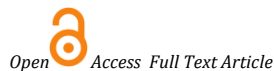


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Review Article

A Comprehensive review of *Nigella sativa* (kalonji) from the Unani perspective

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Abstract



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The remarkable therapeutic properties of *Nigella sativa*, often known as black seed or kalonji are well recognized. The use of *N. sativa* seeds and its oil has a long history in various traditional food and medical systems. As stated by the holy prophet of Islam (PBUH), *Shoneez* is important since it can cure all diseases with the exception of death. It is widely used in several conventional medical systems, including Unani Tibb, Chinese medicine, Ayurveda, and Siddha.

The goal of the current review is to provide a thorough overview of the literature on scientific studies of the pharmacognostical properties, chemical makeup, and pharmacological activity of the seeds of this plant.

The data was collected from various reputed data bases like PubMed, Science direct, Web of Scienes, Google Scholar and Research Gate. The traditional and Unani literature was also searched from the classical books of Greco-Arab medicine in addition to other digital sources.

According to traditional Unani literature, *N. sativa* exhibits a variety of pharmacological properties, including those that are carminative, anti-inflammatory, analgesic, diuretic, emmenagogue, galactagogue, and expectorant. Numerous phytochemical, pharmaceutical, and clinical studies have been conducted on *N. sativa*, revealing its potential anti-diabetic, anti-cancer, immunomodulator, analgesic, antimicrobial, anti-inflammatory, bronchodilator, renal protective, gastro-protective, antioxidant, and other properties. *N. sativa* is among the top-ranked evidence-based herbal medications because of its remarkable healing ability. The main bioactive component of the essential oil, thymoquinone, is responsible for the majority of its medicinal capabilities.

Nigella sativa is a potent herb which exhibits wide range of pharmaceutical properties, most of which have been confirmed via preclinical and clinical studies. This review may thus be useful for the research community in particular and common people in general to avail the benefits of *N. sativa*.

Keywords: Anti-cancer, *Kalonji*, *Habat-ul-Sauda*, *Shoneez*, *Thymoquinone*, *Nigella sativa*, Unani

Introduction:

Kalonji, a well-known herbal remedy also known as black seed or black cumin, has a rich medicinal value. It is used to treat various degenerative disorders. In botanical terms, it is referred to as *Nigella sativa* Linn (F - Ranunculaceae). It is one of the magnificent herbs with a rich historical and religious past.^{1,2}

Various indigenous and traditional medical systems have been using medicinal plants to heal illnesses for many years. *N. sativa* is a dicotyledonous miraculous herb of the ranunculaceae family.^{3,4}

Taxonomical classification:

Kingdom: Plantae
Subkingdom: Tracheobionta
Super division: Spermatophyta

Division: Magnoliophyta
Class: Magnoliopsida
Order: Ranunculales
Family: Ranunculaceae
Genus: *Nigella* L.
Species: *N. sativa*

In Unani literature it is described in the name of *Habat-ul-Sauda*⁵

Among various medicinal plants, *Nigella sativa* (*N. sativa*) (family Ranunculaceae) is emerging as a miracle herb with a rich historical and religious background since many researches revealed its wide spectrum of pharmacological potential. *N. sativa* is commonly known as black seed. *N. sativa* is native to southern Europe, north Africa and southwest Asia.

and it is cultivated in many countries in the world like middle eastern mediterranean region, south europe, india, pakistan, syria, turkey, soudia arabia. ^{6,7}

Since ancient times, *N. sativa* seeds and oil have been widely utilised to cure a wide range of illnesses all throughout the world. Additionally, it is a key medication in the conventional Indian medical system, alongside Unani and Ayurveda. ^{2,3,8}

Vernacular name: ^{9,10,11,12,13,14,15,16,17}

Arabic:	Habbatul Sauda, Kabodan, Kamun Aswad, Shoneez
Persian:	Shoneez, Siyah Dana
Urdu:	Kalonji
Hindi:	Kalonji, Kalajira, Mangraila
English:	Small Funnel, Black Cumin
Bengali:	Kala Zeera, Mangrela
Gujrati:	Kalaunji Jirum, Kadujeeroo
Kannada:	Karijirige
Marathi:	Kalaunji-jire, kalerjire
Malyalam:	Karinchirakam
Telugu:	Peeajila Kara, Nallajilakara
Panjabi:	Kavanji
Tamil:	Karunjarakam, Karunjiragam
Sanskrit:	Susavi, Krishna jiraka, Upakuncika, Karvi, Sthula Jiraka
Turki:	Qarachurak Audi
Unani:	Sino, Sheenon, Kamaazaruus
Sindhi:	Kalodi

Unani Description:

Properties Temperament (*Mizaj*): ⁴

Hot², Dry²

Hot³, Dry³

Taste (*Maza*): ⁴

Slightly bitter

Acrid in taste

Odour (*Boo*): ⁴

Pleasant odour like a lemon

Strong smell

Substitute (*Badl*): ⁴

Olea europaeae (*Samaghe zaitoon*)

Lepidium sativum (*Tukhme Rashaad*)

Pimpinella anisum (*Anisoon*)

Anethum sowa (*Sowa Seed*)

Hyoscyamus niger (*Ajwain Khurasani Seed*)

Adverse Effect (*Muzir*): ⁴

It affects liver

cause diphteria

harms kidney

lungs and patient with headache

Main Function (*Nafa-e-Khas*): ⁴

Diuretic and Emmenagogue (*Mudir-e-Baul wa Haiz*)

and Jaundice (*Yarqaan*)

Abortifient (*Mukhrij-e-Janeen*), Haemorrhoids (*Bawaseer*)

Corrective (*Musleh*): ⁴

Cucumis sativus (*Tukhme Khyaar*)

Sterculia urens (*Kateera*)

Drugs of cold temperament (*Sard Ashiyaa*)

Bumusa arundinacea (*Banslochan*)

Vinegar (*Sirka*)

Cichorium intybus (*Kasni*)

Important Unani formulations: ⁴

Habb-e-Hilteet, Jawarish Shoneez, Majoon Kalkalanaj Majoon Fanjinoosh, Majoon Kundur

Uses of Kalonji in Therapy and Activities:

^{3,5,10,18,19,21,22,23,24}

Therapeutic uses of kalonji can easily be understood from the Table 1 as given below:

Table 1: Therapeutic Uses of Kalonji

<i>Munzij</i> (<i>Coctive</i>),	<i>Nazla</i> (<i>Cold</i>)
<i>Jali</i> (<i>Detergent</i>),	<i>Skin diseases</i> (<i>Amraz e jild</i>), <i>Bars</i> (<i>Vitiligo</i>)
<i>Mushtahi</i> (<i>Appetizer</i>),	<i>Zof e Isthiha</i> (<i>Loss of Appetite</i>)
<i>Muqawwi Jigar</i> (<i>Liver Tonic</i>)	<i>Amraz-e-kabid</i> (<i>Ailments of liver</i>), <i>Yarqan</i> (<i>Jaundice</i>)
<i>Hazim</i> (<i>Digestive</i>)	<i>Su-e-hazm</i> (<i>Dyspepsia</i>)
<i>Musakkin e Alam</i> (<i>Analgesic</i>)	<i>Asabi dard</i> (<i>Neuralgia</i>), <i>Qulanj</i> (<i>Colic</i>)
<i>Mudir-e-tams</i> (<i>Emmenagogue</i>),	<i>Ehtebas-e-tams</i> (<i>Amenorrhoea</i>)
<i>Mudir-e-baul</i> (<i>Diuretic</i>),	<i>Qillat-e-baul</i> (<i>Oligouria</i>)
<i>Qatil-e- kirm Shikam</i> (<i>Anthelmintic</i>)	<i>Kirm Shikam</i> (<i>Worms infestation</i>)
<i>Muqawwi-e-meda</i> (<i>Stomachic</i>)	<i>Zof-e-meda</i> (<i>Weakness of stomach</i>)
<i>Kasir-e-riyah</i> (<i>Carminative</i>),	<i>Nafakh-e-shikam</i> (<i>Flatulence</i>)

Characteristics of Pharmacology:

1. Morphology of the plant: An important Indian medicinal crop called kalonji is grown mostly in the northern Indian states of Panjab, Himachal Pradesh, Bihar, and Assam, with sporadic cultivation also taking place in Assam.^{10,13,25,27}

N. sativa is an annual blooming plant that reaches heights of 20 to 90 cm. It has finely divided leaves with leaf segments that range in width from narrowly linear to threadlike. The fragile, 5-10 petaled blossoms are typically white, yellow, pink, pale blue, or pale purple in colour. The fruit is a sizable, inflated capsule made up of 3-7 connected follicles, each of which is filled with several seeds.^{2,6,27}

2. Characteristics of the seeds and powder: The seeds are small, dicotyledonous, trigonus, angular, regular-tubercular, 2-3.5 mm * 1-2 mm, outwardly black and internally white, with a faintly aromatic and somewhat bitter odour. Transverse section of the seed, viewed under a microscope, reveals a single-layered epidermis made up of elliptical, thick-walled cells that are outwardly coated by a papillose cuticle and internally filled with dark brown material. When seen under a microscope, parenchymatous cells and oil globules are visible in the seed powder.^{6,7,27}

Chemical constituents:

Thymoquinone is the active ingredient in kalonji.^{28,29}

The seeds produced a yellowish-brown volatile oil with a foul aroma after steam distillation.^{11,29}

Essential oil, Volatile oil, Fixed oil, Steroid, Saponin, Melanthin, Mucilage, Resins, Sugars, Alkaloids, Tannins, Linoleic acid, Palmitic acid, Stearic acid, Palmitoleic acid and Oleic acid, Nigellidine, Nigelline, Dithymoquinone, Iron, Copper, Zinc, Phosphorus, Calcium.^{13,15,17,30}

Scientific studies:

A. Phytochemical Studies

The main chemical compounds are thymoquinone (30%-48%), thymohydroquinone, dithymoquinone, p-cymene (7%-15%), carvacrol (6%-12%), 4-terpineol (2%-7%), tanethol (1%-4%), sesquiterpene longifolene (1%-8%), -pinene, and thymol, among others. Additionally, alpha-hederin, a water-soluble pentacyclic triterpene, and saponin, a possible anticancer compound, are present in Kalonji (Kalonji) seeds.^{6,24}

B. Physicochemical Studies

The chemical constituents found in Kalonji seeds have been described in table 2 as given below:

Table 2: Chemical constituents of Kalonji

Protein:	(26.7%)
Fat:	(28.5%)
Carbohydrate:	(24.9%)
Crude Fibre:	(8.4%)
Total ash:	(4.8 %)
Vitamins and minerals:	Cu, P, Zn and Fe etc [15,40]
Saturated fatty acids:	(30% or less)

Fatty oil rich in unsaturated fatty acids, mainly linoleic acid (50-60%), oleic acid (20%), eicodadienoic acid (3%) and dihomolinoleic acid (10%).^{24,31,32,33}

C. Pharmacological Studies

Nephroprotective activity: One of the studies was performed to examine the immunomodulatory and protective effects of *Nigella sativa* L. against renal tissue damage in mice with Pristane-induced lupus (PIL). The outcomes demonstrated that the *Nigella sativa* L. group had the lowest levels of Interleukin (IL) (IL-17, IL-6, and IL-23) expression. The *Nigella sativa* L. group had the lowest and most-near-normal renal damage, according to histological analysis. It has thus been found that *Nigella sativa* L. has an immunomodulatory impact and can protect mice given PIL from kidney damage. We advise that additional study on the use of *Nigella sativa* L. as a supplementary supplement in lupus patients be taken into consideration.³⁴

A study found that gentamicin (GM)-related nephrotoxicity in rabbits was protected by the nephro-protective effects of vitamin C and Kalonji oil. Indicators of nephrotoxicity for all the rabbit groups included serum creatinine, blood urea nitrogen, and antioxidant activity. It was discovered that both Kalonji oil and vitamin C had nephroprotective effects since they reduced serum creatinine, blood urea nitrogen, and antioxidant activity as compared to results from the GM control group. They demonstrated a synergistic nephroprotective effect when these two antioxidants were administered together.^{24,35}

Antidyslipidemic activity:

According to reports, Kalonji proved quite effective in treating dyslipidemia in 20 patients when given in the amount of 1gm in Safoof (powder) form twice day for 60 days.^{17,36}

According to a different study, kalonji has an antiatherogenic impact by lowering the amount of low-density lipoprotein cholesterol and increasing high-density lipoprotein. level.^{17,37}

500 mg of kalonji seed powder taken with a statin (10-20 mg) is the recommended dosage for this group. The addition of *Nigella sativa* results in a significant (P0.05) reduction in cholesterol, LDL, VLDL, and triglycerides as well as a significant increase in HDL. Thus, it decreased a risk factor for coronary artery disease.^{17,38}

Hypoglycaemic activity:

According to reports, following 14 days of therapy, Wistar rats' fasting blood glucose levels decreased significantly (p0.01) to 61.3% when given the aqueous extract of kalonji powder at a dose of 500 mg/kg body weight.^{17,39}

According to a study conducted on 40 diabetic patients, *Nigella sativa* can be used as an additional medication therapy for metabolic syndrome patients who have poor glycemic control and were found to be a safe and efficient treatment for those with the condition.^{17,40}

According to another study, treatment with *N. sativa* (5 mg/kg b.w.) dramatically boosted body weight gain and significantly (p0.001) decreased fasting blood glucose levels compared to the control. Histopathological analysis revealed that *N. sativa* (5 mg/kg b.w.) significantly preserved pancreatic islet cells and partially regenerated the hepatic glycogen content. When compared to the control, the number of islets, cells, and islets diameter were determined to be statistically significant (p0.01, p0.05).^{17,41}

In a study, which was conducted to determine the effects of Kalonji (*N. sativa*) seed ethanol extract on insulin secretion in INS832/13 and β TC-tet lines of pancreatic β -cells and on glucose disposal by C2C12 skeletal muscle cells and 3T3-L1 adipocytes. Treatment with Kalonji (*N. sativa*) increased glucosestimulated insulin secretion by more than 35% without affecting sensitivity to glucose. The treatment also

accelerated β -cell proliferation. Kalonji (*N. sativa*) increased basal glucose uptake by 55% in muscle cells and approximately 400% in adipocytes. It is concluded that in vivo. Anti hyperglycemic effects of Kalonji (*N. sativa*) seed extract are attributable to a combination of therapeutically relevant insulinotropic and insulin-like properties.^{17,42}

In another study, it was found that effect of the seeds of Kalonji (*N. sativa*) have glucose lowering effect in rats. Further study on the plant mixture containing Kalonji (*N. sativa*) revealed that the blood glucose lowering effect was due to the inhibition of hepatic gluconeogenesis and the plant extract mixture may prove to be useful therapeutic agent in the treatment of non-insulin dependent diabetes mellitus.^{17,43}

Anticancer activity:

It has been shown that *N. sativa*'s methanolic extract significantly inhibits the growth of the cancer cells HL-60 and U-937, with IC50 values of 13.70 g/ml and 28.31 g/ml, respectively.^{17,44}

Another study shown that the essential oil of *Nigella sativa* prevents or delays metastasis by rapidly reducing the volume of the initial tumour at the site of induction in mice.^{17,45}

In a different investigation, ethanolic extract of *N. sativa* shown anticancer efficacy in mice with the ehrlich ascites tumour.^{17,46}

Another study used tumour cell lines, fibrosarcoma, murine, and squamous cell carcinoma to demonstrate the anticancer effect of thymoquinone and thymohydroquinone.^{24,47}

Thymoquinone and diosgenin together dramatically decreased tumour volume and mass and enhanced apoptosis in a mouse xenograft model.^{24,48}

The cytotoxicity assay indicated that (biologically synthesized nano thymoquinone) Tb NPs may have anticancer action at concentrations that are much lower than those of (chemically

synthesized nano thymoquinone) Tc NPs. These (nano-thymoquinone) nTQ particles also demonstrated antibacterial activity, eliminating the possibility of bacterial and fungal infections through an expanded zone of inhibition. The findings indicated that the biosynthesized nTQ had more activity due to its capacity to reduce the risk of microbial infections and boost cancer cell death. These results might support the usage of the nTQ biosynthesis method rather than the chemosynthesis method. *N. sativa* seeds are an excellent and affordable option for both medical treatments and natural food additives. When compared to pure chemical approaches, the currently used procedure is straightforward, secure, affordable less expensive, environmentally friendly, and harmless. The cytotoxicity of the cell line and the antibacterial activity for biological and chemical techniques were also examined in this study, and the results demonstrated that the biological (Thymoquinone) TQ had improved or was on par with synthetic chemical activity in terms of activity. As a result, this work creates new prospects for the efficient conversion of natural chemicals into nanoparticles, which is beneficial for a variety of applications. Our study's findings may have intriguing applications as food additives and other biological medication compositions.⁴⁹

Antibacterial activity:

The antibacterial efficacy of the crude Kalonji (*N. sativa*) extracts against diverse bacterial isolates, including 16 gramme negative and 6 gramme positive samples, was examined. Multiple antibiotic resistances, particularly against gram-negative drugs, were present in this strain. Raw Kalonji (*N. sativa*) extracts appeared to have some effect on a few of the test organisms. The water and crude alkaloid extracts

were the most useful extracts. More gram-negative isolates than gram-positive ones were impacted.^{24,43,50}

In a study, it was discovered that *N. sativa*, a phytogetic additive, may replace (Bacitracin methylene disalicylate) BMD, a common in-feed antibiotic, to improve grill performance, particularly when the birds are at risk of necrotizing enteritis.⁵¹

Dermatological effects of *Nigella sativa*:

Anti-fungal activity:

Another study found that the methanolic Kalonji (*N. sativa*) extracts had a potent antifungal impact on various strains of *Candida albicans*. *Candida albicans* colonies were created in the liver, spleen, and kidneys via an intravenous inoculum. Mice treated with the plant extract 24 hours after the inoculation had a significant inhibition of the organism's growth in all organs under investigation. Additionally, it has been noted that Kalonji (*N. sativa*) aqueous extract inhibits the development of candidiasis in mice.^{24,52}

In another study at a dosage of 1 mg/ml, thymoquinone, thymohydroquinone, and thymol also showed antifungal activity against a variety of clinical isolates, including dermatophytes, moulds, and yeasts.^{53,54}

Wound healing:

Moreover, ether extract of *N. sativa* seed applied topically onto staphylococcal-infected skin in mice enhanced healing by reducing total and absolute differential WBC counts, local infection and inflammation, bacterial expansion and tissue impairment.^{54,55}

In Psoriasis:

By using a mouse tail model for psoriasis and the sulforhodamine B assay with human keratinocyte cell lines HaCaT, the ethanolic extract of *N. sativa* seed was assessed for antipsoriatic activity in both vivo and in vitro. The ethanolic *N. sativa* extract resulted in significant epidermal differentiation.^{54,56}

In Vitiligo:

Patients who applied *N. sativa* oil to their vitiligo lesions twice daily for six months saw a significant decline in the vitiligo area scoring index with no adverse side effects.^{54,57}

In Acne vulgaris:

In a clinical study, after two months of treatment, *N. sativa* oil lotion 10% significantly decreased the mean lesion count of papules and pustules. In the test group, 58% of patients had a good response to treatment, 35% had a moderate response, and 7% had none at all. Patients' satisfaction with their care was found to be full in 67% of cases, partial in 28% of cases, and nonexistent in 5% of cases. In contrast, the lesions in the control group did not significantly shrink after two months, and only 8% of them responded favourably to treatment, 34% responded moderately, and 58% did not respond at all. In this group, 8% of patients reported complete, 24% partial, and 68% no satisfaction with their treatment. The 10% *N. sativa* oil lotion group saw no negative side effects. The antibacterial, immunomodulatory, and anti-inflammatory properties of *N. sativa* oil, according to the scientists, were responsible for the outcomes.^{54,58}

In Skin cancers:

The authors hypothesised that thymoquinone could be an immunotherapeutic drug that could be used not only as an adjuvant therapy for melanoma but also in the management and prevention of metastatic melanoma.^{6,54}

Antibacterial:

When used as a side-effect-free treatment for newborns with staphylococcal pustular skin infections, *N. sativa* extract produced outcomes that were nearly identical to those of topical mupirocin.^{54,59}

Topozada et al. (1965) were first to report the antibacterial effect of the phenolic fraction of *N. sativa* oil.^{54,60}

Antiviral activity:

In a study, Zafar et al. discovered that in healthy volunteers, Kalonji (*N. sativa*) helped to improve the ratio of helper T cells (T4) to suppressor T cells (T8) and boosted natural killer (NK) cell activity. The human immune deficiency virus protease is inhibited by Kalonji (*N. sativa*) extract as it boosts immunity, however the active principle(s) responsible for this activity have not been discovered.^{24,61,62,63}

Immunomodulatory activity:

In a study, the immune-suppressing and cytotoxic effects of the volatile oil from Kalonji seeds were examined in a Long-Evans rat model created to assess the impact of Kalonji seeds on certain immunological components with a particular antigen (typhoid TH). According to the findings, typhoid vaccination-induced antibody production was reduced by nearly twofold after treatment with kalonji oil.^{24,64}

It has been shown that *Nigella sativa*'s aqueous extract significantly and dose-responsively increases splenocyte proliferation. Additionally, *Nigella sativa*'s aqueous extract encourages splenocytes to secrete Th2 cytokines rather than Th1 cytokines. The aqueous extract of *Nigella sativa* considerably reduces the release of IL-6, TNF α , and NO by primary macrophages; this suggests that *Nigella sativa* has anti-inflammatory actions in vitro.⁶⁵

Thus, it is clear that NS plays a key role in modulating immune system[®] which can further be elicited by the following research.⁶⁶

In a study published in 2004, Nazrul Islam et al. [80] investigated the immunosuppressive and cytotoxic effects of NSEO (*Nigella sativa* essential oil) in a rat model. After giving NSEO and typhoid antigen injections to Long-Evans rats for 30 days, the authors examined peripheral immune cells (lymphocytes, monocytes, neutrophils, and eosinophils), as well as serum immunoglobulins. The experimental animals' neutrophil counts were markedly reduced by NSEO while their lymphocyte and monocyte numbers were elevated. Serum immunoglobulin levels dropped in animals receiving NSEO treatment.^{67,68}

In this study it was demonstrated that essential oil sourced from *Nigella sativa* seeds has a potential proapoptotic and antiproliferative effect on human T lymphocytes in vitro. TQ, one of the NSEO components, may be responsible for these properties. However, it should be emphasized that there is only a few percent of the TQ in NSEO. So TQ is probably not the only one responsible for such strong immunomodulatory properties of NSEO. Meanwhile, even though p-cymene seems to have some pronecrotic properties, at the same time, it at least partially counteracts some of the effects of TQ. Our results could explain the immunosuppressive effect of NS seeds, extracts, or oils in patients suffering from diseases resulting from hypersensitivity reactions, like asthma or rheumatoid arthritis, but adverse skin reactions in other patients after applying the oil. Therefore, additional studies are necessary to determine in what form NS can be used safely in patients suffering from allergic or autoimmune diseases. In previous work, we tested the immunomodulatory effect of *Nigella sativa* (NS) fatty oil. Our results demonstrated that

unrefined, obtained by cold pressing black cumin seed oil inhibited lymphocytes' proliferation and induced their apoptosis in a dose-dependent manner. In this study, we examined the immunomodulatory properties of essential oil (EO) obtained from the NS seeds by hydrodistillation and its two main constituents: thymoquinone (TQ) and p-cymene. We analyzed the proliferation, activation phenotype, and apoptosis rates of human T lymphocytes stimulated with an immobilized monoclonal anti-CD3 antibody in the presence of serial ethanol dilutions of tested oil or serial distilled water dilutions of tested compounds with flow cytometry. Our results showed that NSEO significantly inhibited the proliferation of CD4+ and CD8+ T lymphocytes, induced cell death in a dose-dependent manner, and reduced the expression of CD28 and CD25 antigens essential for lymphocyte activation. TQ inhibited the proliferation of T lymphocytes and induced cell death, particularly in high concentrations. Meanwhile, p-cymene did not influence lymphocyte proliferation. However, its high concentration induced cell necrosis. These results show that the essential oil from *Nigella sativa* has powerful immunomodulatory properties, which, at least partially, are related to the TQ component.⁶⁹

Cardiovascular activity:

In a different investigation, the effects of Kalonji (*N. sativa*) and its active ingredient thymoquinone on the heart and arterial blood pressure of rats under anaesthesia were assessed. The arterial blood pressure and heart rates are decreased by both drugs in a dose-dependent manner. Atropine dramatically counteracted these effects, mostly by activating muscarinic and 5-hydroxytryptaminergic mechanisms. These results were statistically comparable to those of the widely used hypertension medication nifedipine. It was determined that the drug's effects were partially attributable to its diuretic action, which was equivalent to frusemide.^{24,70}

Contraceptive and anti-fertility activity:

In a study, it was discovered that oral administration of hexane extract of kalonji seeds at a concentration of 2 g/kg daily on days 1 through 10 postcoitum prevented pregnancy in experimental rats.^{24,71}

Hepato-protective activity:

In a different study, male Wistar rats were given an aqueous extract of kalonji seeds to test for hepatoprotective efficacy against carbon tetrachloride-induced hepatotoxicity. To ascertain the hepatoprotective potential, many biochemical variables were examined. A substantial hepatoprotective effect against carbon tetrachloride-induced liver damage was seen in the aqueous extract, demonstrating the presence of hepatoprotective action.^{24,72}

Gastro-protective activity:

In a study, the anti-ulcer potential of Kalonji (*N. sativa*) aqueous suspension was investigated on experimentally induced gastric ulcers and basal gastric secretion in rats. It was discovered that Kalonji has an anti-ulcer effect due to its antioxidant and anti-secretory activities, which may be prostaglandin-mediated.^{24,73}

Antioxidant and antiarthritic activity:

In a study, it was evaluated that thymoquinone component of Kalonji (*N. sativa*) showed the antioxidant and antiarthritic activity in Wistar rat by collagen induced arthritis. Oral administration of thymoquinone significantly reduced the levels of pro-inflammatory mediators [IL-1 β , IL-6, TNF- α , IFN- γ and PGE (2)] and increased level of IL-10.^{24,74}

Anti-allergic activity:

In a study, the thymoquinone dimer "Nigellone," which was extracted from the volatile oil of Kalonji (*N. sativa*), effectively reduced symptoms in individuals with bronchial asthma without causing any harm.⁶⁴

Patients with allergic conditions such as allergic rhinitis, atopic eczema, and bronchial asthma who received kalonji oil had lower immunoglobulin E and eosinophil counts.^{24,75}

In allergic rhinitis:

In a study *Nigella sativa* oil was aimed to compare with mometasone furoate, a topical steroid, on a rat model in the prevention of allergic rhinitis symptoms, in which total of 28 numbers 2-4 months-old Wistar Hannover rats weighing 250-350 gm was randomly divided into four groups of seven, which included control, allergic rhinitis, mometasone furoate, and *Nigella sativa* oil groups. Loss of cilia, an increase of goblet cells, vascular proliferation, inflammatory cell count, eosinophil infiltration, and the degree of hypertrophy in chondrocytes were assessed by light microscopy. According to the findings obtained from this study, it was found that anti-inflammatory and anti-allergic effects of *Nigella sativa* oil as equally effective as mometasone furoate in the treatment of experimentally generated allergic rhinitis.⁷⁶

Adjunctive intervention in obesity management: or as a beneficial dietary element in treating obesity and associated issues:

In this study, *N. sativa* supplementation may have advantages in lowering body composition indicators that increase BW (body weight) and BMI (body mass index). Sensitivity analysis revealed the positive effects of *N. sativa* supplementation on waist and hip circumference. It might be recommended as a beneficial dietary element for treating problems like obesity. In addition, it is advised to take supplements for about 8 weeks of treatment. Overall, this study's findings are in favour of using *N. sativa* supplements as an additional weight-management strategy. When compared to the placebo group, *N. sativa* treatment dramatically decreased BW and BMI. However, no appreciable drops in WC (waist circumference), HC (hip circumference), or WHR (waist-hip ratio) were identified. According to the current meta-analysis, supplementing people with *N. sativa* significantly reduced their body weight and BMI but not their WC, HC, or WHR. As a result of our findings, *N. sativa* supplementation is suggested as an additional strategy in the management of obesity.⁷⁷

Conclusion:

N. sativa is clearly potent herb which exhibits wide range of pharmaceutical properties, most of which have been confirmed via preclinical studies & only a small portion has been evaluated through randomized clinical trials. This review may thus be useful for the research community in particular and common people in general to avail the benefits of *N. sativa*

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Study design: Mahboob Alam, Shabir Ahmad Bhat

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Abbreviation: BW (body weight), BMI (body mass index), WC (waist circumference), HC (hip circumference), *N. Sativa* (*Nigella Sativa*), TQ (thymoquinone), EO (essential oil), NSEO (*Nigella sativa* essential oil).

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