Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2016, 8(3):529-533

Review Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Carum carvi-An important medicinal plant

***Anupam Kr. Sachan[1], Doli R. Das[1] and Mukesh Kumar[2]**

[1]*Institute of Pharmacy, Dayanand Dinanath College, Kanpur Nagar-206214, India*
[2]*Regional Research Institute of Unani Medicine, Bhadrak-756100 Odisha, India*

ABSTRACT

Caraway oil is the essential oil obtained by steam distillation of the dried, ripe fruit of Carum carvi, are one of the earliest cultivated herbs in Asia, Africa and Europe. It is commonly known as Caraway (Hindi - Kala Jira/Arabic-Siyah Zeera) which is grown for its high content of essential oil which is mainly found in seeds Caraway is normally a biennial much-branched herb, 30 - 80cm in height, with narrow finely grooved leafy stems. It produces a deep taproot and a rosette of dark green, finely cut, feathery leaves in the establishment year. Caraway is found in Europe, Siberia, the Caucasus, the near East, the Himalayas, Mongolia and Morocco The flowers are produced on umbels, are white and 2-3 mm across, the outer ones larger than the inner ones. They open from late April onwards and are succeeded by fruits which are 3-6 mm long, and light brown, ripening from early July.The major compounds are carvacrol, carvone, α-pinene, limonene, γ-terpinene, linalool, carvenone, and p-cymene. The flavonoid constituents of caraway were included quercetin-3-glucuronides, isoquercitrin, quercetin 3-0 caffeylglucoside, and kaempferol 3-glucoside It was used in folk medicine for the treatment of many complains. The previous studies showed that the plant contained many bioactive metabolites and exerted antimicrobial, anticancer, antioxidant, hypolipidemic, antidiabetic, analgesic, diuretic, gastrointestinal, bronchial relaxant effects and many other pharmacological activities.

Keywords: Caraway, Phytochemical constituents, Carvone Pharmacological Activities, Antidiabetic Activity,

---

INTRODUCTION

Caraway oil is the essential oil obtained by steam distillation of the dried, ripe fruit of *Carum carvi* L. (Family: Umbelliferae/Apiaceae) are one of the earliest cultivated herbs in Asia, Africa and Europe. It is commonly known as Caraway (Hindi - Kala Jira/Arabic-Siyah Zeera) which is grown for its high content of essential oil which is mainly found in seeds.[1-2] It was used in folk medicine for the treatment of many complains. The previous studies showed that the plant contained many bioactive metabolites and exerted antimicrobial, anticancer, antioxidant, hypolipidemic, antidiabetic, analgesic, diuretic, gastrointestinal, bronchial relaxant effects and many other pharmacological activities.

Scientific Classification

Kingdom:	Plantae
Subkingdom:	Tracheobionta
Superdivision:	Spermatophyta
Division:	Magnoliophyta
Class:	Magnoliopsida
Subclass:	Rosidae
Order:	Apiales
Family:	Apiaceae
Genus:	*Carum*
Species:	*carvi* L. [3].

Vernacular Name

English:	Black Caraway, Caraway;
Hindi:	Kalajira;
Sanskrit:	Asitajiraka, Krishna jeeraka;
Tamil:	Karamjiragam, Shimaishambu;
Telugu:	Nalla Jeelakarra;
Unani:	Zeeraa Siyaah, Kamoon, Kamoon-roomi
Urdu:	Kala Zira and Karo Jeero, Zira Siyah [4-5]

Fig. 1: Plants with Flowers/Fruits

Fig. 1: Leaves

Geographical distribution:
Caraway is found in Europe, Siberia, the Caucasus, the near East, the Himalayas, Mongolia and Morocco. Found in North America after being introduced. [6]

Description:
Caraway is normally a biennial much-branched herb, 30 - 80cm in height, with narrow finely grooved leafy stems. It produces a deep taproot and a rosette of dark green, finely cut, feathery leaves in the establishment year. It has a high vernalisation requirement to initiate the production of flowering stems in the second year, which grow to a height of up to 75cm. The flowers are produced on umbels, are white and 2-3 mm across, the outer ones larger than the inner ones. They open from late April onwards and are succeeded by fruits which are 3-6 mm long, and light brown, ripening from early July. [7]

Chemical Composition:
The major compounds occurring in caraway are carvacrol, carvone, α-pinene,limonene, γ-terpinene, linalool, carvenone, and *p*-cymene, whereas the major compounds occurring in cumin are cuminaldehyde, limonene, α- and β-pinene, 1,8-cineole, *o*- and *p*-cymene, α- and γ-terpinene, safranal and linalool. In aqueous and solvent derived seed extracts, diverse flavonoids, isoflavonoids, flavonoid glycosides, monoterpenoid glucosides, lignins and alkaloids and other phenolic compounds have been found.[8-13] Roots of caraway have also been found to contain flavonoids.[14] The seed and root of caraway showed the presence of polyacetylenic compounds. [15] In a recent study, a nonspecific lipid transfer protein has been isolated from the cumin seed.[16] Several nutrients (vitamins, amino acids, protein, and minerals), starch, sugars and other carbohydrates, tannins, phytic acid and dietary fiber components have also been found in cumin seeds.[17-21]. An aromatic compound, glucoside and a glucide were isolated from the water-soluble portion of the methanolic extract of caraway fruit (Carum *carvi* L.). Their structures were clarified as 2-methoxy-2-(4'- hydroxyphenyl) ethanol, junipediol A 2-O-beta-D-glucopyranoside and L-fucitol [22]. The flavonoid constituents of caraway were included quercetin-3-glucuronides, isoquercitrin, quercetin 3-0 caffeylglucoside, and kaempferol 3-glucoside [23].

Physiochemical parameter:
Moisture: not more than10%, total ash on dry mass: not more than8%, acid insoluble ash on dry basis: not more than1.5%, volatile oil content on dry basis, ml/100g: not less than2.5, alcohol-soluble extractive: not less than 2%, water-soluble extractive: not less than 12 % [24-25]

Traditional uses:
Caraway was used for gastrointestinal cramps and feelings of fullness, as well as nervous cardiac-gastric complaints, in spasmodic gastrointestinal complaints, flatulence, irritable stomach, indigestion, lack of appetite, dyspepsia in adults, and in relieving flatulent colic of infants. It was also used as tranquilizer, diuretic, emenagogue, and gastric stimulant, aphrodisiac, astringent, in the treatment of morning sickness, headache, to improve liver function, in bronchopulmonary disorders, cough and as an analgesic. Vapor of caraway seeds is used to relief lumbago and rheumatism. The seeds were also used for the treatment of scabies. Caraway was also used to improve lactation in nursing mothers. The essential oil is used as constituent in mouthwashes and bath additives and in perfumery, for scenting soap and as a parasiticide [26-28]. It was commonly used as flavouring in ice-cream, candy, meat, cheese, condiments, soft drinks, and alcoholic beverages. [29]

Pharmacological activity:

1. Antioxidant activity:
Cumin and caraway products (oils as well as their aqueous and solvent derived extracts) have shown significant antioxidant activity in several test methods. These effects are documented as their ability to prominently quench hydroxyl, 1,1-diphenyl-2-picrylhydrazyl (DPPH) radicals and lipid peroxides. The other assays employed were ferricthiocyanate method in linoleic acid system, Fe ascorbate-induced rat liver microsomal lipid peroxidation (LPO), soybean lipoxygenase dependent lipid peroxidation and ferric reducing ability. A caraway root extract has also shown significant anti-DPPH radical activity. The cumin and caraway oils exhibited high antioxidant activity which has been attributed largely to the presence of monoterpene alcohols, linalool, carvacrol, anethole and estragol, flavonoids and other polyphenolic compounds. The antiradical profile of caraway has been proposed as the underlying mechanism for their multifaceted pharmacological properties such as antimicrobial, antidiabetic, anticarcinogenic/antimutagenic, antistress, antiulcerogenic, etc. as outlined in the succeeding sections.[30-31]

2. Antimicrobial activity:
Numerous investigations have revealed a potential antimicrobial activity of cumin and caraway products (oils as well as their aqueous and solvent derived extracts). This antibacterial action was assessed against a range of useful and pathogenic gram-positive and gram-negative bacterial strains. Cumin seed oil and alcoholic extract inhibited the growth of *Klebsiella pneumoniae* and its clinical isolates and caused improvement in cell morphology, capsule expression and decreased urease activity. The ability of caraway oils to inhibit the growth of fungi and bacteria is attributed to carvone, limonene and linalool, whereas limnonene, eugenol, -pinene and some other minor constituents have been suggested to contribute to the antimicrobial activity of cumin oil. The antibacterial activity of carvacrol (5-isopropyl-2-methylphenol) is amply documented in various experimental studies and is suggested to be in synergism with its precursor *p*-cymene. Antifungal activity of cumin and caraway oil is recorded against soil, food, animal and human pathogens, including dermatophytes, *Vibrio* spp., yeasts, aflatoxins and mycotoxin producers. Carvacrol (from caraway oil) proved most active against *Penicillium citrinum*.[32-33]

3. Anticarcinogenic/antimutagenic activity
In independent studies, dietary supplementation of both cumin and caraway was found to prevent the occurrence of ratcolon cancer induced by a colon-specific carcinogen, 1,2-dimethylhydrazine (DMH). In cumin receiving animals, nocolon tumors were observed. The excretion of fecal bile acids and neutral sterols was significantly increased, and cumin was shown to protect the colon and to decrease the activity of β-glucuronidase and mucinase enzymes. β-glucuronidase increases the hydrolysis of glucuronide conjugates and liberates the toxins, while the increase in mucinase activity may enhance the hydrolysis of the protective mucins in the colon. Histopathological studies also showed lesser infiltration into the submucosa, fewer papillae and lesser changes in the cytoplasm of the cells in the cumin-treated colon. In cumintreated rats, the levels of cholesterol, cholesterol/phospholipid ratio and 3-methylglutaryl COA-reductase activity were reduced. [34-35]

4. Antidiabetic activity:
The antidiabetic effects of cumin and caraway products are amply documented. In a glucose tolerance test conducted in rabbits, cumin significantly increased the area under the glucose tolerance curve and hyperglycemic peak. A methanolic extract of cumin seeds reduced the blood glucose and inhibited glycosylated hemoglobin, creatinine, blood urea nitrogen and improved serum insulin and glycogen (liver and skeletal muscle) content in alloxan and streptozotocin (STZ) diabetic rats. The collateral benefits included decreased creatinine, urea nitrogen and improved insulin and glycogen in tissue and skeletal muscles, accompanied by a reduction in rat tail tendon collagenlinked fluorescence and pepsin digestion which are implicated in the pathogenesis of diabetic micro-vascular complications. In another study, an aqueous extract of cumin prevented *in vitro* glycation of total soluble protein, α-crystallin, and delayed the progression and maturation of STZ-induced cataract in rats. Cumin prevented loss of chaperone activity in diabetic rats and also attenuated the structural changes of α-crystallin in lens, which is a long-lived protein and is susceptible to several post-translational modifications in certain diabetic conditions.[36-37]

5. Diuretic activity:
The traditional use of caraway as a diuretic was confirmed in an experimental study in which peroral treatment of an aqueous extract of caraway (in acute and sub-chronic mode) was shown to increase the urine output during and after 24 hours in rat. The urinary levels of sodium and potassium were found to be increased, while in plasma these were not affected. Carum extract did not produce any renal toxicity or any other adverse effects during the study period.[38]

6. Immunomodulatory activity:
In a recent study, oral treatment with cumin showed immuno-modulatory properties in normal and immune-suppressed animals via modulation of T lymphocytes′ expression in a dose-dependent manner. It stimulated the T cells′ (CD4 and CD8) and Th1 cytokines′ expression in normal and cyclosporine-induced immune-suppressed mice. In restraint stressinduced immune-suppressed animals, the active compound of cumin countered the depleted T lymphocytes, decreased the elevated corticosterone levels and size of adrenal glands and increased the weight of thymus and spleen.[39]

7. CNS activity:
Administration of cumin oil suppressed the development and expression of morphine tolerance (as measured by tail-flick method). The morphine dependence was also reversed in a dose-dependent manner as evaluated by decreased conditioning scores (the acquisition and expression of morphine-induced conditioned place preference) in mice. [40]

8. Estrogenic/anti-osteoporotic activity:
Cumin and caraway seeds are reported to be estrogenic. Potential effects of caraway on hormone and reproductive parameters of female ovariectomized rats are demonstrated due possibly to the presence of estrogenic isoflavonoids, luteolin and apigenin. An aqueous and an ethanolic extract of caraway seeds produced significant antifertility effect via modulation of follicle stimulating hormone (FSH) and leutinizing hormone (LH) levels, while the estrogen levels were increased. This was accompanied by an increase in the weight of ovary, uterus and also body weight. Caraway oil was effective in inhibiting tonic and phasic rhythmic contractions of isolated uterine preparations.[41]

9. Gastrointestinal activity:
In human trial studies, some herbal preparations consisting predominantly caraway have shown efficacy in relieving dyspeptic symptoms.The antispasmodic effect of an alcoholic extract of caraway has shown inhibitory effects on smooth muscle contractions induced by the spasmogens, acetylcholine and histamine. This response has been evaluated to explain the beneficial effect of caraway in relieving gastrointestinal symptoms associated with dyspepsia. In a study done on 12 intestinal bacteria, caraway oil displayed high degree of selectivity, inhibiting the growth of potential pathogens at concentrations that had no effect on the beneficial bacteria examined. This effect was related to the efficacy and usefulness of caraway oil in traditional medicine for treating symbiosis which is associated with a number of gastrointestinal and systemic disorders.[42]

Precaution and adverse reactions:
No health hazards or side effects are known in conjunction with the proper administration of designated therapeutic dosage.

Dosage:
Mode of administration: Preparations from the essential oil are for internal use.

Daily dosage: The average single dose of oil is 2 to 3 drops on sugar. The average daily dose of oil is 3 to 6 drops.

Storage: Protect from light and moisture in glass or metal containers.

REFERENCES

[1] AK Sachan; NK Sachan; S Kumar; A Sachan; SS Gangwar, *European Journal of Scientific Research,* **2010**, 46(2), 194-203.
[2] J Sedlakov; B Kocourkova; V Kuban, *Czech. J Food Sci.*, **2001**, 19(1), 31-36.
[3] VV Sivarajan; I Balachandra. *Ayurvedic Drugs and their Plant Sources*, (Oxford and IBH Publication, New Delhi), **1994.**
[4] CP Khare. Springer Science and Business Media, LLC, **2007**, 124-125.
[5] Medicinal plants with usage, patents and their publications. http://medplants. blogspot.com/**2012**/05/carum-carvi-kalajirakrishnajeeraka.html
[6] E Guenther. The essential oils, 4th Edition, *Krieger Co. Inc*. NewYork, **1977**, 573-584.

[7] http://Plant data base.com.
[8] SM Khafagy; T.M. Sarg; NA Abdel Salam; O Gabr, *Pharmazi*, **1978**, 33, 296-7.
[9] J Kitazima; T Ishikawa; E Fujimatu; K Kondho; T Takayanagi, *Phytochemistry*, **2003**, 62, 115-20.
[10] J Kunzemann; K Herrmann, *Lebensm Unters Forsch*, **1977**, 164,194-200.
[11] T Matsumara; T Ishikawa; J Kitazima, *Phytochemistry*, **2002**, 61,455-459.
[12] T Matsumara; T Ishikawa; J Kitazima, *Chem Pharm Bull*, **2002** b, 50, 66-72.
[13] T Takayanagi; T Ishikawa; J Kitazima, *Phytochemistry*, **2003**, 63,479-84.
[14] A Najda; J Dyduch; N Brzozowski, *Veg Crops Res Bull*, **2008,** 68,127-33.
[15] Y Nakano; H Matsunaga; T Saita; M Mori; M Katano; H Okabe, *Biol Pharm Bull*, **1998**, 21, 257-61.
[16] U Zaman; A Abbasi, *Phytochemistry*, **2009**, 70, 979-87.
[17] BA Bataina; AO Maslat; MM Al-Kofahil, *J. Trace Elem. Med. Biol*., **2003**, 17, 85-90.
[18] A Maiga; D Diallo; R Bye; BS Paulsen, *J Agric Food Chem*., **2005,** 53, 2316–21.
[19] KSM Milan; H Dholakia; PK Tiku; P Vishveshwaraiah, *Food Chem.*, **2008**, 110, 678.
[20] F Toghrol; H Daneshpejouh, *J. Trop. Pediatr. Environ. Child Health*, **1974**, 20, 109–11.
[21] KU Pradeep; P Geervani, *Plant Foods Hum Nutr.*, **1993**, 44,137–48.
[22] T Matsumara; T Ishikawa; J Kitazima, *Phytochemistry*, **2002**, 61,455-459.
[23] J Kunzemann; K Hermann, *Unters Forsch*, 164, **1977**, 194-200.
[24] The Ayurvedic Pharmacopoeia of India, Part-1. Ministry of Health and Family Welfare, Department of AYUSH, Government of India.1; 48-49.
[25] Indian Standards, Spices and Condiments-Caraway Seeds-Specification, (First Revision). Bureau of Indian Standards, Manakbhavan, Bahadur Shah Zafarmarg, New delhi, **2011.**
[26] IT Vasil, *Israel Program for Scientific Translations, Jerusalem*, **1970,** 240.
[27] AF Hill. Economic Botany, The Maple Press, Pennsylvania, **1952**.
[28] R Chiej. Encyclopaedia of medicinal plants, MacDonald, Edinburgh, **1984**.
[29] JF Morton. Herbs and Spices, Golden Press, New York, **1976**, 42.
[30] N B Thippeswamy; A Naidu, *Eur Food Res Technol*., **2005**, 220, 472-476.
[31] G Ruberto; MT Baratta, *Food Chem.*, **2000**, 69, 167-174.
[32] G Singh; IP Kapoor; SK Pandey; UK Singh; RK Singh, *Phytother Res*., **2002**, 16, 680-82.
[33] BM Youssef; AA Hammad, *Egypt J. Microbiol*., **2010**, 29, 131-137.
[34] N Nalini; K Sabitha; P Vishwanathan; VP Menon, *J. Ethnopharmacol*., **1998**, 62, 15-24.
[35] N Nalini; V Manju; VP Menon, *J. Med Food*, **2006**, 9, 237-45.
[36] S Dhandapani; VR Subramanian; S Rajagopal; N Namasivayam, *Pharmacol Res*., **2002**, 46, 251-255.
[37] AG Jagtap; PB Patil, *Food Chem Toxicol*., **2010**, 48, 2030-2036.
[38] S Lahlou; A Tahraoui; Z Israili; B Lyoussi, *J. Ethnopharmacol.* **2007**, 110, 458-63.
[39] PS Chauhan; NK Satti; KA Suri; M Amina; S Bani, *Chem. Biol. Interac*., **2010,** 185, 66-72.
[40] A Haghparast; J Shams; A Khatibi; AM Alizaseh; M Kamalinejad, *Neurosci Lett.*, **2008**, 440, 134-139.
[41] T Malini; G Vanithakumari, *Indian J. Exp. Biol*., **1987**, 25, 442-444.
[42] J Thomson Coon; E Ernst, *Aliment Pharmacol Ther.*, **2002**, 16, 1689-99.