Introduction

The use of local plants in folk medical practices has a long history. The resource base of the traditional medical practices prevalent in rural and tribal villages of India and abroad is mainly the plants. Medicinal plants are used to maintain and promote healthy life, prevent disease and cure ailments. It has been estimated that even today, 80% of the world population rely on herbal traditional medicine for their primary health care (Absar A. Qureshi et al., 2008). Traditional knowledge of medicinal plants has always guided the search for new cures. In spite of the advent of modern high throughput drug discovery and screening techniques, traditional knowledge systems have given clues to the discovery of valuable drugs (Buenz et al., 2004). Traditional medicinal plants are often cheaper, locally available and easily consumable, raw or as simple medicinal preparations. Nowadays, traditional medicinal practices form an integral part of complementary or alternative medicine. Although their efficacy and mechanism of action have not been tested scientifically in most cases, these simple medicinal preparations often mediate beneficial responses due to their chemical constituents (Park and Puzzutto, 2002).

Nowadays, more emphasis is given on functional foods which are being consumed as part of a usual diet but are demonstrated to have physiological benefits and/or reduce the risk of chronic disease beyond basic nutritional functions. Spices are being used as food additives since ancient times mostly for their organoleptic attributes. It is now understood that spices also exhibit several beneficial physiological effects in addition to enhancing taste and flavor of food (Chandrassekhara and Srinivasan, 1999). In this background, we have planned to review traditional knowledge, phytochemical constituents and scientific validation of traditional claims of a very well know culinary spice i.e. Trachyspermum ammi which is commonly known as Ajowan.

Among traditional potential herbs used as spice in day to day life, ajwain (Trachyspermum ammi L.) belonging to family Apiaceae, is widely used for curing various diseases in both humans and animals. Its other names in literature are, ajwan, ajowan, Bishop’s wee, carom, or Ethiopian cumin. The most utilizes part of ajwain is the small caraway like fruit, which is particularly popular in Indian savory recipes, savory pastries, snacks and as spice (Anilkumar et al., 2009). Trachyspermum ammi is a grassy, annual plant which grows in the east of India, Iran and Egypt with a white flower and small, brownish seeds.

Plant description

An erect, glabrous or minutely pubescent, branched annual, up to 90 cm., tall, cultivated almost throughout India. Stems striate; leaves rather distant, 2-3 pinnately divided, segments linear, ultimate segments 1.0-2.5 cm. long; flowers in terminal or seemingly-lateral pedunculate, compounds umbels, white, small; fruits ovoid, muricate, aromatic cremocrps, 2-3 mm. long, grayish brown; mericarp compressed, with distinct ridges and tubercular surface, 1-seeded. Flowers and fruits from January-April (Asima Chatterjee, 1995 and Anonymous, 2003).

Traditional uses

Ajwan-ka-arak (aqueous extract) is popular remedy for diarrhea; fruits: antidiarrhoeal, antiseptic, antispasmodic, carminative, stimulant, stomachic and tonic; beneficial in bronchitis, atonic dyspepsia and flatulence; dipsomania, hysteria; sore throat; plaster or poultice applied to abdomen in colic; an important ingredient in various Ayurvedic formulations prescribed for cough, digestive disorders, tonsillitis, urticaria, and
infections with worms; oil is antiseptic, carminative and expectorant, efficacious in bronchial pneumonia and other respiratory disorders; leaves: juice is anthelmintic; root: carminative, diuretic, febrifuge; useful in stomach troubles (Asima Chatterjee, 1995). Fruit possesses stimulant and carminative properties and is regarded as antispasmodic. It is an important and remedial agent for flatulence, atomic dyspepsia, and diarrhea (Bentely and Trimen, 1999). The seed of ajwain is bitter, pungent, and it acts as anthelmintic, carminative, laxative and stomachic. It also cures abdominal tumor, abdominal pains and piles (Krishnamoorthy and Madalageri, 1999; Joshi, 2000). Ajwain seeds contain an essential oil containing about 50% thymol which is strong germicide, anti-spasmodic and fungicide. Thymol is also used in toothpaste and perfumery (Krishnamoorthy and Madalageri, 1999). Seeds of *Trachyspermum ammi* are used traditionally in Lebanon as antirheumatic (Marc et al., 2008). Fixed oil from the seed contain resin acids, palmitic acid, petroselanic acid, oleic acid and linoleic acid (Farooq et al., 1953).

**Phytochemical constituents**

Analysis of the fruits gave the following values: moisture, 7.4; protein, 17.1; fat, 21.1; carbohydrates, 24.6; and mineral matter, 7.9%; calcium, 1525; total phosphorus, 443; phytin phosphorus, 296; iron, 27.7; sodium, 56; potassium, 1,390; thiamine, 0.21; riboflavin, 0.28 and nicotinic acid, 2.1 mg/100 g.; carotene, 71 µg./100 g. Ajowan owes its characteristic odour and taste to the presence of an essential oil (2-4%). Other constituents in the fruits include sugars, tannins and glycosides (Anonymous, 2003). Camphene, carvacrol, *p*-cymene, dipentene, myrcene, α- and β- pinesnes, phenol, α- and β- pellandrenes, γ- terpine, thymine, thymol, linoleic, oleic, palmitic petroselanic acid, resin acids are isolated from fruits (Asima Chatterjee, 1995). Essential oil contain styrene, α-pinene, β-pinene, myrcene, *p*-cymene, γ-terpinene, thymol, carvacrol (Abdolali Mohagheghzadeh et al., 2007). However essential oil extracted by hydrodistillation gives better components than super critical fluid extraction (Khajeh, et al., 2004). Fruits of ajwoin contain various minerals like aluminium, calcium, cadmium, copper, iron, lithium etc. whereas nitrates and nitrite are not detected in ajwoin fruit (Zcan M.M. and Akbulut M., 2007). The seed contains 6-O- β-D-glucopyranosylxthymol (Garg and Kumar, 1998). The fruits contains riboflavin, thiamin, nicotinic acid, carotene, calcium, chromium, cobalt, copper, iodine, iron, manganese, phosphorus and zinc (Duke, 1992).

**Pharmacological activities**

**Analgesic effect**

Analgesic effect of Ethanolic extract of *Carum copticum* fruits by using a tail-flick analgesiometer device indicated that Ethanolic extract significantly increase in tail-flick latency (TFL) during 2h post-drug administration (Mohammad Hossein Dashi-Rahmatabadi et al., 2007).

**Antibacterial activity**

Acetone and aqueous extracts of *Trachyspermum ammi* were tested against *Enterococcus faecalis*, *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *Salmonella typhimurium* and *Shigella flexneri* for their antibacterial activity using agar diffusion assay. Acetone extract shows more activity compared to aqueous extract (Gurinder and Daljit, 2008). Ethanolic extract of *Trachyspermum ammi* exhibited bactericidal activity against eight strains of *Helicobacter pylori* (Syed et al., 2009). Methanolic extract of seed of *Trachyspermum ammi* tested against 11 bacterial species at 2mg/well in agar well-diffusion method measured by diameter of inhibition zones (DIZ). It showed >15mm DIZ against *Staphylococcus aureus* and *Staphylococcus epidermidis*; 10-14mm DIZ against *Pseudomonas aeruginosa* and *Bacillus pumilus*; 7-9 mm DIZ against *Escherichia coli*, *Klebsiella pneumonia* and *Bordetella bronchiseptica*, whereas no activity reported against *Pseudomonas fluorescens*, *Mirococcus luteus* and *Bacillus pumilus* (Shahidi, 2004).

**Antifilarial activity**

In the reported work the *in vitro* activity of a methanolic extract of fruits of *Trachyspermum ammi* (Apiaceae) against adult bovine filarial *Setaria digitata* worms has been investigated. A bioassay-guided fractionation was carried out by subjecting the crude extract to flash chromatography. HPLC analysis was done for the crude extract and active fraction. The crude extract and the active fraction showed significant activity against the adult *S. digitata* by both a worm motility and MTT [3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide] reduction assays. The isolated active principle was chemically characterized by IR, (1)H-NMR and MS analysis and identified as a phenolic monoterpene. It was screened for in vivo antifilarial activity against the human filarial worm *B. malayi* in *Mastomys coucha*, showing macrofilaricidal activity and female worm sterility in vivo against *B. malayi*. The findings thus provide a new lead for development of a macrofilaricidal drug from natural products (Mathew et al., 2008).
Antifungal activity

Essential oil of *Trachyspermum ammi* showed fungicidal effect on *Aspergillus niger* and *Curvularia ovoidea* at 5000 ppm as minimum inhibitory concentration (Dwivedi and Singh, 1998).

Antihistaminic effect

Macerated, aqueous and ethanolic extracts and essential of *Carum compticum* were studied for their antihistaminic effect using guinea pig tracheal chains. The results showed clear rightward shifts in histamine-response curves obtained in the presence of extracts, essential oil and chlorpheniramine which is indicating a competitive antagonism effect of *Carum compticum* at histamine H1 receptors (Boskabady and Shaikhi, 2000).

Antioxidant activity

Seeds of *Carum compticum* exhibited antioxidant activity with trolox equivalent antioxidant capacity using ABTS and DPPH assay methods, ferric reducing antioxidant power and total phenolic content. Seeds of *C. compticum* shows antioxidant activity in all these models (Surveswaran et al., 2007). Ethanolic extract of ajwain shows activity against hexachlorocyclohexane (HCH) induced lipid peroxidation. Prefeeding of ajwain extract decreased hepatic levels of lipid peroxides and increased GSH, GSH-peroxidase, G-6-PDH, SOD, catalase and glutathione S-transferase activities. At the same time there was a significant reduction in hepatic levels of HCH-induced raise in lipid peroxides as a result of the Prefeeding the extract (Anilakumar et al., 2009).

Antiplatelet activity

An ethereal extract of omum (*Trachyspermum ammi*; Hindustani: ajwan)—a frequently consumed spice was found to inhibit platelet aggregation induced by arachidonic acid (AA), epinephrine and collagen; in this respect it was most effective against AA-induced aggregation. Inhibition of aggregation by omum could be explained by its effect on platelet thromboxane production as suggested by the following experimental observation. (i) Omum reduced TxB2 formation in intact platelet preparations from added arachidonate, and (ii) it reduced the formation of TxB2 from AA-labelled platelets after stimulation with Ca2+-ionophore A23187 by a direct action on cyclooxygenase as it did not affect the release of AA from labelled platelets. An increased formation of lipoxygenase-derived products from exogenous AA in omum-treated platelets was apparently due to redirection of AA from cyclooxygenase to the lipoxygenase pathway (Srivastava, 1988).

Antitussive effect

The antitussive effect of aerosols of two different concentrations of aqueous and macerated extract of *Carum compticum* and carvacrol, codeine and saline were tested by counting the number of coughs produced due to aerosol of citric acid 10 min after exposing animals to aerosols of different solution (for carvacrol n=5 and for other solutions n=6). The result showed significant reduction of cough number obtained in the presence of both concentrations of aqueous and macerated extracts and codeine (p<0.001 for the extracts an p< 0.01 for codeine). These results indicated an antitussive effect of *Carum compticum* which was greater than that of codeine at concentration used (Boskabady et al., 2005).

Antiviral activity

71 plants commonly used in Sudanese traditional medicine were screened for their inhibitory effects on hepatitis C virus (HCV) protease (PR) using in vitro assay methods. Thirty-four extracts showed significant inhibitory activity (>/=60% inhibition at 100 microg/mL). Of these, eight extracts, methanol extracts of *Acacia nilotica*, *Boswellia carterii*, *Embelia schimperi*, *Quercus infectoria*, *Trachyspermum ammi* and water extracts of *Piper cubeba*, *Q. infectoria* and *Syzygium aromaticum* were the most active (>/=90% inhibition at 100 microg/mL) (Hussein G, 2000).

Enzyme modulation activity

*In vivo* exposure of *Lymnaea acuminata* to thymol and [6]-gingerol (active molluscicidal components of *Trachyspermum ammi* and *Zingiber officinale*, respectively) indicates that they significantly alter acetylcholinesterase, lactic dehydrogenase, succinic dehydrogenase and cyto-oxidase activity in the nervous tissue of snails. This may account for their toxicity to snails (Singh, 1999). *Carum compticum* also has significant protease activity (Ali et al., 2004). Ajowan also enhances activity of pancreatic lipase and amylase, which may support its digestive stimulant activity (Rao et al., 2003).

Gastroprotective activity

Ajowan produced a significant shortening of the food transit time and hence exert its digestive stimulant (Platel and Srinivasan, 2001). *Helicobacter pylori* plays a crucial role in the pathogenesis of peptic ulcer and gastric cancer. Ethanolic extract of *Trachyspermum ammi* exhibit antibacterial against various strains of *Helicobacter pylori* (Zaidi et al., 2009).

Insecticidal activity

In the present study, the essential oil from seven common spices, *Anethum graveolens*, *Cuminum cymimum*, *Illicium verum*, *Myristica fragrans*, *Nigella sativa*, *Piper nigrum* and *Trachyspermum ammi* was
isolated and its insecticidal, oviposition, egg hatching and developmental inhibitory activities were determined against pulse beetle, *Callosobruchus chinensis*. These essential oils caused death of adults and larvae of *Callosobruchus chinensis* when fumigated. These essential oils also caused chronic toxicity as the fumigated insects caused less damage to the stored grains (Choubey, 2008).

**Spermicidal activity**

*In vitro* spermicidal activity against human spermatozoa is shown by ajowan oil (Buch *et al.*, 1988).

**Toxicity**

Spices are important vectors for various micro-organism implication possible health problems for consumers as well as quality and shelf-life problems for foods. *Trachycpermum ammi* contain only *B. cereus* 56-B2 and *Cl. Perfringens* 72-C1 (Banerjee and Sarkar, 2004). Aflatoxins, the mycotoxins produced mainly by *Aspergillus flavus* and *Aspergillus parasiticus*, represent a worldwide threat to public health due to their frequent occurrence in food and feed. But *Trachycpermum ammi* did not contain these aflotoxins (Ali *et al.*, 2004). The undiluted oil is a mucous membrane and dermal irritant. Due to the high thymol content it should be avoided in pregnancy. The acute oral LD$_{50}$ of thymol is reported as 0.98 g/kg in the rat and 0.88 g/kg in the guinea pig (Jenner, 1964).

**Discussion**

The idea of using medicinal plants to treat human beings and livestock is not new, and in many developing countries their use is still in vogue. Despite the fact that in developed countries modern development in allopathic medicine is at climax, there is a renewed interest in using medicinal plants to treat humans, pets and livestock. In this back ground and neutreacutical point of view we have review *Trachycpermum ammi*, ajwoin for its traditional uses, chemical constituents and pharmacological activities. Ajwoin being an integral part of spices present in every house, and traditionally used for many health problems. This review will give a ready made material for the researchers and budding pharmacologists to work on ajwoin.

**References**


