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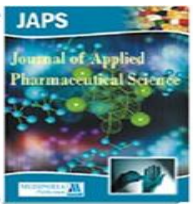

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Phytopharmacological Properties of *Coriander Sativum* as a Potential Medicinal Tree: An Overview

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ABSTRACT

Coriandrum Sativum family Umbelliferae is highly reputed ayurvedic medicinal tree commonly known as the Dhanyaka. It is small sized tree growing throughout India, Italy. Netherlands, Central and Eastern Europe, China and Bangladesh. The different parts of this plant contain monoterpenes, α-pinene, limpnene, γ-terpinene, p-cymene, borneol, citronellol, camphor, geraniol, coriandrin, dihydrocoriandrin, coriandronsA-E, flavonoids and essential oils. Various parts of this plant such as seed, leaves, flower and fruit, possess Diuretic, Antioxidant Activity, Ant-diabetic Anti-convulsant activity, Sedative Hypnotic Activity, Anti-microbial Activity, Anti mutagenic, Anthelmintic activity. Various phytopharmacological evaluations have been reported in this literature for the important potential of the *Coriandrum sativum*.

Key words: *Coriandrum sativum*, Phytochemicals, Pharmacological properties**.**

INTRODUCTION

Dhanyaka consist of dried ripe fruits of *Coriandrum Sativum* Linn Umbeliferae (Evans W.C. et al., 2002). It is an annual herb originating from the Mediterranean countries (Vaidya V.M. et al., 2000). The whole plant and especially the unripe fruit, is characterized by a strong disagreeable odour, whence the name coriander (from the greek K'oρis, a bug) giving characteristic aroma when rubbed (Gruenwalded Joerg. Et al.,2004). All parts of the plant are edible, but the fresh leaves and the dried seeds are the most common parts used in cooking. In the Indian traditional medicine, coriander is used in the disorders of digestive, respiratory and urinary systems, as it has diaphoretic, diuretic, carminative and stimulant activity. In Iranian traditional medicine, Coriander has been indicated for a number of medical problems such as dyspeptic complaints, loss of appetite, convulsion and insomnia (Benjumea D et al., 2005; Maghrani M et al., 2005; Heidar Mir. Et al., 1992; Zargari et al.,1991; Duke J A. et al., 2002).

REGIONAL AND OTHER NAMES

Gujarati(Dhana); Arab (kuzbara, kuzbura); Armenian (chamem); Chinese (yuan sui, hu sui); Czech (koriandr); Danish (coriander); Dutch (coriander); English (coriander, collender, chinese parsley); Ethiopian (dembilal French coriandre, persil arabe); Georgian (kinza, kindza, kindz); German (Koriander); Greek (koriannon, korion); Hindi (dhania, dhanya); Hungarian (coriander); Italian (coriandolo); Japanese (koendoro); Malay (ketumbar); Persian (geshnes); Polish (kolendra); Portugese (coentro); Rumanian (coriándru); Russian (koriandr, koljandra, kinec, kinza, vonjueezel'e, klopovnik); Sanskrit (dhanayaka,); kusthumbari (Serbokroatian korijander); Spanish (coriandro, cilantro, cilandrio, cilantro); Swiss (Chrapfechörnli, Böbberli, Rügelikümmi); Turkish(kisnis); English(Coriander fruits); Hindi(Dhaniya); Sanskruit (Dhanika, Dhania

Vitunnaka); Kashmiri (Dhaniwal, Dhanawal); Oddiya (Dhania); Punjabi (Dhania); Bengali (Dhane, Dhania); Marathi(Dhaue, Kothimbir);Tamil (Kottamalli, Viral dhania); Telagu (Dhaniyalu); Urdu(Kishneez) (Evans W.C. et al., 2002; Axel Diederichsen. Et al., 1996; The Indian herbal pharmacopeia, 2002; The Ayurvedic Pharmacopeia of India, 2010).

Fig 1: Describes photograph of *Coriander Sativum.*

AYURVEDIC DESCRIPTION

Ayurvedic description coriander sativum is described in Table 1 (The Ayurvedic Pharmacopeia of India, 2010; British pharmacopoeia, 2003; European Pharmacopoeia., 2004).

Table: 1 Describe Ayurvedic Description of *Coriander Sativum* (The Ayurvedic Pharmacopeia of India., 2010; British pharmacopoeia., 2003; Monograph of the fifth edition of European Pharmacopoeia., 2008 **).**

Botanical name	Coriandrum sativam linn
Sanskrit name	Dhanika,Dhaniya,Vitunnaka,Kusutumbum
Synonyms	Dhana,Havija,Malli
Properties	
Rasa	Madhur, Tikta, Kashaya
Guna	Laghu, Snigdha
Virya	Ushna
Vipaka	Madhur
Doshaghnata	Tridoshahar,Snigdha
Karma (Actions)	Ushna=vatashaman; kashaya, tikta, madhur= pittashaman; tikta,katu and ushna=kapashman.Green coriander bieng cold is pittashmak.
Therapeutic uses	External: Local swelling and pains; Headache caused by pitta; burning sensation;lymphadenopathy; stomatitis; conjuctivitis; haemostatic;headache; in nasal drops Internal: CNS-Tonic for majjadhatu; vertigo; syncope; memory loss Digestive system: anti dyseptic, appeptizer, digestive, astringent,liver stimulant,anthelmentic CVS:Bleeding disorders Respiratory sysem: Cough, dyspnoe (as kaphaghana) Urinary system: diuretic;useful in prameha caused by pitta

DISTRIBUTION

Coriander is indigenously distributed in Italy, but is widely cultivated in The Netherlands, Central and Eastern Europe, the Mediterranean (Morocco, Malta, and Egypt), China, India and Bangladesh. It was well known in England before the Norman Conquest. Ukraine is the major producer of oil and controls the world price on a supply and demand basis; in one large factory continuous distillation has replaced the batch process. In India it is chiefly found in Madhya Pradesh, Maharashtra, Rajasthan, Andhra Pradesh, Tamil Nadu, Karnataka and Bihar.(British pharmacopoeia., 2003; European Pharmacopoeia., 2004; United states pharmacopoeia., 2004; Handa S.S et al., 1996).

BOTANICAL DESCRIPTION

As shown in figure 1 leaves are small herb having many branches and sub-branches. New leaves are oval but aerial leaves are elongated. Flowers are white, having slightly brinjal like shades while Fruit are round in shape. (British pharmacopoeia., 2003;European Pharmacopoeia.,2004; United states pharmacopoeia., 2004; Handa S.S et al., 1996).

Macroscopic Characteristic

Fruit globular, mericarps usually united by their margins forming a cremocarp about 2-4 mm in diameter, uniformly brownish-yellow or brown, glabrous, sometimes crowned by the remains of sepals and styles, primary ridges 10, wavy and slightly inconspicuous secondary ridges 8, straight, it has aromatic odour. It has spicy and characteristic taste. (United states pharmacopoeia., 2004., ; Handa S.S et al., 1996).

PHYTOCHEMICALS

The general chemical composition present in coriander fruits are described in Table 2.Major active constituents of *coriandrum sativum* is essential oils and fatty oil. The essential oil content of the weight of ripe and dried fruits of coriander varies between 0.03 and 2.6%, and the content of fatty oil varies between 9.9 and 27.7% 1% the major component of which is S-(+)-linalool (60-70%) other minor active constituents present in essential oil are monoterpenes hydrocarbons viz. α-pinene,limpnene,γ-terpinene,p-cymene, borneol, citronellol, camphor, geraniol and geraniol acetate, heterocyclic components like pyrazine, pyridine, thiazole, furan and tetrahudrofuran derivatives, isocoumarins, coriandrin, dihydrocoriandrin, coriandronsA-E, flavonoids, pthlides, neochidilide, digustilide phenolic acids and sterols. The composition of the essential oil & fatty oil are described in Table 3 and Table 4 respectively (Diederichsen Axel et al., 1996; The Indian herbal pharmacopeia., 2002).

Table 2: Describes chemical composition of *Coriander Sativum* (Axel Diederichsen et al., 1996**).**

Component Content	Percentage (%)
Water	11.37
Crude protein	11.49
Fat	19.15
Crude fibre	28.43
Starch	10.53
Pentosans	10.29
Sugar	1.92
Mineral constituents	4.98
Essential oil	0.84

CULTIVATION AND COLLECTION

Climate

Although coriander is a tropical crop, it is successfully grown in a wide range of conditions. It requires a cool climate in the early stages of growth and warm dry weather at maturity. The

best period for cultivation is from October to February. For leaf purpose, it can be grown in small beds around urban areas throughout the year. As an irrigated crop, it is grown during June-July and September-October at the onset of northeastern monsoon and harvested on maturity during January-February. (Czygan F C et al., 2001; Kirtikar K R et al., 1999; Karan singh et al., 2007; khare C.P et al., 2007; Dr. Krishnan K. S et al., 2001; Craker L. E. et al., 2002).

Table 3: Describe composition of Essential oil in ripe Fruits of *Coriander Sativum* (Axel Diederichsen et al., 1996**).**

Main components	% of Total Essential oil	Minor components (all with less than 2%)*
Linalool	67.7	β- pinene
α- pinene	10.5	Camphene
γ- terpine	9.0	Myrcene
Geranylacetate	4.0	Limonene
Camphor	3.0	p-cymol
Graniol	1.9	Dipentene
		α- terpinene
		n-decylaldehyde
		Borenol

Table 4 : Describe compostion of Fatty acid in ripe fruits of *Coriander Sativum* (Axel Diederichsen et al., 1996**).**

Main components	% of all fatty acids	Minor component
Petroselinic acid	68.8	Stearic acid
Linoleic acid	16.6	Vaccenic acid
Oleic acid	7.5	Myristic acid
Palmitic acid	3.8	

Soils and Preparation of Land

As an irrigated crop, coriander can be cultivated on all types of soils, provided sufficient organic manure is applied. Black cotton soils with high retentivity of moisture are the best under rain fed conditions. For rain fed crop, the land is ploughed 3-4 times with the onset of monsoon. For irrigated crop, after ploughing the field, beds and channels are prepared (Czygan F C et al., 2001; Kirtikar K R et al., 1999; Karan singh et al., 2007; khare C.P et al., 2007; Dr. Krishnan K. S et al., 2001; Craker L. E. et al., 2002).

Manures and Fertilizes

Well rotten farmyard manure (10-15 tonnes/ha) and Fertilizers at the rate of 20 kg nitrogen, 30 kg Phosphorus, and 20 kg Potassium per hactor are applied at the time of preparation of the field before sowing for a good crop in rain fed areas. In the irrigated areas, application of N is increased to 60 kg/ha, half of the dose of N is applied as basal dose, and the remaining half is applied 30-45 days after sowing. (Czygan F C et al., 2001; Kirtikar K R et al., 1999; Karan singh et al., 2007; khare C.P et al., 2007; Dr. Krishnan K. S et al., 2001; Craker Lyle. E. et al., 2002).

Sowing

About 12-15 kg of fruits is required for sowing in one hectare. The fruits are required for sowing in one hectare. Rubbing before sowing, as splits fruits. Fruits or seeds are germinated a little earlier than the intact fruits. Soaking the seeds in water for 12-14 hours and drying them in shade for 12 hours also help in quicker germination. Before sowing, seeds are treated with suitable fungicides. Like Thiram at the rate of 2.5 g/kg of seeds as a preventive measure against stem-gall disease. The seeds are sown in lines at a spacing of 25 cm between rows and 15 cm between plants. Sometimes seeds are sown broadcast and later mixed with soil using rakes. Depending upon the temperature, germination takes place in about 10-15 days. (Czygan F C et al., 2001; Kirtikar K R et al., 1999; Karan singh et al., 2007; khare C.P et al., 2007; Dr. Krishnan K. S et al., 2001; Craker Lyle. E. et al., 2002).

Irrigation

Depending upon the soil, climatic conditions and seasons, irrigation is given. Generally no irrigation is required for crop grown in black cotton soils, but for light soils, 3-4 irrigations are given; first one at 2-leaves stage (20-30 days after sowing); the second at branching or flowering stage (60-70 days) and the third at seed-filling stage (80-110 days). At the time of flowering initiation, sufficient soil moisture should be ensured to the crop. (Czygan F C et al., 2001; Kirtikar K R et al., 1999; Karan singh et al., 2007; khare C.P et al., 2007; Dr. Krishnan K. S et al., 2001; Craker Lyle. E. et al., 2002).

Intercultural

For a good crop, weeding and hoeing is necessary. Generally two hoeings are enough for normal crop. First one is done when the plants grow well above the ground and the second is given before rows closed up, but if there is an early rain during the standing crop, additional hoeing and weeding are done to remove weeds and to provide better soil aeration to the crop. For irrigated crops, first hoeing and weeding are done in about 30 days after sowing and depending upon the weed growth one or two more weeding are also done. (Czygan F C et al., 2001; Kirtikar K R et al., 1999; Karan singh et al., 2007; khare C.P et al., 2007; Dr. Krishnan K. S et al., 2001; Craker Lyle. E. et al., 2002).

Diseases and pest

Among disease, the wilt, powdery mildew, stem-rot and stem-gall are important, causing damage to the corp. The powdery mildew is effectively controlled by spraying Sulfate (0.25%) or Mores tan (0.15%); use of wettable sulphar (0.25%) as spray at flowering and subsequently at 15 to 25 days interval is also effective to control powdery mildew. No direct control measures are available for wilt. However, selection of dieses- free seeds, seed treatment with fungicides and avoiding growing coriander continuously in the same land. (Czygan F C et al., 2001; Kirtikar K

R et al., 1999; Karan singh et al., 2007; khare C.P et al., 2007; Dr. Krishnan K. S et al., 2001; Craker Lyle. E. et al., 2002).

Storage and Viability

Preserve in light, light-resistant containers, protect from light, and store at controlled room temperature. Avoid exposure to excessive heat (Czygan F C et al., 2001; Kirtikar K R et al., 1999; Karan singh et al., 2007; khare C.P et al., 2007; Dr. Krishnan K. S et al., 2001; Craker Lyle. E. et al., 2002).

PHARMACOLOGICAL STUDIES

Diuretric

The aqueous extract of coriander seed possesses diuretic and saluretic activity, thus, validating the use of coriander as a diuretic plant in Moroccan pharmacopoeia aqueous extract of coriander seed was administered by continuous intravenous infusion (120 min) at two doses (40 and 100 mg/kg) to anesthetized Wistar rats. Furosemide (10 mg/kg), a standard diuretic was used as the reference drug. Excretion of water and electrolytes (sodium, potassium and chloride) in urine was measured, and glomerular filtration rate (equal to creatinine clearance) was determined. The crude aqueous extract of coriander seeds increased diuresis, excretion of electrolytes, and glomerular filtration rate in a dose-dependent way; furosemide was more potent as a diuretic and saluretic. The mechanism of action of the plant extract appears to be similar to that of furosemide (Aissaoui Abderahim et al., 2008).

Antioxidant Activity

The antioxidant activity of the studied essential oils and their mixtures was assessed in the aldehyde/carboxylic acid test. This method is based on inhibition of autoxidation of aldehyde to carboxylic (hexanoic) acid in the presence of compounds exhibiting antioxidant activity. This method combined with capillary GLC makes it possible to study antioxidant properties and to determine quantitative changes in the content of each component of essential oils during their autoxidation. This method is also carried out by DPPH radical-scavenging assay, Inhibition of 15-LO, Inhibition of phospholipid peroxidation. Extracts from both leaves and seeds showed a concentration-dependent DPPH scavenging activity respectively (Misharina T. A et al., 2008; Wangensteen Helle et al., 2004).

Antidiabetic activity

Coriandrum sativum seeds incorporated into diet and the effect of the administration of coriander seeds on the metabolism of lipids was studied in rats, fed with high fat diet and added cholesterol. The seeds had a significant hypolipidemic action. In the experimental group of rats (tissue) the level of total cholesterol and triglycerides increased significantly. There was significant increase in β-hydroxy, β-methyl glutaryl CoA reductase and plasma lecithin cholesterol acyl transferase activity (LCAT) were noted in the experimental group. The level of low density lipoprotein (LDL), very low density lipoprotein (VLDL) cholesterol decreased while that of high density lipoprotein (HDL) cholesterol increased in the experimental group compared the control group. The increased activity of plasma LCAT, enhanced degradation of cholesterol to fecal bile acids and neutral sterols appeared to account for its hypocholesterolemic effect (Dhanapakiam P et al., 2008).

Anti-convulsant activity

The anti-convulsant effects of aqueous and ethanolic extracts of coriander sativum seeds were studied in order to evaluate the fokloric use of this plant. two anti-convlusant evaluation test, namely the pentylenetetrazole (PTZ) and the maximal electroshock test, were used for assessing antiseizure effectin the pentylenetetrazole test, aqueous and ethenolix extracts prolonged onset of clonic convulsions and anti convulsant activity of high dose (5mg/kg) were similar to that of phenobarbital at a dose of 20mg/kg in the PTZ test. Both extracts in high doses decreased the duration of tonic seizures and showed a stastically significant anticonvulsant activity in the maximal electroshock test(Hosseinzadeh Hossein et al., 2005).

Sedative Hypnotic Activity

Coriandrum sativum L. has been recommended for relief of insomnia in Iranian traditional medicine. To determine sedative & hypnotic activity Aqeuous and hydroalcoholic extract & essential oil administer to rat. The results of experiment shows that Aqueous extract prolonged pentobarbital-induced sleeping time at 200, 400 and 600 mg/kg. Hydro-alcoholic extract at doses of 400 and 600 mg/kg increased pentobarbital- induced sleeping time compared to saline-treated group. The essential oil increased pentobarbital-induced sleeping time only at 600 mg/kg. The extracts and essential oil of coriander seeds possess sedative-hypnotic activity (Emamghoreishi M et al., 2006).

Anti-microbial Activity

Aqueous infusions and aqueous decoctions of Coriandrum sativum (coriander) against 186 bacterial isolates belonging to 10 different genera of G +ve bacterial population and 2 isolates of Candida albicans isolated from urine specimens. The well diffusion technique was employed. The aqueous infusion and decoction of coriander did not show any antimicrobial activity against G -ve urinary pathogens as well as against Candida albicans (Sabahat saeed perween tariq et al., 2007).

Anti mutagenic activity

Aromatic amines are metabolically activated into mutagenic compounds by both animal and plant systems. The 4-nitro-o-phenylenediamine (NOP) is a well-known direct-acting mutagen whose mutagenic potential can be enhanced by plant metabolism; m-phenylenediamine (m-PDA) is converted to mutagenic products detected by the Salmonella typhimurium TA98 strain, and 2-aminofluorene (2-AF) is the plant-activated promutagen most extensively studied. Plant cells activate both 2-AF and m-PDA into potent mutagens producing DNA frame shift mutations. *Coriandrum sativum* is a common plant included in the Mexican diet, usually consumed uncooked. The antimutagenic activity of coriander juice against the mutagenic activity of 4-nitro-

o-phenylenediamine, m-phenylenediamine and 2-aminofluorene was investigated using the Ames reversion mutagenicity assay (his − to his+) with the S. typhimurium TA98 strain as indicator organism. The plant cell/microbe coincubation assay was used as the activating system for aromatic transformation and plant extract interaction. Aqueous crude coriander juice significantly decreased the mutagenicity of metabolized aromatic amines (AA) in the following order: 2-AF (92.43%) > m-PDA (87.14%) > NOP (83.21%). The chlorophyll content in vegetable juice was monitored and its concentration showed a positive correlation with the detected antimutagenic effect. Protein content and peroxidase activity were also determined. The concentration of coriander juice (50–1000 µl/coincubation flask) was neither toxic nor mutagenic. The similar shape of the antimutagenic response curves obtained with coriander juice and chlorophyllin (used as a subrogate molecule of chlorophyll) indicated that comparable mechanisms of mutagenic inhibition could be involved. The negative correlation between chlorophyll content and mutagenic response of the promutagenic and direct-acting used amines allows us to deduce that a chemical interaction takes place between the two molecules, leading to the inactivation of mutagenic moiety (Cortés-Eslava Josefina et al., 2004).

Anthelmentic activity

In vitro anthelmintic activities of crude aqueous and hydro-alcoholic extracts of the seeds of *Coriandrum Sativum* (Apiaceae) were investigated on the egg and adult nematode parasite Haemonchus contortus. The aqueous extract of *Coriandrum Sativum* was also investigated for in vivo anthelmintic activity in sheep infected with Haemonchus contortus. Both extract types of *Coriandrum Sativum* inhibited hatching of eggs completely at a concentration less than 0.5 mg/ml. ED(50) of aqueous extract of *Coriandrum Sativum* was 0.12 mg/ml while that of hydro-alcoholic extract was 0.18 mg/ml. There was no statistically significant difference between aqueous and hydro-alcoholic extracts. The hydro-alcoholic extract showed better in vitro activity against adult parasites than the aqueous one.

CONCLUSION

Numerous phytochemical and pharmacological studies have been conducted on different parts of *Coriander Sativum*. The present literature supports the potential of *Coriander sativum* as a medicinal tree. In view of the nature of the plant, more research can be done to investigate the unexplored and unexploited potential of this plant.

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