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An Update on Pharmacological Properties of Cumin

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ABSTRACT

Cumin commonly known as Jeera commonly used in the house hold work as spice. *Cumin*(*Cuminum cyminum*) is a flowering plant in the family Apiaceae It is an ancient spice which history dates back to use in Egypt used by Greeks, references in middle age Europe. It is usually used both as whole seed or ground in any curry dish which makes it one of the most important of all Indian spices and as flavouring agent. Despite of its flavouring property, cumin has been found to possess various pharmacological activities such as antimicrobial, antidaibetic, antiepileptic antifertility, anticancer, antioxidant and Immunomodulatory due to the presence of various chemical constituents 2.5 to 4.5% volatile oil, 10% fixed oil and proteins, volatile oil mainly consists of 30 to 50% cuminaldehyde, small quantities of a-pinene, b-pinene, phellandrene, cuminic alcohol, hydrated cuminaldehyde and hydro cuminine which make it suitable for medicinal purpose. It is also used an appetite stimulant and thought to relieve stomach disorders such as diarrhea and dysentery. Hence, in this review we are highlighting the important therapeutic and medicinal properties of cumin seeds so that various researches can be carried out to explore its medicinal potential.

KEYWORDS: Jeera, medicinal properties, flavouring agent, antimicrobial, antidaibetic, antiepileptic.

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1. INTRODUCTION

Cumin (*Cuminum cyminum*), a small annual herbaceous plant that is a member of the aromatic plant family (Umbelliferae). It is a native of the Eastern Mediterranean countries and Upper Egypt, but is now cultivated in Morocco, Iran, Turkey, India, China and the Americas. The seeds of the plant are used to add flavour to spicy dishes. They are also used as an appetite stimulant and to ease several stomach disorders.¹ Its micronutrients include about 1.4 mg iron, 38 mg potassium and 8 mg magnesium. Magnesium serves a host of functions, including promoting heart health, controlling blood pressure and aiding the absorption of calcium.² Cumin seeds has been found to possess essential oils such as cuminaldehyde (4-isopropylbenzaldehyde), pyrazines, 2-methoxy-3-sec-butylpyrazine, 2 ethoxy-3-isopropylpyrazine, and 2-methoxy-3-methylpyrazine.³ Moreover, Cumin seeds contain possess numerous phyto-chemicals that are known to have antioxidant, carminative and anti-flatulent properties. The active principles in the cumin may increase the motility of the gastro-intestinal tract as well as increase the digestion power by increasing gastro-intestinal enzyme secretions. This spice is an

excellent source of minerals like iron, copper, calcium, potassium, manganese, selenium, zinc and magnesium. It also contains very good amounts of B-complex vitamins such as thiamin, vitamin B-6, niacin, riboflavin, and other vital anti-oxidant vitamins like vitamin E, vitamin A and vitamin C. The seeds are also rich source of many flavonoid phenolic anti-oxidants such as carotenes, zeaxanthin, and lutein.³

2. DESCRIPTION OF THE PLANT

A small, slender, herbaceous annual, of the umbelliferae family. It have 25 cm height, and tend to hang down under its own weight. It has blue-green linear leaves and are finely separated. The white or pink flowers are borne in small compound umbels. Cumin is grown from seed. A hot climate is ideal, but it can be grown in cooler regions if started under glass in spring. Sandy soil is most excellent; when the seedlings have hardened, transplant carefully to a sunny aspect, planting out 15cm (6 in) apart. The plants bloom in June and July. The seeds are normally ready four months after planting. Cut the plants when the seeds turn to brown, thresh and dry like the other Umbelliferae.⁴

Other Names:

Indian	jeera, jeraka, jira, zeera, zira, sufaid..., safed...(white), kala...(black), kalonji
German	Kreuzkümmel, Romische Kümmel
Spanish	comino
French	cumin
Italian	cumino
Arabic	kammun, kemouyn
Indonesian	(d)jinten
Malay	jintan puteh
Sinhalese	cheeregum, jeera, su(du)duru
Tamil	cheeregum

In traditional herbal medicine, cumin is used as a diuretic and to treat stomach upset and flatulence. It is thought to promote a healthy digestive system. Cumin stimulates menstruation, and also can be added to gargles to treat laryngitis. Poultices of cumin are used to treat swellings of the breasts or testicles. In Ayurvedic medicine, cumin with ghee is smoked to relieve hiccups. According to the Bible, cumin was so valuable that it could be used in the place of money when it came time to tithe in church.” Cumin seeds were highly honored as a culinary seasoning in both ancient Greek and Roman kitchens.⁵ Cumin's popularity was partly due to the fact that its peppery flavor made it a viable replacement for black pepper, which was very expensive and hard to come by. Cumin was also noted for both its medicinal and cosmetic properties.⁶⁻⁹

Cumin seeds contain up to 5% of a volatile oil composed primarily of aldehydes (up to 60%). In addition, the seeds yield about 22% fats, numerous free amino acids, and a variety of flavonoid glycosides, including derivatives of apigenin and luteolin.¹⁰⁻¹⁴ The cuminaldehyde content varies considerably, depending on the source of the oil (fresh vs ground seeds). Fine grinding of the seed can result in the loss of up to 50% of the volatile oil, 10 with the greatest loss occurring within 1 hour of milling. Monoterpene hydrocarbons are another major component of the oil; sesquiterpenes are minor constituents.^{12,13} The chief components of the characteristic aroma of unheated whole seeds are 3p-menthen-7al and cuminaldehyde in combination with other related aldehydes. Cumin also contains safrole, a mutagen, which is degraded by cooking.¹⁵

3. PHARMACOLOGICAL PROPERTIES OF CUMIN

3.1 Anti-microbial

Cumin contain fatty oil (mainly petroselic acid and oil acid) and has an antimicrobial effect. A powder suspension of the cumin has diverse inhibitory effects; it inhibits mycelium growth, toxin production or Alfa-toxin production in *Aspergillus ochraceus*, *C. versicolor*, and *C. flavus*.¹ Numbers of investigations have shown the antimicrobial activity of cumin (oils as well as their aqueous and solvent derived extracts). The antibacterial action was assessed against a range of useful and pathogenic gram-positive and gram-negative bacterial strain.¹⁶⁻²⁰ 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. This property was attributed to cuminaldehyde, carvone, limonene and linalool, whereas limonene, eugenol, -pinene and some other minor constituents have been suggested to contribute to the antimicrobial activity of cumin

oil.²¹ Antifungal activity of cumin is recorded against soil, food, animal and human pathogens, including dermatophytes, *Vibrio* spp., yeasts, aflatoxins and mycotoxin producers.^{18,22-24}

3.2 Anti-diabetic

Oral administration of Cumin for 6 weeks to diabetic rats resulted in significant reduction in blood glucose and body weight. Cumin supplementation was found to be more effective than glibenclamide in the treatment of diabetes mellitus.²⁵⁻²⁶ In a glucose tolerance test conducted in rabbits, cumin significantly increased the area under the glucose tolerance curve and hyperglycaemic peak.²⁷ Methanolic extract of cumin seeds reduced the blood glucose and inhibited glycosylated haemoglobin, creatinine, blood urea nitrogen and improved serum insulin and glycogen (liver and skeletal muscle) content in alloxan and streptozotocin (STZ) diabetic rats.²⁸ Another study shown that, an aqueous extract of cumin prevented glycation of total soluble protein, α -crystallin, and delayed the progression and maturation of STZ-induced cataract in rats.²⁹ Eight-week sub-acute administration of cumin to STZ-diabetic rats reduced hyperglycemia and glucosuria accompanied by an improvement in body weight, blood urea and reduced excretion of urea and creatinine. Oral administration of cumin also showed hypoglycemic effect in normal rabbit, resulting in significant decrease in the area under the glucose tolerance curve.²⁷ The pharmacologically active constituent of cumin seed oil was characterized as cuminaldehyde which inhibited aldose reductase and alpha-glucosidase isolated from rat.³¹ Hyperlipidemia is an associated complication of diabetes mellitus. Oral administration of cumin to alloxan diabetic rats reduced body weight, plasma and tissue cholesterol, phospholipids, free fatty acids and triglycerides. Histological observations demonstrated significant decrease in fatty changes and inflammatory cell infiltrates in diabetic rat pancreas. Cumin suppressed alcohol and thermally oxidized oil induced hyperlipidemia. It decreased aspartate transaminase (AST), alkaline phosphatase (ALP) and γ -glutamyl transferase (GGT) activities and decreased the tissue (liver and kidney) levels of cholesterol, triglycerides and phospholipids and prevented the changes in the composition of fatty acids in the plasma of rats administered with alcohol and/or thermally oxidized oil. Cumin added to hypercholesterolemic diet decreased serum and liver cholesterol in rats.³²

3.3 Anti-cancer

The cancer chemo preventive potential of cumin seed could be attributed to its ability to alter carcinogen metabolism.³³ Current studies has shown that cumin seeds have also anti-carcinogenic properties. In laboratory tests, the seed was revealed to reduce the risk of stomach and liver tumours in

animals. The detoxification and chemo-preventive properties increase secretion of anti-carcinogenic enzymes from the glands. The anti-oxidants like Eugenol and limonene present in Cumin have strong anti-tumor properties. Recent research has also publicized that cumin may prevent the growth of breast and colon cancer cells.³⁴ In independent studies, dietary supplementation of both cumin was found to prevent the occurrence of rat colon cancer induced by a colon-specific carcinogen, 1,2-dimethylhydrazine (DMH). In cumin receiving animals, no colon 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 cumin-treated rats, the levels of cholesterol, cholesterol/phospholipid ratio and 3-methylglutaryl COA reductase activity were reduced.³⁵⁻³⁶ Dietary cumin inhibited benzopyrene-induced forestomach tumorigenesis, 3-methylcholanthrene induced uterine cervix tumorigenesis, and 3-methyl-4-dimethylaminoazobenzene induced hepatomas in mice. This was attributed to the ability of cumin in modulating carcinogen metabolism via carcinogen/xenobiotic metabolizing phase I and phase II enzymes. Activities of cytochrome (CYP) P-450 reductase and CYP b5 reductase were augmented, whereas phase II enzymes GST and DT-diaphorase were increased.³⁷⁻³⁸

3.4 Anti-oxidant

Cumin (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 radicals, 1,1-diphenyl-2-picrylhydrazyl (DPPH) radicals and lipid peroxides. The other assays employed were ferric thiocyanate method in linoleic acid system, Fe^{2+} ascorbate-induced rat liver microsomal lipid peroxidation (LPO), soybean lipoxygenase dependent lipid peroxidation and ferric reducing ability.³⁹⁻⁴⁴ The cumin oil exhibited high antioxidant activity which has been attributed largely to thresence of monoterpene alcohols, , flavonoids and other polyphenolic compounds.⁴⁰

3.5 Anti-osteoporotic

Cumin seeds are reported to be estrogenic. The presence of phytoestrogens in cumin has been shown and also related to its anti-osteoporotic effects. In the animals receiving a methanolic extract of cumin, a significant reduction in urinary calcium excretion and augmentation of calcium content and mechanical strength of bones was found. Animals showed greater bone and ash densities and improved microarchitecture, with no adverse effects like body weight gain and weight of atrophic uterus.⁴⁵

3.6 Immunomodulatory

Large quantity of iron, presence of essential oils and vitamin-C & vitamin-A in cumin boosts up our immune system. . In restraint stress-induced 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. Recent study shown that, oral treatment with cumin showed immunomodulatory 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-A induced immune-suppressed mice.⁴⁶

3.7 Gastrointestinal Disorders

Cumin is extremely good for digestion and related problems. The very smell (aroma) of it, which comes from an aromatic organic compound called Cuminaldehyde, the main component of its essential oil, activates our salivary glands in our mouth (the mouth watering flavor), facilitating the primary digestion of the food.⁵⁶ Next is Thymol, a compound present in cumin, which does same to the glands which secrete acids, bile and enzymes responsible for complete digestion of the food in the stomach and the intestines, due to its Stimulating properties. Cumin is also Carminative i.e. relieves from you from gastroubles and thereby improves digestion and appetite. Due to its essential oils, magnesium and sodium content, it promotes digestion and also gives relief in stomach-ache when taken with hot water (like aqua ptycotis and mint).²⁵ Perfusion of an aqueous extract of cumin via the stomach of pentobarbitone-anesthetized rats under the aspirin-induced gastric mucosal injury showed an increased acid secretion by a cholinergic mechanism.⁴⁷ Aqueous and solvent derived extracts of cumin increased amylase, protease, lipase and phytase activities.⁴¹

3.8 Central Nervous system

Current study shows that in animals by tail flick method, administration of cumin oil suppressed the development and expression of morphine tolerance. 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.^{48,49} Anti-epileptic activity of cumin oil is predictable. It decreased the frequency of spontaneous activity induced by pentylenetetrazol (PTZ). This protection was measured in a time- and concentration-dependent manner as increased duration, decreased amplitude of hyperpolarization potential, the peak and firing rate of action potential and excitability of nerve cells.⁵⁰ Cumin oil was found to attenuate seizures induced by maximal electroshock and PTZ in mice.⁵¹ Cumin oil has also been found to possess significant analgesic action in a chemical model (formalin test) of nociception in rat.⁵² Cuminaldehyde was found to be a tyrosinase inhibitor and prevented the oxidation of l-3,5-dihydroxyphenylalanine (l-DOPA).⁵³ The adaptogenic and antistress activity of an aqueous extract of caraway is documented in normal and stress induced rats (forced swim stress test) which was related to its antioxidant property.⁵⁴ Antiepileptic effects: In garden snails, extracellular application of the essential oil of *C. cyminum* 1% and 3% dramatically reduced epileptic activity induced by pentylenetetrazol by decreasing the firing rate of F1 neuronal cells, causing a significant depolarization in the resting membrane potential and reducing the amplitude of after hyperpolarization potential as well as increasing the duration.

3.9 Anti-asthmatics

Cumin has caffeine and other essential oils that act as a decongestant. Presence of caffeine (the stimulating agent), the abundantly aromatic essential oils (the disinfectants) formulate cumin an ideal anti congestive grouping for those suffering from respiratory disorders such as Asthma, Bronchitis etc.⁵⁷⁻⁵⁸

3.10 Skin Disorders & boils

Cumin has vitamin-E in large quantity. Vitamin-E is good for skin and keeps the skin young and gleaming. So, cumin helps to treat skin problems. The essential oils present in this have disinfectant and anti fungal properties. This prevents any microbial and fungal infection from affecting the skin. Cumin can also be applied topically and is said to be a good salve for boils. Make a black cumin paste by grinding seeds with water and apply to the affected area. It can also be applied topically to help heal boils and other skin problems. Taken regularly components such as Cuminaldehyde, Thymol, phosphorus etc. are good de-toxicants which help in the regular removal of toxins from body, through the excretory system. Externally applied as paste cumin helps to treat

skin problems such as psoriasis, eczema and dry skin. It can help you get rid of burn marks and wrinkles too. If you are troubled with acne or boils try applying vinegar with ground cumin seeds. Cumin, applied topically as paste, may help fight against boils, rashes, pim-ples, acne and other skin problems.⁵⁵

3.11 Ophthalmic effects

Cumin may delay the development of cataracts as demonstrated in diabetic rats. An aqueous extract of cumin delayed progression and maturation of streptozotocin-induced cataracts in rats by preventing glycation of total soluble protein and alpha-crystallin in the lenses.⁵⁷

3.12 Miscellaneous Action

- Cumin is rich in iron and thus very good for lactating mothers as well as women who are undergoing menses or who are pregnant, since they are more in need of iron than others. Moreover, cumin also help ease and increase secretion of milk in lactating women due to presence of Thymol, which tends to increase secretions from glands, including milk which is a secretion from mammary glands. It is more beneficial if taken with honey. Cumin has remarkable amount of calcium (above 900 mg per 100 grams) which accounts to over 90% of our daily requirement of calcium. This calcium is an important constituent of milk and hence cumin is very good for lactating mothers.⁵⁷
- The essential oils present in cumin act as disinfectants and antiviral effect. Cold is a viral infection which affects the body frequently when immune system goes weak. The antiseptic properties of cumin can also help fight the flu by boosting your immune system. Cumin also prevents cough formation in the respiratory system as it is supposed to be hot and dries up the excess mucus. Cumin is rich in iron and has considerable amount of vitamin-C, which are essential for a good immunity and keeps infections away. Thus cumin is effective in cold.⁵⁶
- Cumin is a stimulant as well as a relaxant at the same time. This property cannot be attributed to a single component alone, just as causes of insomnia cannot be attributed to a single cause. But studies show that a proper intake of vitamins (particularly B-complex) and a good digestion help induce a sound sleep. Cumin helps both of these. Some of the components of the essential oil are hypnotic in nature and have tranquilizing effects.

- Cumin is very rich in iron (above 66 mg. in each 100 grams) which is more than 5 times the daily requirement of iron for an adult. This iron is the main constituent of haemoglobin in the red blood corpuscles of blood. It is haemoglobin which transfers oxygen (as oxide of iron) to the body-cells and whose deficiency causes anaemia. So, cumin can be a nutritious additive to daily diet for anaemic people. ⁵⁶

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