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Tabasum Fatima
Assistant Professor, Kashmir
Tibbiya College Hospital and
Research Centre, Srinagar,
Jammu and Kashmir, India

Farheena Iftikhar
PhD Scholar Division of Food
Science and Technology,
SKUAST Kashmir, Srinagar,
Jammu and Kashmir, India

Syed Zameer Hussain
Associate Professor, Division
of Food Science and
Technology, SKUAST
Kashmir, Srinagar, Jammu
and Kashmir, India

Pharmacological and medical screening of *Coriandrum sativum*

Tabasum Fatima, Farheena Iftikhar and Syed Zameer Hussain

Abstract

Coriandrum sativum commonly known as Dhanyaisa highly reputed ayurvedic medicinal tree, known for its distinct flavour when added to the foods. The different parts of this plant contain monoterpenes, α -pinene, limonene, γ -terpinene, p-cymene, borneol, citronellol, camphor, geraniol, coriandrin, dihydrocoriandrin, coriander oils A-E, flavonoids and essential oils which gives it importance on emphasizing its use in nutraceutical development for the prevention of chronic diseases such as CVD's, obesity and diabetes. Various parts of this plant such as seed, leaves, flower and fruit, possess diuretic, antioxidant Activity, ant-diabetic, anti-microbial activity, antimutagenic, anthelmintic activity. The present review was aimed to buttress the health benefits of coriander and draw further attention to the herbal plant.

Keywords: *Coriandrum sativum*, medicinal tree, health benefits, chronic diseases

Introduction

Coriandrum sativum (commonly used species) is a pre-historic annual herbaceous plant belonging to the Apiaceae family. The name is derived from the Greek Koris, meaning bedbug, because of the unpleasant, fetid, bug-like odour of the green herb and unripened fruits. However the ripe seeds have a distinctive sweet citrus/mint/musty aroma that has been commercially and traditionally valued over the centuries. Coriander fruits and leaves possess very peculiar and unique flavors, owing them an important role in different food flavours. This plant is a very ancient herb. It is mentioned in ancient Egyptian, Sanskrit, Greek and Latin writings. The ancient records reveal that coriander was used for both culinary and medicinal purposes. It was one of the substances utilized by Hippocrates, and other Greek physicians, for medicinal purposes. The Romans made coriander a popular spice, and introduced it to Great Britain. It was later brought to America, and was one of the first spices grown in New England and grows wild in Palestine. India is the biggest producer, consumer and exporter of coriander in the world with an annual production of around three lakh tonnes its fruits (commonly called 'seeds') are used for flavouring candies, in cookery, perfumery and beverages and in the tobacco industry.

Morphology

Coriander consists of dried ripe fruits and leaves of *Cori and rum sativum* Linn. A slender, soft, hairless, glabrous, branched, annual and a perennial herb growing to 50 centimeters tall. The stem is feeble, smooth and light green in colour. The leaves are compound, thin and alternate. Leaves are small herb having many branches, new leaves are oval but aerial leaves are elongated. Fruits are spherical about one centimeter in diameter with some longitudinal ridges. Flowers are white, having slightly brinjal like shades while Fruit are round in shape. (32, 33). The seeds/fruits have a lemony citrus flavor when crushed, due to terpenes linalool and pinene (26). *C. sativum* is approximately 30-100 cm in height, with glabrous, greatly divided, strong-smelling leaves. It contains an essential oil (0.03 to 2.6%) (35). All parts of this herb are in use as flavoring agent and/or as traditional remedies for the treatment of different dis-orders in the folk medicine systems of different civilizations (36).

Correspondence

Tabasum Fatima
Assistant Professor, Kashmir
Tibbiya College Hospital and
Research Centre, Srinagar,
Jammu and Kashmir, India

Nutritional Profile (26)

Nutrient (Per kg)	Coriander leaf	Coriander seed
Water	7.30g	8.86g
Protein	21.93g	12.37g
Total lipid(fat)	4.78g	17.77g
Carbohydrate	52.10g	54.99g
Total dietary fibre	10.40g	41.9g
Calcium	1246mg	709mg
Iron	42.46 mg	16.32mg
Magnesium	694mg	330mg
Phosphorus	481mg	409mg
Potassium	4466mg	1267mg
Sodium	211mg 35mg	211mg 35mg
Zinc	4.72mg	4.70 mg
Vitamin C	566.7 mg	21.0 mg
Thiamin	1.252 mg	0.239mg
Riboflavin	1.500 mg	0.290mg
Niacin	10.707 mg	2.130mg
Vitamin B ₁₂	0.00µg	0.00µg
Vitamin A, IU	5850 IU	0 IU
Fatty acids, total saturated	0.115g	0.990g
Fatty acids, total MUFA	2.232g	13.580g
Fatty acids, total PUFA	0.328g	1.750g

Phytochemical Profile

The seeds of coriander contain up to 1.8% volatile oil (27). Which on distillation yields 65 to 70% of (+)-linalool (coriandrol), depending on the source. Hence, the major active chemicals constituents of *Coriandrum sativum* are contained in its essential oils. Coriander also contains significant amounts of fatty acids constituents (28) and the content of which varies between 9.9 and 27.7%. The main essential fatty acids present in coriander include linoleic and linolenic acids. Lino lei cacids belong to PUFA (polyunsaturated fatty acid) group. Coriander oil contains Cori and rol, jireniol and vebriniol as the major constituents. Other minor components of coriander in cludes; Monoterpene hydrocarbons viz α - pinene, β - pinene, limonene, γ -terpinene, ρ -lymene, borneol, citronwillol, Xmphoe, Geraniol and Geranylacetate; Hetero-cyclic compounds viz-pyrazine, pyridine, thiazole, furan, tetra hydro furan derivatives; Is ocoumacinivzcoriandrin, dihydrocoriandrin, coriandrones A-E, glazonoids; Phthalidesviz-neochidilide, Z-digustilide; Phenolicacids and sterols, flavonoids (31).

Traditional Use

Earlier, coriander was among the world's leading essential oil plants [3]. The traditional uses of the plant, which are based on the primary products, i. e. the fruits and the green herb, are two-fold: medicinal and culinary. *C. Sativum* is a popular spice and is finely grounded to be a major ingredient of curry powder [1]. The fruits are used in the preparation of fish, meat and also for baking [10]. The seed has also been used to treat indigestion, worm infections, rheumatism, loss of appetite, convulsion, insomnia, anxiety and pain in the joints [1, 2, 4]. Coriander is used traditionally in Morocco as a diuretic plant [5]. In Iranian folk medicine, it has been recommended for relief of anxiety and insomnia [6]. It is widely used as folk medicine as carminative, spasmolytic, digestive and gala ctagogue; seed extract antimicrobial; used in lotions and shampoos; with castor oil useful in rheumatism [7, 8].

Pharmacological Use**Antidiabetic activity**

C. sativum showed significant hypoglycaemic action in rats fed with high cholesterol diet. The activity of glycogen phosphorylase and gluconeogenic enzymes revealed a decrease in the rate of glycogenolysis and gluconeogenesis. There was also an increased activity of glucose-6-phosphatedehydrogenase and glycolytic enzymes used glucose by the pentose phosphate pathway and glycolysis respectively [9]. Part of the antihyperglycemic action of *C. sativum* may be due to decreased glucose absorption *in vivo* [10].

Antioxidant Activity

The ethanol extract of *C. sativum* leaves is an excellent which is stable at high temperature and can serve as a substitute for synthetic antioxidants [11]. The aqueous extract of coriander seed inhibited peroxidised lipid-induced lysis (induced by FeSO₄-ascorbate, 10:100 µmol/system) by 72% in human erythrocyte membranes [12]. Extract of coriander seeds obtained with supercritical carbon dioxide in semi continuous lab-scale equipment with low density (0.60 g/mL) CO₂ and high density (0.73-0.83 g/mL) CO₂ (pressure from 116 to 280 bar and temperature from 311 to 331 K for the latter) exhibited significant activity in removing free radicals present in a methanol solution of DPPH in a manner which was comparable to those of commercial antioxidants [13].

Antimutagenicity Activity

Coriander played a protective role against the deleterious effects in lipid metabolism in experimental colon cancer induced by 1, 2-dimethyl hydrazine in rats [17]. The antimutagenicity of coriander juice against the mutagenicity of 4-nitro-o-phenylenediamine, m-phenylenediamine and 2-aminofluorene was investigated using the Ames reversion mutagenesis assay with the *S. Typhimurium* TA98 strain as the indicator organism. It was found that aqueous crude coriander juice significantly decreased the mutagenicity of metabolised amines. An aqueous juice of *C. Sativum* showed antimutagenic effect on the three tested amines, decreasing its mutagenic effect in a dose-dependent manner.

In the case of 4-nitro-phenylenediamine (NOP), an 83.21% in mutagenesis reduction was observed at the highest extract concentration, an 87.71% for m-PDA and a 92.43% for 2-AF [18].

Immunomodulatory Activity

The aqueous crude extracts of *C. sativum* stimulated the proliferation of human peripheral blood mononuclear cells (PBMC) and the secretion of IFN- γ at concentration between 50 and 200 µg/ml. The flavonoid rutin, coumarins bergapten and xanthotoxin modulate the secretion of IFN- γ but did not enhance the proliferation of human PBMC while the coumarin isopimpinellin, promoted the proliferation of PBMC but did not modulate the secretion of IFN- γ [19, 14].

Anthelmintic Activity

Crude aqueous and hydro-alcoholic extract of the seeds of *C. sativum* completely inhibited hatching of nematode eggs at concentration lower than 0.5 mg/mL with no statistically significant difference between both extracts. However, the hydroalcoholic extract showed better *in vitro*

activity against adult parasites than the aqueous one. Efficacy of anthelmintic activity *in vivo* was tested by faecal egg count reduction (FECR) and total worm count reduction (TWCR) in sheep artificially infected with *Haemonchus contortus* [20].

Antimicrobial Activity

Coriander oil strongly inhibited gram-positive bacteria (*Listeria monocytogenes* and *Staphylococcus aureus*) and *S. cerevisiae*, but had little effect on gram-negative bacteria (*Pseudomonas fragi*, *Escherichia coli*, *Salmonella typhimurium*) [21]. The essential oil of *C. sativum* showed antimicrobial activity, varying from 125 µg/ml (*C. Parapsilosis* CBS 604) to 500 µg/ml (*C. albicans* CBS 562), against most of the *Candida* species tested, except for *C. tropicalis* CBS94 [22]. This antimicrobial activity against bacteria and fungi has also been demonstrated in essential oils extracted from *C. Sativum* seed [23].

Anxiolytic Effect

The aqueous extract of *C. sativum* seed has anxiolytic effect and may have potential sedative and muscle relaxation effect. The aqueous extract (100 mg/kg, i. p.) showed an anxiolytic effect in male albino mice using the elevated plus-maze model by increasing the time spent on open arms and the percentage of open arm coordination. Furthermore, the aqueous extract (50, 100 and 500 mg/kg) significantly reduced spontaneous activity and neuromuscular coordination compared to the control group [6].

Anti-fungal Activity

Coriander oil did not have an effect on mycelial growth (*A. Parasiticus*) and did not affect the aflatoxin content of the fungus [25]. This antimicrobial activity against bacteria and fungi has also been demonstrated in essential oils extracted from *C. sativum* seed [23].

Hepato-protective activity

Hepatotoxicity is a common disease among people with long term consumption of alcohol amidst other causative hepatotoxins. Among the plant leaves that are highly hepatoprotective, curry and coriander leaves are mostly dominant which in turn regulates many diseases including hyperlipidemia, diabetes and hepatotoxicity. The bioactive compounds that are highly protective are of alkaloids, flavonoids and phenolic compounds. Coriander leaves are rich in these compounds found to be highly hepatoprotective.

Aflatoxin Control

The inhibitory effects of the essential oils of coriander on the mycelial growth and ochratoxin A production by *A. ochraceus* NRRL 3174 were studied by Basilico and Basilico [34].

Conclusion

From the early times, herbs and spices are processed in foods and used for seasoning as well as to increase shelf life of food and to restore health. Coriander (*Coriander sativum* L.). Is one of the miraculous, peculiar herb that functions as both, spice as well as herbal medicine. The plant can be grown throughout the year and is processed to increase food palatability, profitability and facilitate international trade. The leaves and fruits are highly fragrant and contain

nutrients like fat, proteins, vitamins minerals etc. Its health benefits activities ranging from antibacterial to anticancer activities. Most important and well characterized property of coriander is its use as antioxidant. Coriander also possesses hypoglycemic, hypolipidemic, antibacterial, antimutagenic activity, insecticidal and aflatoxin controlling effects. Besides, coriander also possesses many other traditional health benefits. The healing properties of coriander can be attributed to its exceptional phytonutrient content. Considering these potentials, coriander biomolecules possess a tremendous future in the health-related industry. Due to its multifunctional uses and protective and preventive action against various chronic diseases, this herb is rightly called as "herb of happiness".

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