexion. It is also effective in polishing of teeth. In some traditional texts, anise is mentioned for melancholy, nightmare, and also in treatment of epilepsy and seizure.^[5,6] It is also known for its powerful health-promoting properties and acts as a natural remedy for a wide variety of ailments. Anise seed is low in calories but contains a good amount of several important minerals, including iron, manganese and calcium.

Pharmacological activities of *Pimpinella anisum*

Anti-depressant effect

Depression is a common yet debilitating condition that affects upto 25% of women and 12% of men around the world. Interestingly, some researches found that anise seed may help treat depression. Human and animal studies showed that anise seed extract exhibited powerful antidepressant properties in mice and was effective as a common prescription medication used to treat depression. Anise seed may help reduce symptoms of depression and may be as effective as some types of anti-depressants.

Effect on gastric ulcer

Stomach ulcers, also called gastric ulcers, are a painful sore that forms in the lining of your stomach, causing symptoms like indigestion, nausea and a burning sensation in your chest. Though traditional treatment typically involves the use of medications to decrease the production of stomach acid, preliminary research suggests that anise seed could help prevent stomach ulcers and reduce symptoms. For instance, one animal study noted that anise

reduced stomach acid secretion, helping prevent the formation of stomach ulcers and protecting cells against damage. However, research on anise seed's effects on stomach ulcers is still very limited. Though research is extremely limited, anise seed reduced stomach acid secretion and protected against stomach ulcer formation in one animal study.

Analgesic and Anti-Inflammatory Effect

In a study by Tas, essential oil of *Pimpinella anisum* showed significant analgesic effect similar to morphine and aspirin.^[7] Also, fixed oil of anise was investigated for anti-inflammatory and analgesic activity in mice. The finding showed that the fixed oil of anise has anti-inflammatory effect as strong as indomethacin and it showed analgesic effect comparable to that of 100mg/kg aspirin and 10mg/kg morphine at 30th min.^[8] In many cases, inflammation is considered a normal response by your immune system to protect against injuries and infection. However, high levels of long-term inflammation are linked to chronic conditions, such as heart disease, cancer and diabetes. Animal and test-tube studies suggest that anise seed may reduce inflammation to promote better health and prevent disease. For example, one study in mice showed that anise seed oil reduced swelling and pain. Other research indicates that anise seed is high in antioxidants, which can reduce inflammation and prevent disease-causing oxidative damage. Animal and test-tube studies have found that anise seed is high in antioxidants and can reduce inflammation to help prevent chronic disease.

Effect on morphine dependence

The effects of essential oil of *Pimpinella anisum* on the expression and acquisition of conditioned place preference (CPP) induced by morphine in mice were studied. The findings showed that subcutaneous injections of morphine (2–5mg/kg) produced place preference in a dose-dependent manner and injection of essential oil of *P. anisum* may induce conditioned place aversion in mice, that is, the essential oil has some aversive effects as investigated by place conditioning paradigm. In addition, this oil has also a GABA ergic effect.^[9]

Effect on menopausal hot flashes

In a double blind clinical trial, the effect of anise extract on menopausal hot flashes in 72 postmenopausal women was examined. In this study, consumption of 3 capsules of anise extract (each capsule contains 100mg of extract) for 4 weeks leads to significant reduction in hotflash frequency and intensity and in postmenopausal women.^[10]

Effect on dysmenorrhea

In a study by Khoda Karami *et al.*, the effectiveness of a herbal capsule containing dried extracts of celery, saffron, and anise was compared with mefenamic acid capsule in 180 female students (with age 17–28) with primary dysmenorrhea. The results showed significant reduction in pain intensity in both herbal and mefenamic acid group compare to placebo group. Also, the results revealed that the effectiveness of herbal capsule was better than mefenamic acid in pain relief and can be a suitable alternative in primary dysmenorrhea.^[11]

Effects on diabetic patients

The antidiabetic, hypolipidemic, and antioxidant activities of aniseeds and coriander seeds were compared in type 2 diabetic patients. The seed powders (5g/day) were administered to two groups of type 2 diabetes patients for 60 days. The results indicated 11% rise of fasting blood glucose in control and 36% decrease in aniseed-treated, and 13% decrease in coriander-treated type 2 diabetics. Also significant decrease in serum cholesterol and triglycerides in aniseed treated and coriander seed-treated patient was observed. Protein oxidation in serum and lipid peroxidation in erythrocytes and plasma was decreased in both treated groups as compared with the initial values. Both the groups showed rise in serum β -carotene and vitamin A levels which could have resulted in a significant decrease in lipid peroxidation in RBC and plasma, and also rise in vitamin C was detected in both anise and coriander group. So, both the seeds have antidiabetic, hypolipidemic and antioxidant effects in diabetic patient.^[12,13]

Effect on milk production

The effects of diet supplementation with aniseed and fenugreek seeds on the performance does and kits were studied. Finding revealed that the daily milk intake of kits in aniseed-fenugreek group was equivalent to that of control rabbits. Also, the 17 days body weight did not differ significantly between two groups. At 35 days of lactation, the differences between aniseed fenugreek group and control groups were not significant in litter size, litter weight, kit weight and 1–35 day weight, gain. In conclusion, further studies are needed to investigate the palatability and optimal level of these spices in the feed of lactating rabbits.^[14]

Antimicrobial effect

Test-tube studies show that anise seed and its compounds possess potent antimicrobial properties that prevent infections and block the growth of fungi and bacteria. One test-tube

study demonstrated that anise seed and anise essential oil were especially effective against certain strains of fungi, including yeasts and dermatophytes, a type of fungus that can cause skin disease. Anethole, the active ingredient in anise seed, inhibits bacterial growth as well. In one test-tube study, anethole blocked the growth of a specific strain of bacteria that causes cholera, an infection characterized by severe diarrhea and dehydration. However, further research is needed to examine how anise seed may affect the growth of fungi and bacteria in humans. Test-tube studies show that anise seed and its components may decrease the growth of certain strains of fungi and bacteria. Antimicrobial effects of water and ethanolic extracts of aniseed were studied by Gulcin et al. against 10 bacterial species and also *Candida albicans* with disc diffusion method. In this study, ethanolic extract showed significant inhibitory activity against all tested bacteria but not effective on *Candida albicans*. However, the antimicrobial effect of water extract was not detected against Gram-negative bacteria, *Pseudomonas aeruginosa*, and *Escherichia coli*, but it was effective against *Candida albicans*.^[15] The alcoholic extracts of *Pimpinella anisum* seeds also showed antibacterial activity against *Micrococcus luteus* and *Mycobacterium smegmatis*.^[16]

Table 1: The pharmacological effects of *pimpinella anisum*.

System	Effect	Preparation	Reference
Organism	Anti-bacterial	Aqueous and 50% (v/v) methanol extract	[17]
		Ethanol extract	[15,16]
		Essential oil and methanol extract (in combination with <i>Thymus vulgaris</i>)	[18]
		Aqueous decoction	[19]
	Antifungal	Essential oil	[20,21]
		Fluid extract	[22]
		Methanol extract	[23]
	Insecticidal	Essential oil	[24–28]
		<i>p</i> -Anisaldehyde from aniseed oil	[28]
	Antiviral	Essential oil	[29]
Lignin-carbohydrate-protein complexes from hot water extract		[30]	
Muscle	Muscle relaxant of tracheal chain	Aqueous extract	[31]
		Ethanolic extract	[31]
	Antispasmodic and relaxant of anococcygeus smooth muscle	Essential oil	[32]
		Hydro alcoholic extract (60% ethanol)	[32]
Nervous system	Anticonvulsant	Essential oil	[33]
		Methanol extract of seeds	[34]

		Aqueous extract of leaves and stem extract	[35]
	Analgesic	Essential oil	[7]
		Fixed oil	[8]
	Conditioned place aversion in morphine dependence	Essential oil	[9]
Gastrointestinal	Antiulcer	Aqueous suspension	[36]
	Palliation of nausea	Essential oils of aniseeds, foeniculum vulgare, Anthemis nobilis, and Mentha piperita	[37]
	Laxative	Phytotherapeutic compound of anise and foeniculum vulgare, Sambucus nigra, Cassia angustifolia	[38]
	Increase glucose absorption from the jejunum	Essential oil	[39]
Renal	reduce volume of urine by increased activity of the renal Na ⁺ -K ⁺ -ATPase	Essential oil	[39]
Endocrine	Anti-diabetic	Seed powder	[12,13]
	Hypolipidemic	Seed powder	[12,13]
Immune system	Antioxidant	Ethanol extract	[15,12,47]
		Water extract	[15,40]
		Essential oil	[41]
		Oleoresin	[41]
		Ethyl acetate fraction of ethanol extract	[42]
		Anise tea	[43]
	Increase of β -carotene, vitamins A, C	Seed powder	[13]
Other	Reduction of menopausal hot flashes	Capsules of anise extract	[10]
	Growth promoter of day-old broilers	Essential oil	[44]
	Reduction of pain in dysmenorrhea	Herbal capsule (extracts of anise, celery, saffron)	[11]

Wound healing activity

Cutaneous wounds are different, multifactorial, complex and diligent in patients with diabetes. A few components can cause cutaneous wounds, such as destitute blood stream and oxygen discharge due to expanded blood sugar. This condition is accepted to be caused by impeded blood stream and oxygen discharge from expanded blood sugar, diminished collagen and fibronectin amalgamation from protein lack of healthy sustenance, impeded neighborhood resistant and cell resistances, and diminished anabolic action with diminished affront and development hormone. The think about of wound recuperating solutions for patients with diabetes and the journey for superior, more compelling cures is conceivably one of the most challenges for agents. The gigantic costs of advanced medications lead the analysts to look for elective procedures for the superior administration of wounds in their patients with diabetes. Medicinal plants are common cures utilized by individuals in numerous nations. Due to its detailed hypoglycaemic, anti-inflammatory and antioxidant impacts of *Pimpinella anisum*, conjointly its anti-ulcer movement and recuperating properties, we guessed that this plant may well be utilized as a compound to quicken wound recuperating prepare in diabetic conditions. The comes about of this ponder demonstrate that topical application of *Pimpinella anisum* moved forward the quality of wound withdrawal, re-epithelialisation and scar arrangement in diabetic rats within the short-term. Over a longer time-period, topical application of this compound showed up to diminish add up to cellularity, progress development of fibroblast, increment fibroblast separation rate in injury and eventually decrease scar tissue estimate.^[45]

CONCLUSIONS

Pimpinella anisum is one of the restorative plants which have been utilized for distinctive purposes in conventional medication of Iran. So distant, diverse ponders were performed on the extricates and basic oil of *Pimpinella anisum* to distinguish the chemical compounds and pharmacological properties of this plant, and different properties such as antimicrobial, antifungal, antiviral, antioxidant, and insecticidal impacts have been detailed of aniseeds. The discoveries moreover uncovered that aniseeds can cause gastric assurance, muscle relaxant, and influence stomach related framework. In diabetic patients, it has hypoglycemic and hypolipidemic impacts and decreases lipid peroxidation. Moreover, aniseeds appeared anticonvulsant impact, decreased morphine reliance, and initiated conditioned put abhorrence in mice. Aniseed too has useful impacts on dysmenorrhea and menopausal hot flashes in ladies. The foremost imperative compounds of aniseeds basic oil were trans-anethole,

estragole, γ -hymachalen, panisaldehyde, and methyl chavicol. Due to wide range of pharmacological impacts of this plant, and exceptionally few clinical thinks about performed on this plant, more clinical trials are prescribed to assess the advantageous impacts of *Pimpinella anisum* in human models and distinguishing proof of dynamic compounds of this plant which can lead to blend of unused drugs from the dynamic fixings in future.

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