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REVIEW ARTICLE

# Phytochemistry and Pharmacological review: *Nigella sativa*

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## ABSTRACT

Habba-tul-barka or Black cumin seeds (*Nigella sativa*) belongs to the family Ranunculaceae. It is an important seeds due to its nutritional and medicinal properties. *N. sativa* is widely distributed worldwide and, therefore, has a broad genetic diversity, resulting in differences in their phytochemical composition. The scientific community has focused on the positive health effects of *N. sativa* as a whole, but the different varieties have rarely been compared according to their bioactive compounds and bioactivity. This review aims to provide a holistic overview of the current knowledge on the bioactivity of *N. sativa*. This review intends to provide a general and organized overview of the accumulated knowledge on *N. sativa*, identify the most bioactive varieties, their potential consumption pathways, and provide knowledge on the present gaps to guide future research.

**Keywords:** Anti-cancer, *Nigella sativa,* Thymoquinone.

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## INTRODUCTION

Medicinal plants have been used to cure diseases for many centuries in different indigenous systems of medicine and folk medicines. Moreover, medicinal plants are also used to prepare herbal medicines as they are considered safe compared to modern allopathic medicines. Many researchers are focusing on medicinal plants since only a few plant species have been thoroughly investigated for their medicinal properties, potential, mechanism of action, safety evaluation, and toxicological studies.

The seeds of *N. sativa* and their oil have been widely used for centuries to treat various ailments throughout the world. And it is an important drug in the Indian traditional system of medicine like Unani and Ayurveda.[1-2] Among Muslims, it is considered one of the greatest forms of healing medicine available. It was mentioned that black seed is the remedy for all diseases except death in one of the Prophetic hadiths. It is also recommended for use regularly in Tibb-e-Nabwi (Prophetic Medicine).[3]

*N. sativa* has been extensively studied for its biological activities and therapeutic potential and shown to possess a wide spectrum of activities *viz.* as a diuretic, antihypertensive, antidiabetic, anticancer and immunomodulatory, analgesic, antimicrobial, anthelmintics, analgesics and anti-inflammatory, spasmolytic, bronchodilator, gastroprotective, hepatoprotective, renal protective and antioxidant properties. The seeds of *N. sativa* are widely used to treat various diseases like bronchitis, asthma, diarrhea, rheumatism, and skin disorders. It is also used as a liver tonic, digestive, anti-diarrheal, appetite stimulant, and emmenagogue to increase milk production in nursing mothers to fight parasitic infections and support the immune system.[4-8] Most of the therapeutic properties of this plant are due to the presence of Thymoquinone (TQ), a major active chemical component of the essential oil. Black seeds are also used in food like flavoring additive in bread and pickles because it has very low level of toxicity.[9]

*Synonyms:* Nutmeg flower, Black caraway, Black cummin, Bishops wort, Small fennel flower.

### Vernacular Name

English: Fennel flower, fitches

Arabic: Habba-tul-barka, habba-tus-sauda

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Hindi: kala-jira, ,kalonji, kulangj
Kannada: kare-jirage, karejeerage
Malayalam: karinchirakam, karincirakam
Marathi: kalongji, kalonjee
Sanskrit: ajaji, aranyajeeraka
Tamil: Aciyacirakam, aciyacirakam, aciyam.
Telugu: Nallajeelakarra, nalla-jilakara,
Urdu; kalonji, kalonji, gandana
Used In: Ayurveda, Folk, Unani and Sidha.

**Habitat**

It is a wild plant found in southern Europe, north Africa, minor parts of Asia, and the Mediterranean region.It is also cultivated in various parts of Saudi Arabia, northern Africa, and UAE.

*Part Used:* Seeds and seed oil

**Morphological Characteristic**[7-8]

*Medicinal Uses*

*N. sativa* seeds were used for centuries as traditional medicine for treating various diseases.[14] The seeds are used for treating cough, influenza, eczema, flatulence, jaundice, dyspepsia, inflammation, amenorrhea, anorexia paralysis, antihypertensive, antidiabetic, anticancer and immunomodulatory, analgesic, antimicrobial, anthelmintics, analgesics and anti-inflammatory, spasmolytic, bronchodilator, gastroprotective, hepatoprotective, renal protective and antioxidant properties.[1-5]

The other medicinal properties are represented in Figure 3.

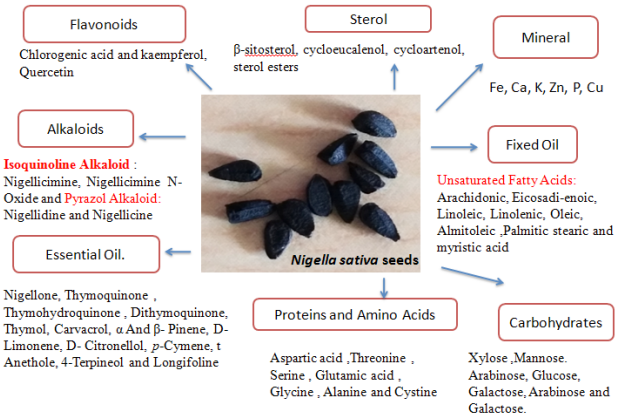


**Figure 2:** Showing the Chemical constituents present in *N. Sativa.* [9-16]

**Figure 1:** *Nigella sativa* seeds

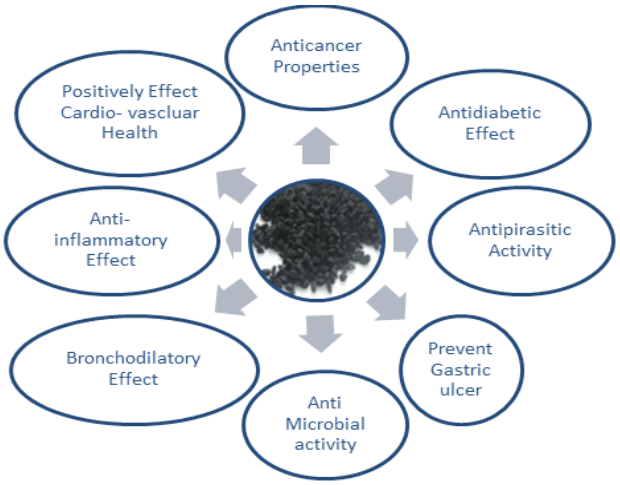


**Figure 3:** Various medical properties of *N. sativa* seeds

**Table 1:** Macroscopic characteristics of *Nigella Sativa* seeds

| *Properties* | *Observations* |
|---|---|
| Shape | Peer shaped curvey ends that are flatter on one side and convex on the other side |
| Colour | Black color with light grey shade |
| Size | 3.9 cm in length<br>2.3 cm width |
| Flavor | Metallic taste.on crushing gives a sharp pepper aroma |

**Pharmacological Activity**

*Anticancer Activity*

The anticancer activity of seeds is by the action of Thymoquinone that follows various methodologies to block the cancer cell activity.[16-21]

*Wound Healing Activity*

Seed extract at 500 mg/kg, compared with different formulations polyethyleneglycol 10%w/w ointment base, Placentrex gel and Povidone iodine on Excision and incision wound healing models; the extract was found to show mean wound healing time of 2.52 days compared to 4.58 days with Control, 2.82 days with Placentrex gel and 3.6 days with Povidone-iodine in Excision and incision.[22-25]

A study on comparing the efficiency of *Nigella sativa* and silver sulfadiazine (SSD) on treating burns in rats for 14 days show that applications of NS and SSD cream are equally effective in healing the burns related skin wounds in the rat.[26]

**Gastroprotective Effect**

Gastroprotective effect of *Nigella sativa* Seeds against Aspirin-Induced Gastric Ulcer, N. sativa oil extracts at 50mg/kg for 5 days compared with Esomeprazole + Clarithromycin. Oral administration of these extracts displayed noteworthy gastric protection as the ulcerated areas were reduced. Histological observations proved that less edema and leucocytes infiltration were observed compared to an ulcer control group that displayed severe gastric mucosal injuries.[27]

The effects of *Nigella sativa* on gastroprotective activity in rats, a dose of 2 and 5mg *N. sativa* reduces the secretion of gastric acid that is stimulated by bethanechol.[28]

*Nigella sativa* on indomethacin (20 mg/kg SC) induced gastric ulcers and basal gastric secretions. At a dose

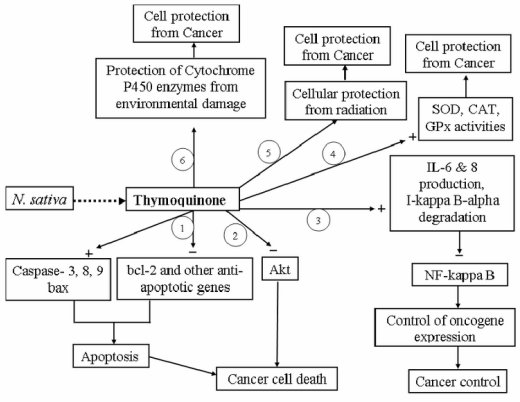


**Figure 4:** Anticancer mechanism of *N. sativa* seeds

of Nigella sativa 50, 100, and 200mg/kg s.creducethe gastric juices, acidity, acid output and pepsin amount in dosage-dependent possesses gastroprotective activity.[29-31]

*Antidiabetic Activity*

The NS oil, when co-administrated with metformin, resulted in improved diabetic regulation and diabetes-induced subfertility in male rats.[32]

*Anti-stress Activity*

The NS decreased blood glucose, cholesterol, triglyceride, and the weight of organs. A decrease in WBC count and lymphocytes was observed.[33]

*Hepatoprotective Activity*

The study on $CCl_4$ induced liver damage in male rats. Show that animals treated with *N. sativa* displayed normal hepatocytes with no inflammation. The study shows that olive oil and *Nigella sativa* oil possess protective effects against hepatotoxicity, with Ns oil being more effecient[146]. In addition, the liver tissues of animals treated with *Nigella sativa* oil displayed regular hepatocytes with no confirmation of inflammation.[34-35]

*Antibacterial Activity*

*Nigella sativa* oil was analyzed for antibacterial activity against multidrug-resistant isolates of Staphylococcus auras in different amounts. The oil displayed distinct dosage-dependent antibacterial activity with 200 mg/ml, 400 mg/ml and 800 mg/mL sensitivity.[36]

Antimicrobial activity of methanolic and aqueous extracts of *Nigella sativa* on oil on bacteria was tested, and results show that antibacterial activity of methanolic extracts is superior against GPBs.[37]

*The NS* extracts in various solvents were tested for antibacterial activity on diabetic foot ulcers. And results indicate that the Gram-negative bacteria were found to be more than the occurrence of Gram-positive bacteria.[38]

*Antioxidant Activity*

The antioxidant properties of Nigella sativa against the DPPH radical has been evaluated by spectrophotometry. The results show an antioxidant power with an IC50 of 0.056 mg/ml. This activity is mainly due to the combined action of various endogenous antioxidants contained in the essential oil.[39]

N-hexane extract unsaponifiable fraction (UF) of Nigella sativa(NS) oil in vitro antioxidant property, DPPH and H2O2 radicals scavenging tests, and lipid peroxidation inhibition capacity assay. All tests were realized by the spectrophotometric method. UF has the strongest Lipid

peroxidation inhibition capacity. With a percentage inhibition of 57.5%.[40]

References and further reading may be available for this article. To view references and further reading you must purchase this article.

**Effect in Kidney Calculi**

Ethanolic extract of *NS* seeds on ethylene glycol induced calcium oxalate kidney calculi in rats, showed a momentous decline in the number of calcium oxalate deposits, and increased urine on 14 and 30 days. Hence *Nigella sativa* is found to be useful in treating kidney calculi in rats.[41]

*Anti Tissue Activity*

The anti tussive activity of NS seeds reduced the cough in animals. The antitussive effect of these components were analyzed d by pretreatment provide that Thymoquinone (present in NS oil )posses antitussive activity.[42]

*Hypolipidemic Activity*

Animals supplemented with *NS* displayed noteworthy lessening of TC and LDL cholesterol and an increase in HDL cholesterol.[43]

A high fat diet with metabolic *supplements* reduced TG and LDL cholesterol and raised HDL cholesterol levels when compared to standard atorvastatin induced animal group.[44]

*Anti-ischemic Activity*

The anti-ischemic effect *N S* extracts showed significantly reduced neural cell injuries in rat hippocampus CA1 and CA3 regions. These results show that *N.Sativa* seed extracts might possess a therapeutic effect against cerebral ischemia.[45]

*Nephroprotective Activity*

The protective effects of NS oil Di methyl nitrosamine (DMN) induced nephrotoxicity in rats were superior.

The NS extracts of hexane on gentamicin-induced nephrotoxicity in rats showed enhanced renal cortical histology suggesting that the extract effected in ameliorating the signs of nephrotoxicity.[46]

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