A REVIEW STUDY ON ANTIOXIDANT POTENTIAL AND HEALTH BENEFITS OF CUMIN

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ABSTRACT

Cumin (Cuminumcyminum) is a significant and popular spice locally called as 'zeera' that is utilized for culinary purpose owing to its unique fragrant impact. Cumin is a classic and widely used spice from Middle Ages since it was a symbol of love and loyalty. Cumin (Cuminumcyminum) seeds are derived from the plant Cuminumcyminum, native from East Mediterranean to South Asia belonging to the family Apiaceae-a part of the parsley family. The proximate analysis of the cumin seeds shows that they include fixed oil, volatile oils, acids, essential oils, protein and other components. Cumin includes several essential components such as pinene, cymene, terpinene, cuminaldehyde, oleoresin, thymol and others that have proven their effectiveness against different illnesses. It is a vital source of energy, boosts immune system, provides protection against various illnesses. The total phenolic content of methanolic extracts of various cumin types (cumin, black cumin and bitter cumin) vary from 4.1 to 53.6 mg/g dry weight. In this thorough study, emphasis is on the nutritional, antioxidant and pharmacological characteristics of cumin.

KEYWORDS: *Antioxidant potential, Cumin, Cuminumcyminum, health benefits, Seed.*

1. INTRODUCTION

Spices have been recognized for centuries as excellent medicinal food. The ability of spices to impart biological activity is currently slowly reemerging as an area of study for human health. The seed spices form an important category of agricultural commodities and have a major role in our national economy. The crops covered as main seed spices are coriander, cumin, fennel and fenugreek, while ajowan, dill (sowa), celery, nigella (kalonji), caraway (siahjeera) and anise form small group of seed spices. Cumin seeds are oblong and yellow-grey. Cumin seeds are widely utilized in many cuisines of many diverse culinary cultures from ancient times, in both whole and powdered forms. In India, cumin seeds have been utilized for thousands of years as a traditional component of countless meals like kormas and soups and also constitute an ingredient of many other spice mixes. Besides culinary usage, it has also numerous uses in traditional medicine. In the Ayurvedic system of medicine in India, cumin seeds have great therapeutic potential, especially for digestive problems[1]–[5].

They are used in persistent diarrhoea and dyspepsia. Black seed is an annual flowering plant belonging to the family Ranunculaceae and is a native of Southern Europe, North Africa, and Southwest Asia. Black cumin is grown in the Middle Eastern Mediterranean area, Southern Europe, Northern India, Pakistan, Syria, Turkey, Iran, and Saudi Arabia. Nigella sativa seeds and their oil have a long history of folkloric use in Indian and Arabian culture as food and medicinal. The seeds of N. sativa have a strong bitter flavor and fragrance and are used as a spice in Indian and widely in Middle Eastern cuisines. The dry-roasted nigella seeds spice curries, veggies, and legumes. Black seeds are used in cuisine as a flavor ingredient in breads and pickles. It is also utilized as an ingredient of the spice combination (panchphoron) and also independently of various dishes in Bengali cuisine. Cumin was historically employed as a preservative in mummification in the ancient Egyptian culture. Black cumin has a long history of usage as medicine in the Indian traditional system of medicine like Unani and Ayurveda[6].

Cumin (Cuminumcyminum) is a flowering plant in the family Apiaceae, native from the east Mediterranean to East India. In India cumin is known in as ‘jeera’ or ‘jira’ while in Iran it is called ‘zira’. Indonesians call it ‘jintan’ (or jinten) and in China it is called ‘ziran’ while in Pakistan it is known as ‘zeera’. Cumin is a herbaceous annual plant, having a thin branching stem 20-30 cm tall. The leaves are 510 cm long, pinnate or bipinnate, thread-like leaflets. The blooms are tiny, white or pink, and borne in umbels. The fruit is a lateral fusiform or oval achene 4-5 mmlong, bearing a single seed. Cumin seeds are similar to fennel and anise seeds in appearance, but are smaller and darker in color. The English cumin was obtained from the French cumin, which was acquired indirectly from Arabic ‘Kammon’ through Spanish ‘comino’ during the Arab reign in Spain in the 15th century. The spice is native to Arabic speaking Syria where cumin flourishes in its hot and dry regions[7]–[10].

1.1.Nutrition:

Cumin seeds are nutritionally dense; they offer significant quantities of oil (particularly monounsaturated fat), protein, and dietary fibre. Vitamins B and E and many nutritional elements, particularly iron, are also significant in cumin seeds. Cuminaldehyde, cymene, and terpenoids are the main volatile components of Cumin has a unique strong taste. Its pleasant fragrance is attributable to its essential oil concentration. Its major component of fragrance molecules arecuminaldehyde and cumin alcohol.

1.2.Cumin essential oil contents:

The most significant chemical component of cumin fruits is essential oil content, ranging from 2.5 percent to 4.5 percent which is pale to colorless depending on age and geographical differences. The ripe seeds of cumin are utilized for essential oil manufacturing, whether as whole seeds or coarsely crushed seeds. If readily alcoholsoluble oil is needed, the entire seed must be utilized. Hydro distillation is used for essential oil extraction, yielding a colorless or light yellow oily liquid with a distinct dour. The yield for oil production ranges from 2.5 to 4.5 percent, depending on whether the whole seed or the coarsely crushed seed is distilled. In a research, the essential oil content of cumin seeds after exposing them to heating by microwaves and traditional roasting at various temperatures was examined. The circumstances were standardized in both approaches. The volatile oils distilled from these samples were examined by GC and GC-MS. The findings revealed that the microwave-heated samples exhibited greater preservation of distinctive taste components, such as aldehydes, than did the traditionally roasted samples.

A total of 19 components were discovered through direct similarity searches for cumin oil. This number was expanded to 49 components, with the assistance of chemo metric techniques. Major components in cumin include gamma-terpinene (15.82 percent), 2methyl-3-phenyl-propanal (32.27 percent) and myrtenal (11.64 percent). (11.64 percent). In addition to volatile oil cumin also includes nonvolatile chemical components like tannins, oleoresin, mucilage, gum, protein compounds and malates. The oleoresins are produced by exposing the ground cumin to various organic solvents such as nhexane, ethanol, methanol etc. The extract obtained is then treated to rotational evaporation to remove the solvent. The micro encapsulations of cumin oleoresin by spray drying utilizing gum arabic, maltodextrin, and modified starch and their ternary blends as wall materials for its encapsulation efficiency and stability under storage. The microcapsules were tested for the content and stability of volatiles, and total cuminaldehyde, γ-terpinene and p-cymene content for six weeks.

1.3.Antioxidative properties of cumin:

Cumin has also been investigated for its antioxidative effects. The total phenolic content of methanolic extracts of various cumin types (cumin, black cumin and bitter cumin) varied from 4.1 to 53.6 mg/g dry weight. Cumin (Cuminumcyminum) methanol extract was discovered to have a total phenolic content of 9 mg/g dry weight. It has been also demonstrated that the methanolic extracts of cumin exhibit greater antioxidant activity compared with that of the aqueous extract. In another research the antioxidant activity and the phenolic components of 26 spice extracts including cumin was evaluated. Antioxidant activity was reported as TEAC (mmol of trolox/100 g of dry weight). Cumin exhibited a value of 6.61 mmol of trolox/ 100 g of dry weight whereas the total phenolic content of cumin was 0.23g of gallic acid equivalent/ 100 g of dry weight.

The antioxidant activity of cumin (Cuminumcyminum) has been evaluated on Fe^{2+} ascorbate induced rat liver microsomal lipid peroxidation, soybean lipoxygenase dependent lipid peroxidation and 1, 1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging techniques. The total phenolic content of methanolic extract of cumin was 9 mg/ g dry weight. IC_{50} values of the methanolic extract of cumin seeds were 1.72±0.02, 0.52±0.01 and 0.16±0.30 on the lipoxygenase dependent lipid peroxidation system, the DPPH radical scavenging system and the rat liver microsomal lipid peroxidation system, respectively. The results also revealed that cumin is a strong antioxidant capable of scavenging hydroxy, peroxy and DPPH free radicals and therefore prevents radical mediated lipid peroxidation. In another research the antioxidant activity and the phenolic components of 26 spice extracts including cumin was evaluated. Antioxidant activity was reported as TEAC (mmol of trolox/100 g of dry weight). Cumin exhibited a value of 6.61 mmol of trolox/ 100 g of dry weight whereas the total phenolic content of cumin was 0.23g of gallic acid equivalent/ 100 g of dry weight.

1.4.Digestive Stimulant Action:

In the context of cumin seeds being claimed in home remedies and traditional medicine, to help digestion, an animal research has investigated if they have any stimulatory impact on the digestive enzymes. The effect of cumin seeds on the digestive enzymes of the rat pancreas and intestinal mucosa has especially been studied as a consequence of both continuous food consumption and single oral administration. Dietary (1.25 percent) cumin reduced the activity of pancreatic lipase, while the activitiesof pancreatic trypsin, chymotrypsin, and amylase were substantially increased by the same. When administered as asingle oral dosage, cumin exhibited a decreasing impact on pancreatic lipase, amylase, trypsin, and chymotrypsin. Among the terminal digestive enzymes, a modest intestine maltase activity was substantially increased in mice fed with cumin, while lactase and sucrose were unaffected.

Dietary cumin had a strong stimulatory impact on bile flow rate, the amount of increase in bile volume being 25 per cent, while its single oral dosage did not have any influence on bile secretion rate. Dietary consumption of cumin had a significant effect on bile acid production (amount secreted per unit time), bile acid secretion being as high as 70 per cent above the control. Similar substantial increases in bile acid secretion were observed in the case of cumin when given as a single oral dosage. Since bile juice provides a major contribution to the entire process of digestion and absorption, primarily by providing bile acids needed for micelle production, it is anticipated that cumin, which has a digestive stimulant effect, may do so by boosting biliary secretion of bile acids. Another research has investigated if this digestive stimulant spice cumin similarly influences the length of residency of food in the gastrointestinal system of experimental rats. Cumin caused a substantial reduction of the food transit time by 25 per cent. The decrease in food transit time caused by dietary cumin approximately corresponds with their positive effect either on digestive enzymes or bile secretion.

1.5.Cardio-protective influence through hypolipidemic and hypotensive effects:

Cuminumcyminumis historically used for the treatment of dyspepsia and hypertension. The anti-hypertensive efficacy of aqueous extract of cumin seed and its involvement in arterial endothelial nitric oxide synthase production, inflammation, and oxidative stress have been investigated in renal hypertensive rats. Cumin given orally (200 mg/kg body) for 9 weeks increased plasma nitric oxide and decreased the systolic blood pressure in hypertensive rats. This was followed by the up-regulation of the expression of inducible nitric oxide synthase (iNOS), Bcl-2, TRX1, and TRXR1 and down regulation of the expression of Bax, TNF-α, and IL-6. These results indicate that cumin seeds enhance endothelial functioning and alleviate inflammatory and oxidative stress in hypertensive rats Gastro protective Effect

The anti-ulcer potential of N. sativa aqueous suspension on stomach ulcers experimentally produced with different unpleasant chemicals (indomethacin, 80 percent ethanol, and 0.2 M NaOH) in Wistar rats was investigated. Nigella sativa substantially reduced stomach ulcer development caused by necrotizing agents by significantly refilling the decreased gastric wall mucus content and gastric mucosal nonprotein sulfhydryl concentration. The antiulcer effect of N. sativa was exerted via its antioxidant and anti-secretary properties. Both N. sativa (2.5 and 5.0 ml/kg, p. o.) and TQ (5, 20, 50, and 100 mg/kg, p. o.) were shown to exhibit gastro-protective effect against stomach mucosal damage caused by ischemia or reperfusion in Westar rats. Lipid peroxidation and lactate dehydrogenize, elevated by the ischemia or reperfusion insult and decreased glutathione and activity of SOD accompanied by an increased formation of gastric lesions, were countered by N. sativa or TQ treatment, indicating their gastro protective effect, probably by conservation of the gastric mucosal redox state.

1.6.Pulmonary-protective activity and anti-asthmatic effects:

Nigella sativa has been studied for the potential therapeutic effects on experimental lung damage in rats following pulmonary aspiration and discovered that N. sativa therapy suppresses the inflammatory pulmonary responses. Nigella sativa treatment resulted in a substantial decrease in the activity of iNOS and an increase in surfactant protein D in the lung tissue of various pulmonary aspiration models. It is concluded that N. sativa therapy may be helpful in lung damage that warrants prospective therapeutic application. The ameliorative effect of N. sativa oil in rats with hyperoxiainduced lung damage has also been observed.

1.7.Chemo Preventive Effects:

Cancer chemo preventive potentials of dietary 2.5 and 5.0 per cent cumin were tested against benzo (α) pyrene-induced carcinogenesis in forestomach and 3-methylcholanthrene (MCA)-induced tumorigenesis in uterine cervix in mice. Cumin caused a substantial suppression of stomach tumour. The impact on carcinogen/ xenobiotic metabolizing phase I and phase II enzymes, antioxidant enzymes, and lipid peroxidation in the liver was also investigated. Cytochrome P450 and cytochrome b5 were substantially increased bydietary cumin. The phase II enzyme glutathione-S-transferase (GST) was enhanced by cumin, while the specific activity of superoxide dismutase (SOD) and catalase were substantially raised. Lipid peroxidation was reduced by cumin, indicating that the cancer chemo preventive effect of cumin may be related to its capacity to regulate carcinogen metabolism. The anti-cancer activity of N. sativa has extensively been investigated in various in vitro and in vivo settings.

Nigella sativa is ableto exhibit antioxidant, anti-mutagenic, cytotoxic, proapoptotic, antiproliferative, and anti-metastatic actions in different primary cancercells and cancer cell lines. The existing results clearly indicate that N. sativa may serve as an effectiveagent to reduce cancer start, development, and metastasis alone or in conjunction with standard chemotherapeutic medicines. Nigella sativa extract ameliorated the benz (α-) pyreneinduced carcinogenesis in the forestomach in mice. This is partially due to the capacity to affect phase II enzymes. Orally given N. sativa oil (14 weeks) interfered with the development of aberrant crypt foci (ACF) by 1, 2-dimethylhydrazine, suspected preneoplastic lesions for colon cancer in rats. This inhibition may be linked, in part, with the reduction of cell growth in the intestinal mucosa. Nigella sativa aqueous solution substantially reduced gastric ulcer development experimentally generated by necrotizing agents and also considerably ameliorated the severity of ulcer and gastric acid production in pylorus-ligated Shay rats.

2. DISCUSSION

The immunomodulatory characteristics of N. sativa and its main active component, TQ in terms of its experimentally proven abilityto influence cellular and humoral adaptive immune responses have thoroughly been examined. The molecular and cellular processes underpinning such immunomodulatory actions of N. sativa and TQ are emphasized, and the signal transduction pathways involved in the immunoregulatory activities are proposed. Experimental data indicates that N. sativa extracts and TQ may therapeutically be used in the control of immunological responses in infectious and noninfectious diseases such as allergies, autoimmune, and cancer. The potential immunomodulatory effects of aqueous extract of N. sativa investigated in BALB/c mice and C57/BL6 primary cells with respect to splenocyte proliferation, macrophage function, and anti-tumor activity demonstrated that N. sativa significantly enhancesplenocyte proliferation in a dose-responsive manner.

3. CONCLUSION

The overall assessment of this review indicates that cumin has a strong antioxidant potential. The essential oils contained in this spice have strong antioxidant activity and its nonvolatile extracts also have excellent inhibitory capabilities against the free radicals. Multiple research performed in the past decades confirm its health positive benefits especially in diabetes, dyslipidemia, hypertension, respiratory disorders, inflammatory illnesses, and cancer. These seeds also exhibit immune stimulatory, gastro protective, hepatoprotective, nephroprotective, and neuroprotective properties. Therefore, this research indicates that cumin in addition to its function as a taste ingredient, has excellent antioxidant potential and has numerous associated health advantages as well.

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