

# Multidimensional therapeutic uses of ajwain (*Trachyspermum ammi* L.)

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## Abstract

Ajwain is scientifically known as *Trachyspermum ammi*. It belongs to family Apiaceae. It is a native of Egypt and cultivated in India, Iraq, Iran, Afghanistan, Pakistan and several other countries. In India, it is mainly grown in Rajasthan, Gujarat, Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, Maharashtra, Bihar and West Bengal. The fruit possesses stimulant, antispasmodic and carminative properties and it is used traditionally as an important key remedial agent for flatulence, atonic dyspepsia, diarrhea, abdominal tumors, abdominal pains, piles, bronchial problems, lack of appetite, galactagogue, asthma and amenorrhea. Medicinally, it has been proven to possess various pharmacological Properties like antioxidant, antimicrobial, antinociceptive, cytotoxic, hypolipidemic, antihypertensive, antispasmodic, broncho-dilating actions, antilithiasis, diuretic, abortifacient, antitussive, nematocidal, anthelmintic and antifilarial. Scientific studies reveal that the presence of various phytochemical constituents mainly carbohydrates, glycosides, saponins, phenolic compounds, volatile oil (thymol,  $\gamma$ -terpinene, p-cymene and  $\alpha$  and  $\beta$ -pinene), protein, fat, fiber and mineral matter containing calcium, phosphorous, iron and nicotinic acid. Hence *Trachyspermum ammi* is a one of major source of medicinally active compounds and have various pharmacological effects; so, it is encouraging to find its new therapeutic uses.

**Keywords:** Phytochemical constituents, pharmacological effects, trachyspermum ammi, therapeutic uses,

## Introduction

The name ajwain (*Trachyspermum ammi*) was derived from a Sanskrit word ajamoda or ajamodika. It belongs to family Apiaceae. It is a native of Egypt and cultivated in India, Iraq, Iran, Afghanistan, Pakistan and several other countries. In India, it is mainly grown in Rajasthan, Gujarat, Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, Maharashtra, Bihar and West Bengal.

During - 2016-17, 13820 tonnes of ajwain seed was produced from 24230 hectare area, which accounted 0.68% and 0.20% of total seed spices production and area respectively in India. It is an annual herbaceous, cross pollinated crop plant bearing small egg shaped greyish brown fruits in the form of umbels. The plants of ajwain botanically are erect, glabrous or minutely pubescent branched, 80-95 cm tall; Stem striate; leaves rather distant 2-3 pinnately divided; flower is terminal pediculate, compound umbels, white, small; fruit ovoid, mucicarp, aromatic cremocarps, 2-3 mm long, greyish brown, mericarps compressed with distinct ridges and tubercular surface and one seeded. It has a key role in Indian cooking, where it is also known as bishop's weed or carom (Davidson and Jaine, 2014). Ajwain essential oil showed the presence of 26 identified components

which account for 96.3% of the total amount. Major component found was thymol (39.1%) followed by p-cymene (30.8%),  $\gamma$ -terpinene (23.2%),  $\beta$ -pinene (1.7%); terpinene-4-ol (0.8%), while acetone extract of ajwain exhibited the presence of 18 identified components which account for 68.8% of the total quantity. The major component identified was thymol (39.1%) followed by oleic acid (10.4%), linoleic acid (9.6%),  $\gamma$ -terpinene (2.6%), p-cymene (1.6%), palmitic acid (1.6%) and xylene (0.1%) (Singh *et al.*, 2004). Ajwain seeds are also used sometimes as an ingredient in barbered, a spice mixture favored in Eritrea and Ethiopia (Christie *et al.*, 2005).

Ajwain seed has antifungal, antibacterial, antiseptic and antihelminthic effects (Morsi, 2000). The major phenolic compound thymol is found in ajwain has been reported to be an antispasmodic, germicide and antifungal (Nagalakshmi *et al.*, 2000). In the essential oil of *Trachyspermum ammi* or ajwain, the principle active constituents of the oil are phenols, mainly thymol (35-60%) and some carvacrol (Tsimidou and Boskou, 1994). Both the phenols thymol and carvacrol have been reported as antiseptic, expectorant and antitussive agents (Trease and Evans, 2002). Thymol was proved as

a antiseptic and carvacrol as a antifungal agent (Menphini *et al.*, 1993).

### Medicinal and Pharmacological Properties

**Gastro protective activity:** Ajwain seeds were reported as anti-ulcer activity. Animals pre-treated with ethanolic extract exhibited decrease in ulcer protection per cent and ulcer index. The findings inferred that the extract has showed significant protection by reducing ulcerative lesions when compared with control group of animals (Platel and Srinivasan, 2001).

**Abdominal pain:** Ajwain has been considered as a traditional medicine for relieving abdominal pain especially in rural areas. A traditional remedy of ajwain for abdominal pain, 2 tea spoon of bruised seeds or 1 tea spoon of ajwain powder to 570 ml cold water in a small pan. Boil; simmer for up to 2 minutes and then use. It may helpful for treating respiratory and digestive infections, asthma, cramp muscle spasms, colic griping pains, edema, arthritis and rheumatism. As an antiseptic the extract of ajwain can be applied externally to clean the wounds and skin infections (Ramaswamy *et al.*, 2010, Platel and Srinivasan, 2001).

**Hepatoprotective activity:** Hepatoprotective actions reported (Gilani *et al.*, 2005) *in vivo* of ajwain where 80% protection was given to mice against a normally-lethal dose of paracetamol ( $1 \text{ g kg}^{-1}$ ), it prevented the  $\text{CCl}_4$  induced prolongation of pentobarbital sleeping time in mice and it tended to normalize the high serum levels of liver enzymes caused by  $\text{CCl}_4$  induced liver damage in rats.

**Anti-spasmodic:** Ajwain seeds oil are used for medicines. The seed can also be powdered in grinder, tied tightly in a thin cloth to treat migraine headache and heavy colds by inhaling the aroma frequently throughout the day. Take 100g of ajwain, 50g of ginger power and 25g of black salt and crush them together to be put in a dry container. Applying hot formation on the area of pain will bring faster in pain relief (Platel and Srinivasan, 2001, Murty *et al.*, 2009).

**Digestive stimulant actions:** Ajwain would increase the secretion of gastric acid nearly four times. In experimental rats *in vivo*, the addition of ajwain to the diet reduced food transit time and also enhanced the activity of digestive enzymes that caused a higher secretion of bile acids (Platel and Srinivasan, 2001).

**Antiflatulent:** Traditionally ajwain is used for retention of gas and flatulence. It is practiced in rural areas to use ajwain in a very special way. One famous preparation can be made by taking 500g ajwain seed, 20g rock salt,

20g black salt and 20g table salt. Put all of these in 500ml lemon juice for a few days to be dried at its own. Taking with warm water half to one tea spoon of this specially prepared ajwain mixture is an excellent home remedy to treat abdominal gas anorexia, nausea, travel sickness and vomiting (Hawrelak *et al.*, 2009).

**Antibacterial influence:** Ajwain is well known for its excellent antimicrobial effect. It protects the food stuffs against microbial spoilage. The active compounds thought to be responsible for the antimicrobial activity of ajwain were reported carvacol and thymol. Bacteria resistant to even prevalent third generation antibiotics and multi-drug resistant microbial pathogens can be killed by thymol and thus works as a plant based 4th generation herbal antibiotic formulation (Caccioni *et al.*, 1998, Saxena and Vyas, 1986).

**Antifungal effect:** Antifungal influence of volatile oil of ajwain seeds on 10 fungi (*Alternaria grisea*, *A. tenuissima*, *Acrophialophora fusispora*, *Curvularia lunata*, *Drechslera tetramera*, *Fusarium chlamydosporum*, *F. poae*, *Myrothecium roridum*, *Papulaspora sp.* and *Rhizoctonia solani*) was reported and reduced the fungal growth by 72-90% (Singh *et al.*, 1979, Singh *et al.*, 2004).

**Anti-inflammatory power:** Anti-inflammatory power of the Total Alcoholic Extract (TAE) and Total Aqueous Extract (TAQ) of the Ajwain seed was found significant anti-inflammatory potential (Thangam and Dhananjayan, 2003). The TAE and TAQ shown significant antiinflammatory activity in both the animal models. The weights of the adrenal glands were significantly increased in TAE and TAQ treated animals.

**Anthelmintic effect:** Ajwain seed were reported as a anti-anthelmintic influence and very much effective against specific helminths, e.g. *Ascaris lumbricoides* in humans and *Haemonchus contortus* in sheep. The activity exerted by interference with the energy metabolism of parasites through potentiation of ATPase activity and thus causes loss of energy. Ajwain plants has been reported as cholinergic activity with gut's peristaltic movements, thus helps in expulsion of intestinal parasites (Jabbar *et al.*, 2006).

**Nematicidal action:** Wilt disease in pine caused by the pinewood nematode (PWN), *Bursaphelenchus xylophilus*. Nematicidal activity of ajwain oil constituents (camphene, pinene, myrcene, limonene, terpinene, terpinen-4-ol, thymol and carvacrol) were found against PWN. Carvacrol and thymol are found to be very effective against PWN. Amino and hydroxyl groups have

also been reported as target sites of methyl isothiocyanate in nematodes. Essential oil of ajwain has been reported to interfere with the neuromodulator octopamine or GABA gated chloride channels of insect pests. These findings were confirmed the nematicidal activity of ajwain oil that were mainly attributed by carvacrol and thymol (Kong *et al.*, 2006, Park *et al.*, 2007).

**Amebiasis:** In the Unani system, Ajwain has been used as a crude drug to enhance the body's resistance and so it has been prescribed for amebiasis (Bairwa, 2011).

**Antihypertensive and broncho-dilating property:** The antihypertensive effect of ajwain administered intravenously *in vivo* and the antispasmodic and broncho-dilating actions. *In vitro* research showed that calcium channel blockade has been found to mediate the spasmolytic effects of plant materials and it is being considered that this mechanism contributed to their observed result and supported the traditional use of *Trachyspermum ammi* in hyperactive disease states of the gut such as colic and diarrhea as well as in hypertension (Gilani *et al.*, 2005).

**Antitussive actions:** The effects of aerosols of two different concentrations of aqueous and macerated extracts and carvacrol, codeine and saline were tested by counting the number of coughs. Significant reduction of cough number obtained in the presence of both concentrations of aqueous and macerated extracts and codeine ( $p < 0.001$  for extracts and  $p < 0.01$  for codeine) (Boskabady *et al.*, 2005).

**Antiplatelet-aggregatory property:** A research study carried out by Srivastava (1988) was intended to support the traditional use of ajwain in women post delivery. Antiplatelet-aggregatory experiments revealed that in application of dried ethereal extract of ajwain seeds, inhibited aggregation of platelets induced by collagen, arachidonic acid and epinephrine in women body.

**Hypolipidemic action:** In albino rats antihyperlipidemic effect of ajwain seed has been obtained. It was assessed that powder made by ajwain seed at a dose rate of  $2\text{g kg}^{-1}$  body weight and its equivalent methanol extract on use were extensively effective in lipid lowering action by decreased LDL-cholesterol, total cholesterol, triglycerides and total lipids (Javed *et al.*, 2002).

**Antilithiasis and diuretic property:** It was found in a study conducted on antilithiasis and diuretic property *in vivo* that ajwain was not effective in increasing the 24 hour urine production. Hence, it was concluded that the traditional use of *T. ammi* in the treatment of kidney

stones was not supported by their experimental evidence (Ahsan *et al.*, 1989).

**Abortifacient and galactogogic effect:** At ICAR-National Dairy Research Institute, Karnal, India a study was carried out on the estrogenic content in some herbs which are traditionally used to increase milk yield in dairy cattle. Ajwain has also been traditionally used as a galactogogue in human beings. It was found that total phytoestrogen content of dry *Trachyspermum ammi* seed was 473 ppm, which was the second highest in the list of eight herbs tested (Nath *et al.*, 1997).

**Detoxification of aflatoxin action:** In a study ajwain seed extract exhibited maximum degradation of aflatoxin G1 (AFG1). Aflatoxin detoxifying action of the seed extract reduced significantly while boiling. Remarkable levels of degradation of other aflatoxins namely, AFB1, AFB2 and AFG2 by the dialyzed seed extract were also recorded. Time course study of AFG1 detoxification by dialyzed ajwain seed extract exhibited more than 91% degradation within 24 h and 78% degradation within 6 h after incubation (Priestley *et al.*, 2003).

**Ameliorative influence:** Influence of ajwain seed extract has been reported on hexachlorocyclohexan (HCH)-induced oxidative stress and toxicity in rats. Ajwain seed extract pre-feeding rates resulted in increased GSH, GSH-peroxidase, SOD, G-6-PDH, catalase, Glutathione-S-Transferase (GST) activities and decreased hepatic levels of lipid peroxides. It was inferred from the investigation that HCH administration as in produce the hepatic free radical stress, causing toxicity, which could be reduced by the dietary ajwain seed extract (Singh *et al.*, 2004).

## Conclusion

Ajwain seed possesses stimulant, antispasmodic, carminative properties and is used traditionally as an important remedial agent for flatulence, atonic dyspepsia, diarrhea, abdominal tumors, abdominal pains, piles, bronchial problems, lack of appetite, galactogogue, asthma and amenorrhoea. Medicinally, it has been proven to possess various pharmacological activities like antifungal, antibacterial antioxidant, antimicrobial, antinociceptive, cytotoxic, hypolipidemic, antihypertensive, antispasmodic, broncho-dilating actions, antilithiasis, diuretic, abortifacient, antitussive, nematicidal, anthelmintic and antifilarial. Further, studies were revealed the presence of various phytochemical constituents in ajwain mainly carbohydrates, glycosides, saponins, phenolic compounds, volatile oil (thymol,  $\gamma$ -terpinene, para-cymene and  $\beta$ -pinene), protein, fat, fiber

and mineral matter containing calcium, phosphorous, iron and nicotinic acid. These studies declared that *Trachyspermum ammi* is one of the important source of medicinally active compounds and have various pharmacological effects; hence, it is being encouraged to find its new therapeutic uses. which are very much useful for both human being and animal health.

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