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REVIEW ARTICLE

# Health Benefits of Cumin in Foods: A Review

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## Abstract

Spices are parts of plants that are used in flavoring food and beverages, preservatives, and medications because of their phytochemicals or secondary metabolites. Cumin is a natural fragmented medicinal herb that is prepared from dried seeds of *Cuminum cyminum L.* plants belonging to the Apiaceae family. Cumin is used as a traditional healing material and has been used for a long time in many parts of the world to treat a variety of ailments. Cumin has proven to have a number of health benefits when it comes to preventing and treating a variety of diseases, including cancer, aging, metabolic, neurological, cardiovascular, and inflammatory diseases. Cumin has long been known to provide health advantages since it possesses the chemicals like phenylpropanoids, terpenes, flavonoids, and anthocyanins. People in India are using cumin to treat conditions ranging from indigestion and diarrhea to headaches. Recent research has shown that cumin is a beneficial herb with therapeutic characteristics and can be employed in the preparation of several medically significant foods. It has antimicrobial activity and adds alkaline value to the food.

## Introduction

People have been using spices for countless years in food preparation and preservation as well as for embalming in areas where they are native. Spices were ideal for treating a number of diseases due to their beneficial medicinal properties. Ayurveda says that spices help to keep the body's pH balanced [1]. In addition to these, spices have been used to affect the physical appearance of food and impart characteristic flavor due to their specific aroma. For instance, turmeric, cumin, and pepper improved the taste, color, and flavour of food, and also used for several health benefits. Even these spices, also used to support the spleen, pancreas and protect against sore throats, help in improving digestion [2]. Spices constitute vital bio-nutrients for both nutrients supplements and meal components. From ancient times, spices have been used as food ingredients to enhance the flavor and taste of food [3]. The spice trade economy was so crucial for several nations that they took repeated costly expeditions to find out and raid spice-growing countries. Christopher Columbus undertook hazardous voyages to establish the routes to trading ports of spice-growing countries and discovered the sea route to India.

The word "cumin" comes from the Latin *Cuminum*, which itself originates from the Greek "kyminon". In India, cumin is commonly known as jeera or zeera [4,5], with its botanical name *Cuminum cyminum* belonging to the family Apiaceae. Cumin originated from East Mediterranean to

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South Asia. Ayurveda claims that cumin seeds have immense medicinal properties, and is especially used in digestive disorders [6]. In India, cumin was used in ancient Ayurvedic medicine to treat gastrointestinal disorders, diarrhea, and jaundice [7]. It has also been used to treat diseases like hypertension, epilepsy, fever, pediatric illnesses, gynecological issues, and respiratory issues [8]. The traditional Indian medical system made extensive use of cumin to treat a variety of disorders. Cumin is largely utilized in food and medicine, and India produces 70% of the world's production [9], Syria, Turkey, UAE, and Iran are the other cumin-producing countries. Cumin is cultivated in most areas of the world for its medicinal benefits [10]. The current researches reveal that the active component in cumin may function in various ways, such as reducing oxidative stress and suppressing the expression of inflammatory markers, regulating signaling pathways that control cell death, and changing hormone levels in the blood [11].

In 2017, Dubey S [12] suggested that cumin is a great source of iron and helps to keep the immune system strong. Boiled water with cumin seeds is beneficial for dysentery disease [13]. The seeds of cumin are used to improve immune and digestive system, prevent allergies and help fight nasal congestion, and possess antioxidant, anti-diabetic, memory enhancer, brain functionality properties, and is anti-cancerous, remove acne and reduce hair fall (Figure 1). It is an aromatic spice and helps in clotting wounds. It is used in the treatment of gastrointestinal disorders such as food poising, typhoid, vomiting, short bowel syndrome, cardiovascular disease, pulmonary disorders and as a cough remedy, as well as pain reliver [14].

The essential oil of cumin seeds showed antibacterial activity against *Klebsiella pneumonia, Bacillus subtilis and Escherichia coli* [15]. Larger amounts of cumin as food additives during fermentation for prolonged preservation of foods, their sustainability, toxicity, and microbiological safety need to be assessed afresh [16,17].

Black cumin (*Nigella sativa*) belongs to the family Ranunculaceae and is also classified as a medicinal plant because of its very high content of various phytochemicals that determine their medicinal properties, such as anti-inflammatory, anti-allergic, anti-cancer, hypoglycemic, antioxidant, hypotensive, lipid-lowering, and immunomodulatory [18], but it is less commonly used and is not popular as *Cuminum cyminun*.

## Chemical Compositions

Cumin seeds contained 1.8-4.9% volatile oil, 18-19% protein, 56-61% carbohydrates, various phenolic compounds, vitamins, and minerals [19]. Cuminaldehyde (4-isopropyl benzaldehyde) is an important component of essential oils that also contain p-cymene, -terpinene, -pinene, and p-mentha-1,3-dien 7-al and other useful compounds, with concentrations changing greatly depending on the plant's place of origin, mode of growth, harvesting, and extraction [20]. Kocoglu E, et al. [21] developed an oval biorefinery approach and applied to cumin seed (*Cuminum cyminum*) as a potential source

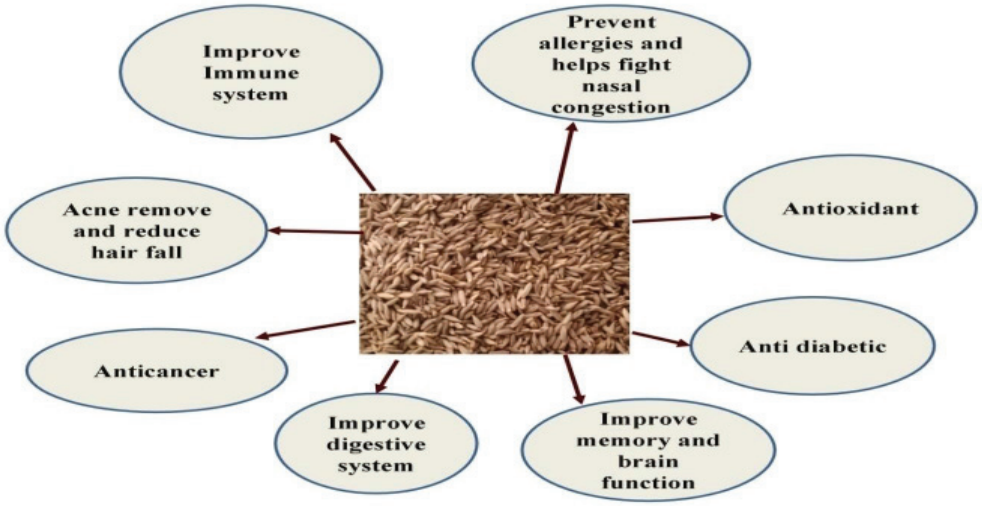


**Figure 1** Common biomedical uses of cumin.

of phytochemicals of interest [22]. Cumin is a popular spice that is widely used for its unique aroma [23], rich in vegetables and essential oils.

The disinfectant approach of four different geographic origins *i.e.* Lebanon, France, Algeria, and Syria of cumin seed oil yield and quality was studied, and to first examine their nutrient content and biological activity [24] and found that it is highly active against *Listeria monocytogenes, Staphylococcus aureus,* and *Enterococcus faecalis*. Samples from all different origins exhibited antimicrobial activities.

## Nutrients Present in Cumin Seeds

Several phytochemicals like alkaloids, flavonoids, and terpenoids including p-cymene, -terpinene, -pinene, and p-mentha-1, 3-dien 7-al, are present in cumin seeds that have several health benefits [3]. These are used to flavor foods, remove fat and include nutrients, fiber, sugar, protein, phenol, and flavonoids [25]. The nutritional value and sensory quality of foods are significantly affected by food oxidation due to the formation of ketones, quinones, phenols, carboxylic acids, aldehydes, and anhydrides that cause unpleasant taste [26]. Cumin seeds contain important valuable functional nutrients like protein, minerals, dietary fiber, and phytochemicals [27]. Black cumin (*Nigella sativa*) also contains high nutritional value, minerals, protein, and soluble sugar content [20].

Kaur G, et al. [28] performed volatile compound composition analysis of cumin seeds from India and Bangladesh and found that Bangladeshi cumin seeds contained p-cymene (36.35%), thymoquinone (29.77%), α-thujen (12.40%), carvacrol (2.85%), β-pinene (2.41%), it was limonene (1.64%), methyl linoleate (1.33%), and sabinene (1.18%), accounting for 87.93% of all essential oils while Indian cumin seeds contained volatile compounds i.e. p-cymene (41.80%), α-thujene (13.93%), thymoquinone (10.27%), methyl inoleate (4.02%), carvacrol (3.65%), β-pinene (2.96%), d-limonene (2.11%), 4,5-epoxy-1-isopropyl-4-methyl-1-cyclohexene (1.80%), sabinene (1.50%), and 4-terpineol (1.22%) [29]. Consequently, Bangladeshi cumin seeds contained almost three times more thymoquinone compared to Indian seeds. Kaur G, et al. [28] suggested that Bangladeshi cumin seeds contain more terpene ketones (29.86%), represented by thymoquinone, compared to Indian seeds (10.61%). On the other hand, Indian seeds contained more terpene hydrocarbons (63.18%), mainly p-cymene, compared to Bangladeshi seeds (54.53%) [30]. It suggests that the agro-climatic conditions of different locations influence the biochemical compositions of cumin seeds not only in quality but also in quantity. Figure 2 shows the structure of biochemical present in cumin while various groups of phytochemicals are shown in Figure and nutrients with their applications are summarized in table 1.

## General Health Benefits

Cumin possesses natural antimicrobial properties that are present that are used to heal wounds [3]. The cumin seeds are excellent for digestive problems and influence anti-carcinogenic properties, reduce the risk of intestinal and liver tumours, activate the pancreatic enzymes *i.e.* lipases, amylases, and proteases, which break down sugar, fat, and starch as well as help in the digestive system and strengthen the immune system [31]. Cumin is also helpful in carpal tunnel syndrome, relieves in gastrointestinal problems, soothes an upset stomach, and relive in urine problems [8]. Yimer EM, et al. [32] found that cumin seeds were utilized for many centuries by different civilizations around the world to treat a variety of animal and human diseases.

In cumin, the main active compounds are thymoquinone that are used to be medicated in a variety of chronic diseases, including neurological treatment, psychiatric, cardiovascular, cancer, diabetes, inflammatory diseases, and infertility [33]. Numerous researches showed that it is very effective against different types of diseases caused by bacteria, fungi, parasites and including viruses.

The promising efficacy of black cumin (*N. sativa*) against Human Immunodeficiency Virus (HIV) that lead to Acquired Immune Deficiency Syndrome (AIDS), is also known. It was also used as an alternative treatment option during COVID-19 after demonstrating full medicinal treatment as well as the powerful antioxidant properties of this valuable cumin seeds that recently attracted the attention for its potential role as a dietary supplement with minimal side effects [34]. When used, their effects are synergistic, resulting in optimized efficacy and minimal and/or non-toxic doses of concomitant medications. A number of pharmaceutical and biological properties are attributed to cumin seeds. Akhzari, et al. [35] found cumin seeds and their oil as a functional food with high dietary supplement

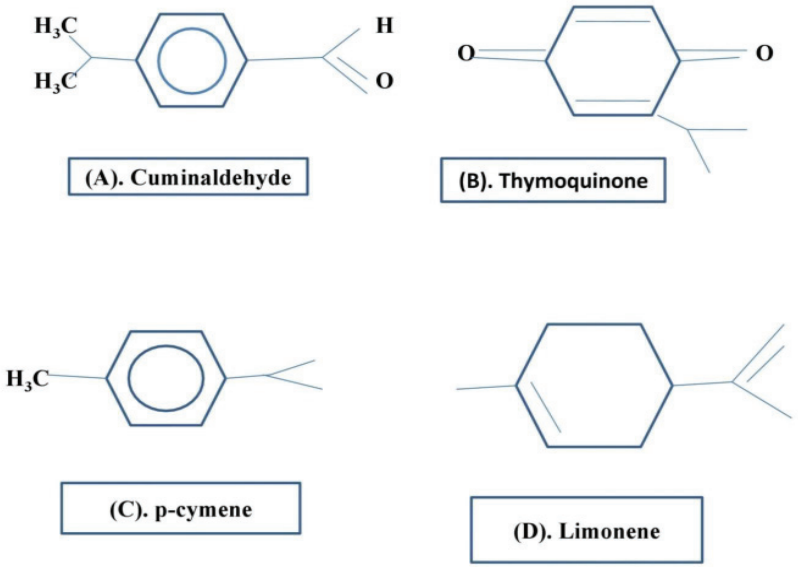


**Figure 2** Chemistry of major components of cumin A). Cuminaldehyde B). Thymoquinine C). p-cymene D). Limonene.

**Table 1:** Representative types of nutrients with example, their applications and nutritional values.

| Nutrients | Example | Application | Nutrient Value |
|---|---|---|---|
| Minerals | Iron | Red Blood Cell formation | 66.63 mg |
| | Copper | Red Blood Cell production | 0.85 mg |
| | Calcium | Bones and teeth formation | 92 mg |
| | Manganese | Formation connective tissue, bones, blood clotting factors and sex-hormones | 3.34 mg |
| | Zinc | Help body in immune system to properly work | 4.6 mg |
| Electrolytes | Potassium | Help to maintain normal levels of fluid inside cell | 67 mg |
| | Sodium | Conduct nerve impulses, contract and relax muscles and maintain the proper balance of water and minerals | 1698 mg |
| Vitamins | B(complex) | Antioxidant | 0.69 mg |
| | Thiamin Riboflavin | Antioxidant | 0.38 mg |
| | Niacin | Antioxidant | 4.56 mg |
| | Pyridoxine | Antioxidant | 0.439 mg |
| | Folic acid | Antioxidant | 10 µg |
| | E | Antioxidant | 3.9 mg |
| | C | Antioxidant | 7.1 mg |
| | A | Antioxidants | 1280 IU |
| | K | Antioxidants | 5.9 µg |
| Phytonutrient | Carotenes | Antioxidant | 788 µg |
| | Lutein | Antioxidant | 482 µg |
| Others | Energy | | 392 Kcal |
| | Carobhyrate | | 46.1 g |
| | Protein | | 18.6 g |
| | Fat | | 23.19 g |
| | Fibers | | 10.8 g |

potential, as well as traditional medicinal and biological principles of the general health benefits of cumin seeds (Figure 4).

## Anti-osteoporotic and rheumatoid arthritis

In cumin phytoestrogen are present which are helpful to prevent osteoporotic and arthritis [36]. In animal treated with a methanol extract of cumin, a considerable reduction in urinary calcium excretion was found that improved calcium content boosting the mechanical strength of bones [22]. Due to the health-promoting qualities of its bioactive

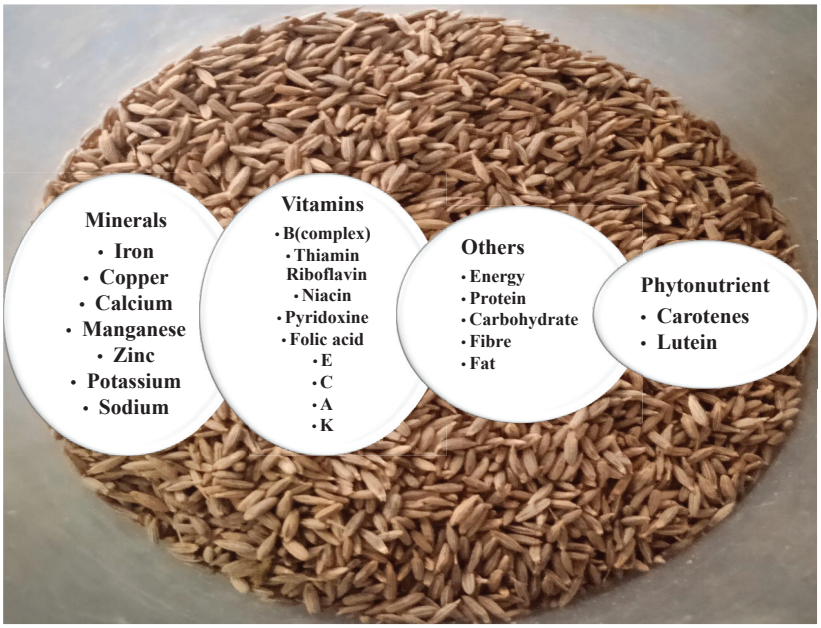


**Figure 3** Major phytochemicals present in cumin.

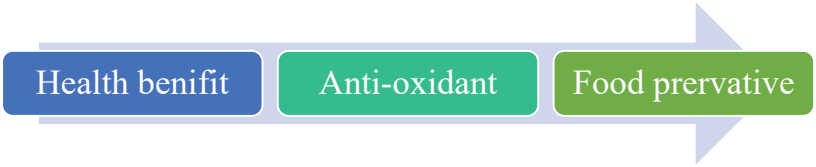


**Figure 4** Show general benefits of cumin seed.

components, clinical research suggests that cumin seed may help to treat autoimmune disorders such as rheumatoid arthritis [37]. Animals demonstrated better micro architecture, stronger bone and ash densities, and no negative side effects, such obesity and uterus atrophic weight [38] when treated with cumin seeds.

## Anti-diabetic

Cumin's anti-diabetic properties have a long history of research. It was discovered that oral administration of cumin to healthy rabbits was observed to have a hypoglycemic effect that significantly decreased the hyperglycemic peak area under the glucose tolerance curve [39]. The natural active substance *i.e.* cumin aldehyde suppressed aldose reductase and α-glucosidase in isolated rabbit's cells [25]. Cumin was given orally to rabbit with alloxan diabetes to minimize hyperlipidemia, body weight, and plasma and tissue levels of cholesterol, phospholipids, free fatty acids, and triglycerides, additionally reduced glutamyl transferase activity, alkaline phosphatase, and tissue (liver and kidney) cholesterol levels [3]. The beneficial effects of green synthesis of silver nanoparticles utilizing cumin extract have been studied by various workers [40-43] with albino rats using biochemical indicator for diabetes, inflammation and antioxidant biomarkers. Brain histopathology was also performed and it was the results revealed considerable glucose increases, AGEs (Advanced Glycation End Products) and aldose reductase as well reduced insulin in the diabetic neuropathy-induced category in comparison with the healthy control category. Inflammatory markers were considerably enhanced with the diabetic neuropathy group [35]. Additionally a marked change in oxidation level was observed in the same group, a significant reduction in nitrotyrosine amount was observed [26]. In terms of gene expression, they observed significantly decrease regulation of brain TKr A in the diabetic neuropathy group in comparison with healthy controls, associated by increase regulation for nerve growth factor therefore numerous treatments for diabetic neuropathy significantly enhanced all biomarkers researched [31]. However, green synthesis of silver nanoparticles along with cumin

extract may be a potential neuroprotective substance against inflammation and oxidative stress, which characterizes diabetic neuropathy by antidiabetic, anti-inflammatory, and antioxidant properties [44].

## Lactation

Despite the fact that beneficial effect of breastfeeding are self-evident, they are also being increasingly investigated [45]. Benefits include breast milk's higher nutritional composition, lowering the incidence of feeding intolerance and necrotizing enter colitis in premature babies, improved immunity to infectious diseases [46]. There are considerable physiological advantages of breast feeding for both mother and infant [47]. Lactating mothers, menstruating women, and pregnant women need high iron rich food, as compared to other women [48]. Iron is more necessary for growing children, teenagers, pregnant women, and nursing moms. Additionally, it is observed that cumin helps nursing mothers produce more milk [31]. Taken cumin with honey is more effective [13]. Cumin contained a significant amount of calcium approx 900 mg/100 g, accounting for over 90% of the calcium content [3].

## Antioxidant

Cumin contained mono-terpene alcohols, alkaloids, flavonoids, and other poly-phenolic molecules that have strong antioxidant activity [8]. Black cumin seeds' antioxidant capabilities are specifically responsible for their health benefits [49]. Black cumin, a potential supplier of natural antioxidants, increases the activity of antioxidant molecules including glutathione and superoxide dismutase [50], and reduced the levels of reactive oxygen species [25]. The ability of these compounds to significantly suppress hydroxyl radicals, 1,1-Diphenyl-2-Picrylhydrazyl (DPPH) radicals, and lipid peroxides are evident [51]. The linoleic acid system's ferric thiocyanate method, rat liver microsomal Lipid Peroxidation (LPO) triggered by $Fe^{2+}$ ascorbate, soybean lipoxygenase-dependent lipid peroxidation, and ferric reducing potential prove its antioxidant activity [32].

The major part of the presence of flavonoids, monoterpene alcohols, linalool, carvacrol, anethole, andestragol,aswellasotherpolyphenoliccomponents, cumin oil displayed excellent antioxidant activity [34]. The antiradical profile of cumin has been suggested as the underlying mechanism for its numerous medicinal properties, including antimicrobial, antidiabetic, anticarcinogenic/antimutagenic, antistress, and antiulcerogenic [52]. The analgesic properties of cumin oil showed acute inflammation, however, therapies with cumin oil exhibited its antioxidant effects by reducing malondialdehyde and oxidized glutathione and increasing hydrogen-donating capacity [34]. It is also shown that cumin oil provides significant anti-inflammatory, analgesic, and antioxidant activities [53].

## Skin disorders

The skin benefits from vitamin E, which is essential for appearing young and healthy, is also abundant in cumin [3]. Cumin oils contained antimicrobial and hygienic characteristics that protect the skin from microbial infections [49]. The ability to scavenge free radicals and reduce melanogenesis were both key factors in the skin-whitening effect [54]. The activity of skin whitening evaluated through scavenger assay, cell viability assay, cellular tyrosinase assay cell-free fungal tyrosinase assay, and melanin content used by B16F10 murine melanoma cells and the findings revealed that the monophenolase and diphenolase activities of fungal tyrosinase were both inhibited by the cumin extract at different concentrations [36]. Using diphenolase it was demonstrated that cumin extract was a mixed reversible inhibitor, with an identified suppression constant of 0.62 mg/ml [44]. It reduced melanin production and activity of cellular tyrosinase in B16F10 melanoma cells with minimal cytotoxicity, furthermore, cumin extract shows a powerful scavenging effect on DPPH, hydroxyl, as well as superoxide anion radicals [55], and it is strongly suggested that cumin is a promising skin-lightening ingredient for the cosmetics sector [46].

## Anti-cancer effects

In independent investigations, it was discovered that adding cumin to the diet could stop rats from developing colon cancer after being exposed to the colon-specific carcinogen 1,2-Dimethylhydrazine (DMH) [35]. Animals consuming cumin showed no signs of colon tumors. The excretion of fecal bile acids and neutral sterols beneficially increased, and cumin showed nourish the colon and reduced the activity of mucinase enzymes and β-glucuronidase [56]. β-glucuronidase rise hydrolysis of glucuronide compound and liberate toxin whereas the rise in mucinase activity may enhance the hydrolysis of the colon's protecting mucins [57]. Histopathology analysis revealed that decreased infiltration into the submucosa, lesser papillae, and fewer changes

in the cytoplasma cell in the cumin treated colon [46]. A rat was treated by cumin, the cholesterol level decrease, phospholipids ratio reduced, as well as 3-methylglutaryl COA-reductase activity was decreased [36]. Dietary cumin prevented the formation of tumor, uterine cervix tumor induced by 3-methylcholanthrene as well 3-methyl-4-dimethyaminoazobenzene induced hepatomas in mice [58]. This was associated with cumin's capacity in modulating carcinogenic metabolic activity *via* xenobiotic metabolizing to phase I and phase II enzymes [59]. Phase II enzymes GST and DT-diaphorase levels were high, while activity of cytochrome (CYP) P-450 reductase and CYP b5 reductase were elevated [14]. In cumin, monoterpenes such as anethofuran, carvone, and limonene occurred which are helpful in anticarcinogenic action [60]. Numerous researches have indicated the anti-cancerous, activity of cumin to its feasible apoptotic antimutagenic and antiproliferative characterstics [18,49,61,62].

### Antimicrobial

A multiple researches have shown that cumin have potential of antimicrobial properties either from cumin oil or cumin extract aqueous as well as solvent derived [4,17,54]. Antimicrobial activity was tested for a number of significant and harmful Gram-positive and Gram-negative strains of bacteria [55,63]. The application of cumin seeds (either oil or solvent extract) prevented the growth of *Klebsiella pneumonia, Bacillus subtilis*, *Escherichia coli*, *Haemophilus influenzae*, *H. catarrhalis*, and *Streptococcus pneumoniae* and their clinical isolates, and helpful to improve cell morphology [64], capsule expression and reduce urease property [12]. This characteristic was attributed to cuminaldehyde [65]. The presence of limonene, eugenol, pinene, along with certain additional minor components have been proposed to possess the antimicrobial properties of cumin oil [66]. Cumin oil has been shown to have antifungal properties against soil [67], food borne pathogens [60], human and animal pathogens [36] such as dermatophytes such as *Microsporum*, *Trichophyton*, and *Epidermophyton* [23], *Vibrio cholera*, *V. parahaemolyticus and V. vulnificus* [20], including fungus such as yeasts and fungal metabolites like aflatoxins and mycotoxin [68].

## Conclusion

There are numerous health advantages of using cumin seeds as additives in foods that impart aroma and flavour to food and improve the immune system, contribute to the prevent microbial diseases, prevent cancer, blood sugar and improve cholesterol level, diabetes and cardiovascular disease. Cumin is generally considered to be safe to use, with no evidence of side effects. It is also helpful during pregnancy, lactation, and it prevents obesity, facilitate food preservation, as well as anti-diabetics to prevent hypoglycemia.

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### Conflicts of Interest

The authors declare no conflict of interest.

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